

Flora and Fauna Impact Assessment Bulk Earthworks Project Application and Industrial Development Concept Plan Application CSR Lands, Erskine Park

23 August 2006

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 CSR Lands, Erskine Park
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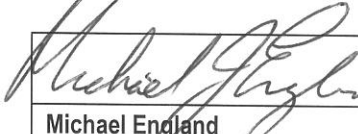
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1 INTRODUCTION

HLA-Envirosciences Pty Limited (HLA) has been commissioned to prepare environmental documents to support an Environmental Assessment (EA) for an application for approval of a concept plan and a project application for Stage 1 works including bulk earthworks, stormwater management works and the construction of a storage and distribution building on CSR lands, at Erskine Park.

1.1 Understanding of the Project

The works that are the subject of the Project Application for bulk earthworks and supporting EA would involve bulk earthworks, including relocation of an existing creek, and the construction of a building for storage and distribution purposes. The Development Zone is indicated in **Figure 1**.

It is also noted that part of the Erskine Park Employment Area (EPEA) lands are to be incorporated into a Biodiversity Conservation Corridor that aims to conserve and enhance locally significant biological values. This biodiversity corridor is proposed to contain existing core areas of habitat together with significant revegetation of other areas to improve local wildlife and ecological connectivity. The establishment of this biodiversity corridor will be recognised as a means of protecting and enhancing biodiversity within the corridor while allowing lands to be located outside the corridor to be developed for employment generating purposes in accordance with the land use zoning.

The Biodiversity Conservation Corridor has now been endorsed in principle by Penrith City Council (PCC) and Department of Environment and Conservation (DEC).

1.2 Study Area Description

The Study Area is located within part of Lot 5 in DP 1094504 and land managed by the Department of Lands for the purposes of a Crown Road Reserve to the immediate south of the CSR lands at Erskine Park. The Development Zone comprises approximately 38ha and is located within the Study Area in the PCC local government area (LGA). Associated stormwater works on the adjoining Crown Road Reserve to the south will occupy an area of approximately 1.1ha. The Study Area and Development Zone is shown in **Figure 1**. Lands adjoining the north and west are currently being developed for major employment generating activities while land to the east is the subject of a separate approval for a major warehouse development. The southern boundary of the Study Area incorporates part of the Biodiversity Conservation Corridor, is vegetated and is defined by a water supply pipeline.

1.3 Assessment Tasks

The principal tasks undertaken as part of the Flora and Fauna Impact Assessment were:

- Complete targeted surveys and habitat assessments for listed threatened species, endangered populations (EPs) and endangered ecological communities (EECS);
- Review survey findings in accordance with existing legislation and guidelines;
- Prepare an assessment for listed matters of significance, in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act); and
- Prepare a significance assessment for matters listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2 APPLICABLE LEGISLATION

This section provides an overview of relevant State and Commonwealth legislation concerning the assessment of flora and fauna issues.

2.1 State Legislative Framework

Development within NSW is subject to legislation and other instruments that regulate the management of vegetation and threatened species. The following are relevant to the proposed development.

2.1.1 Environmental Planning and Assessment Act, 1979

Under Parts 4 and 5 of the Environmental Planning and Assessment Act (EP&A Act), where development is on land that is, or is part of, critical habitat, or where development or an activity is likely to significantly affect threatened species, endangered populations (EPs) or endangered ecological communities (EECs) and their habitats, the application for development consent or for approval to carry out the activity must be accompanied by an assessment of impact on threatened species, populations or ecological communities, or their habitats. This document is to be prepared in accordance with Section 5A of the EP&A Act and the requirements of the Threatened Species Conservation Act (TSC Act).

Section 5A of the EP&A Act does not apply to matters being considered under Part 3A of the EP&A Act. The proposed project has been declared by the Minister to be a Major Project under Part 3A of the EP&A Act and therefore Section 5A does not apply to the proposed project. Notwithstanding this, since Section 5A sets out the matters to be taken into account in deciding whether there is likely to be a significant effect on threatened species, EPs or EECs and their habitats, this flora and fauna impact assessment has been carried out using the seven heads of consideration listed in Section 5A.

2.1.2 Threatened Species Conservation Act, 1995

In addition to prescribing the requirements for preparation of a SIS, the Threatened Species Conservation Act (TSC Act) contains schedules listing endangered species, EPs and EECs, as well as vulnerable species and key threatening processes. It also provides for the keeping of a register of critical habitat, the granting of licences authorising actions leading to the harm of any threatened species, EP or EEC, the picking of any plant that is or is part of any threatened species, EP or EEC, or damage to critical habitat or habitat of a threatened species, EP or EEC.

The TSC Act does not apply to projects dealt with under Part 3A of the EP&A Act.

2.1.3 State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP44) encourages the conservation and management of koala habitat in certain local government areas. This policy applies to lands located within the PCC LGA.

2.2 Commonwealth Legislative Framework

2.2.1 Environment Protection and Biodiversity Conservation Act, 1999

The Environment Protection and Biodiversity Conservation Act (EPBC Act) prohibits actions that are likely to have a significant impact on matters of national environmental significance (MNES) without certain procedures first being followed. The MNES protected by the EPBC Act are identified as:

- Declared World Heritage properties;
- A National Heritage Place;
- Ramsar Wetlands;
- Listed threatened species and communities;
- Listed migratory species;
- Nuclear actions; and
- Actions in a Commonwealth marine area.

It is an offence to carry out an action that will or is likely to have a significant impact on a MNES without first obtaining an approval from the Commonwealth Environment Minister except where an exemption in the EPBC Act applies. A person who is proposing to carry out an action that may have a significant impact on one of the above MNES (and which is not the subject of an exception) is required to refer the proposed action to the Commonwealth Environment Minister. The Minister will determine whether the project is a 'controlled action' (ie an action that requires the approval of the Environment Minister).

3 SURVEY METHODOLOGY

3.1 Literature and Database Reviews

A search of the National Parks and Wildlife Services (NPWS) Wildlife Atlas Database was undertaken to identify the listed threatened species, EPs and EECs within the local area (defined as 10 km radius from the Study Area). Wildlife Atlas data contained within the most recent Penrith 1:100000 map sheet was used for this purpose (NPWS, 2004). A 5km point search using the online EPBC Act protected matters search tool was also completed to generate an EPBC Act Protected Matters Report. Details of these searches were integrated into this assessment.

3.2 Field Survey

The Study Area was investigated by Rochelle Lawson (NPWS Licence Number S11077) on 27 April 2005. The survey aimed to identify the Study Area's flora and fauna values including the presence of threatened species, EPs, EECs and their habitats. Plans supplied to HLA were used to identify the boundaries of the proposed development and the limits of the field investigation were extended to adjacent areas within Lot 5 to form the Study Area.

The field inspection was conducted in general accordance with flora and fauna guidelines developed by LHCCREMS (2002) for disturbed and vegetated sites. Details regarding survey effort are discussed in the following sections.

3.2.1 Flora Survey Methods

The flora survey was restricted to the lands within the Study Area's boundaries. Flora surveys were completed using four quadrats, each sampling 400 m² (20m x 20m). Random Meanders were also used throughout the remaining parts of the Study Area to complement the quadrat sampling methods. Survey stations were selected within four vegetation communities. The locations of the flora survey stations are provided in **Figure 1**.

3.2.2 Fauna Survey Methods

Sampling techniques employed during the survey included visual/audible, scat/physical searches and habitat investigations during daylight hours in the areas walked for the flora survey. Spotlighting, call playback, Elliott trapping and microchiropteran bat recordings did not form part of the survey design.

4 EXISTING ENVIRONMENT

4.1 Physical Characteristics

Table 1 describes the physical characteristics of the Study Area, as observed during the survey.

Table 1: Physical Attributes of the Study Area

Attribute	Comment
Slope	Variable. Creak flats range between 1-2°. Adjoining slopes range between 4-6°, with ridge tops ranging between 1-3°.
Aspect	Westerly and northerly facing slopes dominate the Study Area.
Landform	Open depressions (creeks); Closed depressions (dams); Misdoes; Ridge tops.
Catchment	Unnamed creek draining to the southwest.
Geology	Sedimentary deposits of the Triassic geological period.
Rock Outcrops	Absent. Some isolated outcrops of bare soil exist throughout the central and southeastern parts of the Study Area.
Vegetation Cover	Native trees, grasses and herbs of grassland, woodland and open forest structure characterise the vegetation of the Study Area, with the density of these constituents varying in accordance with the intensity of past agricultural, fire and clearing activities. Exotic grass and herb species are also present and are more common in the open grassland habitats.

4.2 Biological Characteristics

Previous studies conducted in the Erskine Park locality were reviewed to establish the general ecological characteristics of the locality. Sources reviewed were:

- Biosis Research (1999) *Environmental Study: Erskine Park Employment Area*;
- Kevin Mills & Associates (2003). *Conservation and Development Strategy. Erskine Park Employment Area City of Penrith*;
- HLA (2004). *Flora and Fauna Report. Proposed Ecological Investigations, Precinct 5, Erskine Park CSR*; and
- HLA (2005). *Flora and Fauna Impact Assessment, Proposed Warehousing Facility, Lenore Lane, Erskine Park*.

A summary of key information presented within these reports is provided in the following sections.

4.2.1 Flora

Native vegetation of the Erskine Park locality is characterised within at least five flora communities (Biosis Research, 1999; Kevin Mills & Associates, 2003; HLA, 2004; HLA, 2005), these being:

- Open Dry Grasslands (unimproved pasture)
- Grey Box – Broad-leaved Ironbark Woodlands (Shale/Gravel Transition Forest);
- Grey Box – Forest Redgum Open Forest (Cumberland Plain Woodland);
- Riparian Forest dominated by Swamp Oak and Eucalypts (Sydney River-Flat Forest); and

- Aquatic Herblands and Wetlands.

These flora communities are widespread but scattered throughout the predominantly urbanised landscape of the Cumberland Plain. The majority of remnant woodlands and open forest are restricted to a mosaic of small and medium fragmented remnants amidst the urban – rural – residential fringe. Connectivity between remnants varies with the intensity of these local land uses. Vegetation connectivity is relatively intact to the east of the Study Area, with residential development to the north and grasslands to the south severing vegetation connectivity in these directions.

Surveys completed by Biosis Research (1999) identified 152 native and 64 exotic flora species. One species classified as threatened (*Grevillea juniperina* ssp. *juniperina*) was identified in the locality. A further species, classified as extinct (*Hypsela sessiliflora*) was identified by Biosis adjacent to Mamre Road, however, subsequent targeted surveys for this extinct species have failed to identify any evidence of its presence. While no other threatened flora species were found during these surveys, a number of regionally significant species (NPWS 1997) were recorded within the Study Area, these being:

- *Chenopodium carinatum*;
- *Erodium crinitum*;
- *Panicum obseptum*;
- *Utricularia gibba* ssp. *exolata*; and
- *Vittadinia pustulata*.

HLA (2004) surveyed lands to the west of the Study Area and identified 39 species, consisting of 22 natives and 17 exotics, throughout a grassland environment with scattered trees. One threatened flora species was observed, this being *Grevillea juniperina* ssp. *juniperina*. No regionally significant species were observed during that survey.

Kevin Mills & Associates (2003) reviewed a number of previous studies conducted over the Study Area and summarised the significant ecological values of the EPEA as including:

- Cumberland Plain Woodland EEC is present throughout the southern and central areas of the EPEA;
- Sydney Coastal River Flat Forest EEC is present throughout the northern parts of the EPEA; and
- The presence of *Grevillea juniperina* ssp. *juniperina* populations throughout the area.

4.2.2 Fauna

Surveys completed by Biosis Research (1999) identified 60 native and five introduced fauna species throughout the EPEA in four fauna habitat types, these being:

- Open Woodland;
- Riparian Woodland';
- Grassland; and
- Wetland.

Targeted surveys failed to detect any threatened vertebrate species listed at the time of survey. However, a review of the species list indicates the Grey-headed Flying Fox (*Pteropus poliocephalus*) was observed during the survey period. Further, previous fauna records of the

EPEA, which are cited in the Biosis Research (1999) report, include the threatened Turquoise Parrot (*N. pulchella*) and Large-footed Myotis (*M. adversus*). A number of regionally significant species have been recorded within the EPEA, these being:

- Common Scaly-foot
- Red-naped Snake;
- Little Eagle;
- Grey Goshawk;
- Latham's Snipe;
- Yellow-rumped Thornbill;
- Fuscous Honeyeater;
- White-winged Chough;
- Singing Bushlark;
- Short-beaked Echidna; and
- Eastern Grey Kangaroo.

Molluscs were also surveyed, with the results identifying one endangered species (Cumberland Plain Land Snail – *Meridolum corneovirens*) and another classified as regionally significant (*Succinea cf macgillivrayi*) within the EPEA. Sixty-five live specimens of the Cumberland Plain Land Snail (*M. corneovirens*) were observed during that survey. A general description of the EPEA's fauna composition and habitats, as identified by Biosis Research (1999), is discussed below:

Avifauna

Avifauna species that frequent the locality throughout the year include generalists such as the Magpie (*Gymnorhina tibicen*) and Noisy Miner (*Manorina melanocephala*). Avian species of wide-open spaces also occur throughout the locality due to the abundance of open woodland environments. Species such as the Grey Butcherbird (*Cracticus torquatus*) and Richard's Pipet (*Anthus novaeseelandiae*) occupy the grassland and open woodlands of the locality.

Tree hollows are rare within the locality due to the extended past land clearing activities and age of regrowth. Species reliant on this habitat feature include small parrots and introduced avifauna such as the Indian Myna (*Acridotheres tristis*) and Common Starling (*Sturnus vulgaris*). Owls are unlikely to be found breeding with the locality due to the absence of large tree hollows. However, owls may opportunistically forage throughout the area as part of a larger home range.

Avifauna of woodland and open forest vegetation communities occur throughout the locality, with observations including species such as Thornbills, Pardelottes, Silvereyes, Kookaburra, Grey Fantail and Honeyeaters. Woodland specialists such as White-winged Chough was also observed within the Study Area.

Mammals

Small tree hollows of the locality offer roosts for microchiropteran bat species such as Goulds Wattled Bat (*Chalinolobus gouldii*), Lesser Long-eared Bat (*Nyctophilus gouldii*) and Eastern Forest Bat (*Vespedulus pumilus*). The grassland habitats of the locality provide ideal foraging habitat for exotic fauna such as the European Fox (*Vulpes vulpes*) and Rabbit (*Oryctolagus cuniculus*). The larger mobile mammals of the region, such as Eastern Grey Kangaroo (*Macropus gigantea*), are well suited to the grassy habitats offered throughout the locality.

Reptiles

Ground habitats of the locality are generally void of rock outcrops and loose surface rock, which are important habitat features for small shelter dependent reptiles such as the Striped Skink (*Ctenotus robustus*), Copper-tailed Skink (*Ctenotus taeniolatus*) or Yellow-faced Whip Snake (*Demansia psammophis*). Accordingly, it is rare for these species to be observed within the locality. It was reported that the accumulation of leaf litter was sufficient to provide habitat for small ground dwelling species such as the common Garden Skink (*Lampropholis delicata*).

Generally, the locality is most suited to reptilian species of large home ranges that have varied non-specific dietary requirements. Species such as the Eastern Brown Snake (*Pseudonaja textiles*) and Tree Dragon (*Amphibolurus muricatus*) are well adapted to the open grassy conditions of the local area. Both these species were observed by Biosis.

Amphibians

Small to large closed depressions (dams) characterised the locality, which support a variety of amphibian species, these being the Eastern Froglet (*Crinia signifera*), Brown Striped Marsh Frog (*Limnodynastes peronii*). Open depressions (creek lines) offer limited habitat values relative to the dams of the locality. Many of the creek lines in the locality are ephemeral, thus offering only limited breeding habitats. Small tree hollows provide potential diurnal shelters for tree frog species such as the Perons Tree Frog (*Litoria peronii*) and Green Tree Frog (*L. caerulea*), with breeding often associated with dams.

4.2.3 Wildlife Connectivity

The local area contains a mosaic of urban development, rural-residential properties, cleared pastures and native vegetation of small to medium sized remnants. Past land uses were predominantly agricultural, an activity that has substantially diminished the biological character of the Erskine Park locality. Many of the remaining vegetation remnants and regrowth provide a series of 'stepping stones', representing at best a fragmented corridor. A strategy for a biodiversity conservation corridor includes the establishment of an east-west biodiversity corridor through the EPEA lands (including the southern parts of the Study Area) linking the vegetation of Ropes Creek to the east and South Creek to the west (HLA, 2005)

4.3 Existing Study Area Impacts

The Study Area has been influenced by human activity since the settlement of the local area. Main influences on the natural environment include vegetation clearing, agriculture, the introduction of exotic flora and fauna and unmanaged fire regimes. Existing impacts currently affecting the ecological character of the Study Area are discussed in **Table 2** below.

Table 2: Existing Study Area Impacts

Impact	Time since Disturbance (years)			Percentage of the Study Area affected by Impact (%)	Notes
	+30	15-30	0-15		
Clearing	✓	✓	✓	50	The majority of the Study Area's mid slopes have been subjected to land clearing activities for agricultural development. Scattered trees exist throughout these cleared parts of the Study Area. Tree coverage is largely restricted to the upper slopes and drainage lines.
Fire	-	-	✓	95	The Study Area has been exposed to a recent fire event. However, the frequency of past events is not known. The majority of local fire events are not planned and do not consider biological thresholds.
Rubbish	-	✓	✓	10	Rubbish is evident throughout the Study Area. The majority of this rubbish is associated with wind throw. Items regularly encountered included plastic bags and paper
Agriculture	✓	-	✓	100	The Study Area has been exposed to agricultural uses. Much of the Study Area's vegetation has been disturbed by past agricultural activity, particularly the grazing of sheep and goats.
Exotic Flora	✓	✓	✓	50	The extent and size of exotic flora populations within the Study Area appears to vary in accordance with chronic disturbances such as land clearing. Elevated densities of exotic flora were observed throughout the cleared slopes and drainage lines. Naturally vegetated lands contain limited exotic flora populations.

5 SURVEY RESULTS

The results of the flora and fauna survey are provided in the following sections.

5.1 Flora

The flora survey identified 48 species, consisting of 40 natives and 8 exotics, in five flora communities, these being:

- Grey Box – Forest Redgum Open Forest;
- Broad-leaved Ironbark – Grey Box;
- Open Dry Grassland;
- Riparian Forest dominated by Swamp Oak and Eucalypts; and
- Aquatic Herblands and Wetlands.

A description for each of these flora communities is provided in **Tables 3 – 7**.

Table 3: Flora Community 1 – Grey Box – Forest Redgum Open Forest

Structure	Tree Canopy Mid Canopy Groundcover	Open (30-35% cover) with a height range of 10 m to 20 m Sparse to open (10-30% cover), with a height range of 0.5 m to 2 m Open (30-40% cover) with a height range of 0.0 m to 0.8 m.
Common Species	Tree Canopy Mid Canopy Groundcover	<i>Eucalyptus moluccana</i> , <i>E. tereticornis</i> <i>Bursaria spinulosa</i> <i>Aristida vagans</i> , <i>Austrodanthonia linkii</i> , <i>Paspalidium distans</i> , <i>Themeda australis</i> .
Description	This flora community is found throughout parts of the Study Area. Tree cover is mostly Grey Box (<i>E. moluccana</i>), with Forest Redgum (<i>E. tereticornis</i>) forming a major associate throughout the drier parts of the Study Area. The midstorey stratum consists of an open to sparse layer of Blackthorn (<i>B. spinosa</i>) in areas where the adverse influences of fire and grazing are limited. Other shrub species observed in this community include <i>Grevillea juniperinba ssp. juniperina</i> and <i>Dodonea viscosa</i> . Native grasses and herbs dominate the groundcover stratum, with the most commonly observed species being Wire Grass (<i>A. vagans</i>), Blue Trumpet (<i>Brunonella australis</i>) and Kangaroo Grass (<i>T. australis</i>).	
Disturbance History	Disturbances include wind thrown rubbish, fire and grazing. Exotic flora species occupy the chronically disturbed areas such as the margins of this community with grassland environs.	
Weeds	Exotic flora species are rare within this flora community. Species include, but are not restricted to the following: <i>S. Madagascariensis</i> .	

Table 4: Flora Community 2 – Grey Box – Broad-leaved Ironbark Open Forest

Structure	Tree Canopy	Very sparse (<50% cover) with a height range of 10 m to 12 m
	Mid Canopy	Isolated plants (<1% cover), with a height range to 2 m
	Groundcover	Sparse grassland (75% cover) with a height range to 0.4 m
Common Species	Tree Canopy	<i>E. fibrosa</i> , <i>E. moluccana</i> .
	Mid Canopy	<i>B. spinosa</i> , <i>Grevillea juniperina</i> .
	Groundcover	<i>A. vagans</i> , <i>Cynodon dactylon</i> , <i>Themeda australis</i> .
Description	The elevated parts of the Study Area, these being the lands along the eastern boundary, are characterised by woodland to open forest vegetation dominated by Broad-leaved Ironbark (<i>E. fibrosa</i>) and Grey Box (<i>E. moluccana</i>). The mid canopy consists of short shrub species in moderately low densities, with the main species being Blackthorn (<i>B. Spinosa</i>) and <i>Grevillea juniperina</i> . Grasses and herbs codominate the groundcover stratum. The density of exotic species in this vegetation community is very low (less than 1% cover).	
Disturbance History	Disturbances include wind thrown rubbish, fire and grazing. Exotic flora species occupy the chronically disturbed areas such as the margins of this community with grassland environs and track margins.	
Weeds	Exotic flora species are rare within this flora community. Species include, but are not restricted to the following: <i>S. madagascariensis</i> and <i>Plantago lanceolata</i> .	

Table 5: Flora Community 3 – Open Dry Grassland

Structure	Tree Canopy	Sparse (<5% cover) with a height range of 6 m to 10
	Mid Canopy	Sparse (<5% cover) with a height range of 0.5 m to 3 m
	Ground cover	Open (30-60% cover) with a height range of 0.1 m. to 0.4 m
Common Species	Tree Canopy	<i>E. moluccana</i> , <i>E. Tereticornis</i> .
	Mid Canopy	<i>B. spinosa</i> , <i>Dodonea viscosa</i> , <i>Grevillea juniperina</i> ssp. <i>juniperina</i>
	Groundcover	<i>A. vagans</i> , <i>E. leptostachya</i> , <i>Paspalum dilatatum</i>
Description	Native and exotic species of disturbed lands dominate this area of the Study Area. The tree and shrub cover is scattered. Shrubs are largely absent due to past fire and recent grazing activities.	
Disturbance History	Land clearing has been the most detrimental factor contributing to the existence of this flora community, with the absence of an established tree and shrub canopy being the most visible impact from this activity.	
Weeds	Exotic flora species are common throughout this community. Species include, but are not restricted to the following: <i>P. dilatatum</i> and <i>Senecio madagascariensis</i> .	

Table 6: Flora Community 4 - Riparian Forest dominated by Swamp Oak and Eucalypts

Structure	Tree Canopy	Sparse (<5% cover) with a height range of 6 m to 10
	Mid Canopy	Sparse (<5% cover) with a height range of 0.5 m to 3 m
	Ground cover	Open (30-60% cover) with a height range of 0.1 m. to 0.4 m
Common Species	Tree Canopy	<i>E. moluccana</i> , <i>E. Tereticornis</i> .
	Mid Canopy	<i>B. spinosa</i> , <i>Dodonea viscosa</i> , <i>Grevillea juniperina ssp. juniperina</i>
	Groundcover	<i>A. vagans</i> , <i>E. leptostachya</i> , <i>Paspalum dilatatum</i>
Description	Native and exotic species of disturbed lands dominate this area of the Study Area. The tree and shrub cover is scattered. Shrubs are largely absent due to past fire and recent grazing activities. Native.	
Disturbance History	Land clearing has been the most detrimental factor contributing to the existence of this flora community, with the absence of an established tree and shrub canopy being the most visible impact from this activity.	
Weeds	Exotic flora species are common throughout this community. Species include, but are not restricted to the following: <i>P. dilatatum</i> and <i>Senecio madagascariensis</i> .	

Table 7: Flora Community 5 - Aquatic Herblands and Wetlands

Structure	Tree Canopy	Sparse (<5% cover) with a height range of 6 m to 10
	Mid Canopy	Sparse (<5% cover) with a height range of 0.5 m to 3 m
	Ground cover	Open (30-60% cover) with a height range of 0.1 m. to 0.4 m
Common Species	Tree Canopy	<i>E. moluccana</i> , <i>E. Tereticornis</i> .
	Mid Canopy	<i>B. spinosa</i> , <i>Dodonea viscosa</i> , <i>Grevillea juniperina ssp. juniperina</i>
	Groundcover	<i>A. vagans</i> , <i>E. leptostachya</i> , <i>Paspalum dilatatum</i>
Description	Native and exotic species of disturbed lands dominate this area of the Study Area. The tree and shrub cover is scattered. Shrubs are largely absent due to past fire and recent grazing activities. Native.	
Disturbance History	Land clearing has been the most detrimental factor contributing to the existence of this flora community, with the absence of an established tree and shrub canopy being the most visible impact from this activity.	
Weeds	Exotic flora species are common throughout this community. Species include, but are not restricted to the following: <i>P. dilatatum</i> and <i>Senecio madagascariensis</i> .	

5.1.1 General Observations

Tree cover of the Study Area is characterised by woodland and open forest structure that is mostly dominated by Forest Redgum (*E. tereticornis*) and Grey Box (*E. moluccana*), a community that is widely referred to as Cumberland Plain Woodland. These two eucalypt species also occur in association with Broad-leaved Ironbark (*E. fibrosa*), Stringybark (*E. eugenioides*) and Paper Bark (*M. decora*) throughout the Study Area's eastern elevated parts to form a distinct community type that is widely referred to as Shale/Gravel Transition Forest.

Blackthorn (*B. spinosa*) is common throughout both these communities as the principle shrub species. Other shrub species observed throughout the Study Area in localised patches include *Grevillea juniperina ssp. Juniperina*, *Dodonea viscosa* and *Melaleuca nodosa*. Recent fires throughout the Study Area, in combination with grazing pressures, have eliminated the presence of wattle species that were once present within this area.

Trees and shrubs were generally absent from the grasslands of the Study Area. Forest Redgum (*E. tereticornis*) and Grey Box (*E. moluccana*) were the only two tree species observed in the open grasslands of the Study Area, with little evidence of juvenile regrowth apparent due to the grazing conditions. Isolated specimens of Blackthorn (*B. spinosa*) and *Grevillea juniperina* ssp. *juniperina* were observed near the interface of the open dry grassland with the adjoining open forest communities.

Native grasses and herbs dominate the majority of the Study Area's vegetation cover. The most regularly observed native grasses were Wire Grass (*Aristida vagans*), Common Couch (*Cynodon dactylon*) and Kangaroo Grass (*Themeda australis*). The density of the groundcover stratum was greatest throughout the dry open grassland, with decreased density under the influence of the open forest eucalypt canopy.

The vegetation of the Study Area's treed creek lines is dominated by a Forest Redgum (*E. tereticornis*) tree cover above a stratum of grasses and herbs, with the dominants being Couch (*Cynodon dactylon*) and Paspalum (*P. dilatatum*). Instream conditions are described as ephemeral with the occasional semi-permanent pool. *Juncus usitatus* is commonly found throughout this environment.

Exotic species were frequently observed throughout the cleared areas of the Study Area (i.e. dry open grassland community), with some species forming co-dominants in the groundcover stratum (i.e. Paspalum (*P. dilatatum*) in the drainage lines). Other frequently observed exotics include Ribwort (*Plantago lanceolata*), Fireweed (*Senecio madagascariensis*) and Paddy's Lucerne (*Sida rhombifolia*). The species list for the Study Area is provided in **Appendix 1**.

5.2 Fauna

The fauna survey identified 13 species, consisting of 9 avian species, three mammal species, and one amphibian species. The species are listed in **Appendix 1**. General observations are discussed in the following sections.

5.2.1 General Fauna Observations

Avifauna

The most frequently observed fauna group was that of avifauna with the majority of avifaunal activity associated with the tree canopy of woodland and open vegetation communities. The Noisy Minor (*Manorina melanocephala*), a colonising species that is regularly encountered throughout the locality, often dominates its territory and defends it by harassing other avifauna species in large numbers. Areas affected by this territorial behaviour often exhibit lower avifauna species richness, particularly in the mid and upper strata of the vegetation.

Other generalists that were observed occupying the more modified parts of the Study Area (i.e. upper cleared slopes) include the Magpie-Lark (*Grallina cyanoleuca*), Pied Butcherbird (*Cracticus nigrogularis*) and Magpie (*Gymnorhina tibicen*). Eastern Rosella (*Platyercus eximius*) were regularly observed foraging throughout the Study Area. Birds of prey were not observed during the survey period. However, the Brown Goshawk (*Accipiter faciatius*) and Australasian Hobby (*Falco longipennis*) are known to occur in close proximity to the Study Area. These species may infrequently roam the more open areas of the Study Area as part of their foraging activities within the locality.

The White-winged Chough (*Corcorax melanorhamphos*), a species that generally occupies woodland environments, was observed in the southern parts of the Study Area, where it was

utilising the grass understorey of the Grey Box – Forest Redgum Open Forest community for foraging purposes.

Smaller avifauna species of woodland environments such as the Buff-rumped Thornbill (*Acanthiza reguloides*), Weebill (*Smicrornis brevirostris*), Spotted Pardalote (*Pardalotus punctatus*) and Striated Pardalote (*Pardalotus striatus*) were not observed within the Study Area during the survey. Similarly, smaller honeyeaters such as the Yellow-faced Honeyeater (*Lichenostomus Chrysops*) and White-plumed Honeyeater (*L. pencillatus*) were also absent from the Study Area. This cohort of woodland birds requires a complex mature vegetation structure (diverse shrub understorey and mature tree canopy) for successful breeding events. However, the Study Area has been substantially modified through grazing and fire histories to an extent where these species no longer occur within the Study Area.

Mammals

The limited quantity of fallen timber and tree hollows substantially reduces the potential for small mammals to exist throughout the Study Area. Eastern Grey Kangaroo (*M. gigantea*) was observed travelling through the Study Area.

Evidence of two introduced mammal species was observed within the Study Area including the European Fox (*Vulpes vulpes*) and Rabbit (*Oryctolagus cuniculus*). Predation by the European Fox (*V. vulpes*) was not quantitatively assessed within this study, however, the foraging activity of this exotic species may be having a negative impact on native faunal populations.

Microchiropteran bats were not surveyed during the Study Area investigation. Species common to the Erskine Park locality are likely to be found foraging throughout the Study Area, particularly the open forests and woodland margins. Species likely to be found within the Study Area include Gould's Wattled Bat (*Chalinolobus gouldii*), Chocolate Wattled Bat (*C. Morio*), White-striped Freetail Bat (*Nyctinomus Australis*) and Little Forest Bat (*Vespadelus vulturnus*). These species roost in tree hollows, which are predominantly absent from the Study Area. Cave dwelling species are unlikely to occur within the Study Area.

Reptiles

No reptiles were observed during the survey period. The Sun Skink (*Lampropholis delicata*), Goanna (*Varanus varius*) and the Bearded Dragon (*Pogona barbata*) are likely to be observed within the open forest vegetation community during the warmer periods of the year.

Amphibians

Amphibian species of the Study Area primarily restrict their activity to the drainage line in the southern parts of the Study Area. Only common species were heard calling during the survey period, such as the Eastern Froglet (*Crinia signifera*), with no evidence of threatened species or their habitats observed within the Study Area.

5.2.2 Fauna Habitat Values

The field survey identified four broad fauna habitat classes providing opportunities for a range of fauna activity such as foraging and breeding. These habitat classes are as follows:

- Native and exotic grasses and herbs;
- Scattered shrub canopy of various densities and species composition;
- Aquatic environs (farm dam and creek line); and
- Native tree canopy of woodland and open forest structure.

Microhabitat features contained within these broad habitat classes are as follows:

- Tree branches;
- Low abundance of tree hollows;
- Scattered patches of dense shrubs;
- Shallow permanent water (two closed depressions within the creek line); and
- Pollen and nectar producing plants, principally Eucalypts.

Potential fauna utilisation of these habitat classes is discussed as follows.

Habitat for Avifauna

Nectar supplies are principally restricted to the Eucalypt tree canopy, this being the spring flowering Forest Redgum (*E. tereticornis*) and summer flowering Grey Box (*E. moluccana*). Consequently, it is expected that the majority of Study Area activity during the spring-summer period will be associated with seasonally migrating nectivores. Honeyeaters and insectivorous species of open forest and woodland environs are likely to be the principal foragers throughout the treed parts of the Study Area, with open grassland generalists restricted to the sparse fragmented tree cover of the cleared grasslands.

Sedentary avifauna species that will frequent the Study Area throughout the year will consist primarily of generalists such as the Magpie (*Gymnorhyna tibicen*) and Noisy Miner (*Manorina melanocephala*). Avian species of wide-open spaces are expected to dominate the Study Area due to the restricted tree canopy cover. Species such as the Pied Butcherbird (*Cracticus nigrogularis*) and Magpie-Lark (*Grallina cyanoleuca*) are likely to utilise the Study Area's open areas.

The low abundance of tree hollows throughout the Study Area substantially reduces the Study Area's breeding potential for avifauna species dependant on this habitat feature. Hollows and tree splits located in a dead tree near the Study Area's southern boundary, combined with a few hollows in some mature *Melaleuca decora* at the southeastern corner, are the only concealed arboreal roost of the Study Area.

Species reliant on this habitat feature will restrict the majority of their activity within the Study Area to foraging only. Owls will not be found breeding within the Study Area due to the absence of large tree hollows. The likelihood of owls opportunistically foraging throughout the Study Area as part of a larger home range is considered remote due to the absence of suitable foraging resources (eg small ground mammals).

Habitat for Mammals

The discontinuous sparse tree canopy of the grassland environment provides limited potential foraging habitat for arboreal species such as microchiropteran bats and possums. The low abundance of small tree hollows throughout the Study Area substantially reduces the potential for roosting populations of microchiropteran bat species and possum such as the Sugar Glider (*Petaurus breviceps*).

The grassland environments also provide foraging habitat for exotic fauna such as the European Fox (*V. vulpes*) and Rabbit (*O. cuniculus*). Small native ground fauna reliant on habitat features such as fallen timber and rocky outcrops are likely to be absent from the Study Area due to the influence of past land clearing activities, sheep and goat grazing and influence of fire. However, the larger mobile species such as the Eastern Grey Kangaroo (*Macropus gigantea*) are well suited to the grassy habitats offered throughout the open areas of the Study Area. This species has been observed in the Study Area.

Habitat for Reptiles

The Study Area is mostly suited to reptilian species of large home ranges that have varied non-specific dietary requirements. Species such as the Goanna (*Varanus varius*) and Bearded Dragon (*Pogona barbata*) are well adapted to these conditions. Arboreal reptiles such as the Barred-side Skink (*Eulamprus tenuis*), which utilise trees hollows and cracks for shelter, are likely to be absent from the Study Area.

The field survey identified no specialised shelter sites such as rock outcrops or surface rock throughout the Study Area, thus substantially restricting the potential for small reptiles. Species dependent on rock shelters such as the Striped Skink (*Ctenotus robustus*), Copper-tailed Skink (*Ctenotus taeniolatus*) or Yellow-faced Whip Snake (*Demansia psammophis*) are likely to be absent from the Study Area. The lack of leaf litter and fallen timber throughout the open forests of the Study Area substantially reduces the habitat values for small ground dwelling species such as the common Sun Skink (*L. delicata*).

Habitat for Amphibians

The Study Area is predominantly characterised by dry terrestrial environs, which is not conducive to amphibian activity. However, a number of small closed depressions are scattered throughout the Study Area, with most of these water bodies containing fringing vegetation capable of supporting a variety of small amphibian species.

Many of the depressions provide sufficient habitat values for viable populations of the Eastern Froglet (*Crinia signifera*), Brown Striped Marsh Frog (*Limnodynastes peronii*), Burrowing Frog (*Limnodynastes ornatus*) and Perons Tree Frog (*Litoria peronii*). Habitat for threatened species such as the Green and Golden Bell Frog (*Litoria aurea*) is generally limited to closed depressions containing thick growths of microphyte such as Cumbungi (*Typha* spp.), which is absent from the Study Area.

The limited supply of small tree hollows substantially limits the Study Area's potential to harbour diurnal sheltering tree frog species such as the Perons Tree Frog (*Litoria peronii*) and Green Tree Frog (*Litoria caerulea*). These species will utilise both terrestrial and aquatic environments for foraging and breeding purposes.

6 DISCUSSION OF POTENTIAL IMPACTS

6.1 Review of Impacts

In addition to the existing impacts of the Study Area, as discussed in **Section 4.3** of this report, the proposed works will result in additional project specific impacts such as:

- Clearing of native vegetation;
- Development of known threatened species, EP and EEC habitat; and
- Potential removal of tree hollows.

These matters are discussed in detail in the following sections.

6.1.1 Clearing of Native Vegetation

The proposed development will require the removal of native vegetation. An area of native vegetation of moderate condition will be impacted through the development of the Development Zone. The loss of biodiversity through the clearing of vegetation for the proposed development is likely to be consistent with the long-term impacts associated with ongoing grazing practices and unmanaged fire events. While the clearing of native vegetation throughout the Development Zone without sufficient mitigation is likely to have an adverse impact on threatened species and EECs, it could be concluded that the long-term action of indirect impacts will have a similar result.

The provision of a significant area of managed habitat within the proposed Biodiversity Conservation Corridor is likely to produce a net low, insignificant impact.

6.1.2 Development of Known Threatened Species, EPs or EECs Habitat

Relevant impacts associated with development in and adjacent to areas containing known Cumberland Plain Woodland and Shale/Gravel Transition Forest EECs involve:

- Removal of trees, shrub and groundcovers characteristic of the listed EECs; and
- Removal of fallen timber from the forest floor.

The proposed project is likely to result in the removal of Cumberland Plain Woodland EEC, some Shale/Gravel Transition Forest EEC and specimens of *Grevillea juniperina* spp. *juniperina* identified in the northern part of the Study Area.

It is considered that providing the implementation of the proposed Biodiversity Conservation Corridor occurs, the likely net impact of the proposed development on Cumberland Plain Woodland, Shale/Gravel Transition Forest EECs and *Grevillea juniperina* spp. *juniperina* will be low and insignificant.

6.1.3 Removal of Tree Hollows

The accelerated and ongoing removal of standing dead trees and woody debris on the ground caused by human activity has been recognised as a factor contributing to loss of biological diversity (NSW Scientific Committee, 2004). The Study Area contains few tree hollows of sufficient value for avifauna and microchiropteran bats. Fallen timber is largely absent from the Study Area, with the majority of this material restricted to the open forest vegetation near the

Study Area's southern boundary (generally in the area proposed for the Biodiversity Conservation Corridor).

6.2 Summary

The principal ecological constraint of the Study Area is the presence of known habitat for *Grevillea juniperina* spp. *juniperina* habitat, Cumberland Plain Woodland and Shale/Gravel Transition Forest EECs. The proposed development of the Development Zone will result in the removal/modification of the Study Area's vegetation cover. With the establishment of the Biodiversity Conservation Corridor as now agreed in principle by PCC and DEC, the potential impact on the identified threatened species and EECs is considered to be low and not significant.

7 SIGNIFICANT ECOLOGICAL MATTERS

7.1 Threatened Species

A search of the NPWS Wildlife Atlas Database and EPBC Act Protected Matters Report identified a number of listed threatened flora and fauna species within a 10km radius of the Study Area (NPWS, 2004). The species identified from this search are listed in **Table 6** and **Table 7** together with their legislated status under the TSC and EPBC Acts.

Species of relevance to this impact assessment are indicated in the far right column of **Tables 6 and 7** (i.e. "Potential Sensitive Species"), with the primary selection based on the Study Area's habitat values described in **Section 5**. 'Potential sensitive species' are species and their habitats that may, or do, occur within the Study Area and may potentially experience an impact through development of the Development Zone.

Table 6: Threatened Flora Species of the Erskine Park Locality

Common Name	Scientific Name	Legislative Status		Study Area Habitat Value	Potential Sensitive Species Yes / No
		TSC Act	EPBC Act		
Bynones Wattle	<i>Acacia bynoeana</i>	V	V	Absent	No
Downy Wattle	<i>Acacia pubescens</i>	V	V	Moderate	Yes
-	<i>Allocasuarina Glareicola</i>	E	E	Absent	No
White-flowered Wax Plant	<i>Cynanchum elegans</i>	E	E	Absent	No
-	<i>Darwinia biflora</i>	V	V	Absent	No
-	<i>Dillwynia tenuifolia</i>	V	V	Moderate	Yes
-	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V	-	High	Yes
-	<i>Grevillea parvifolia</i> subsp. <i>parvifolia</i>	V	V	Moderate	Yes
-	<i>Hypsela sessiliflora</i>	E	-	Moderate	Yes
Deane's Melaleuca	<i>Melaleuca deanei</i>	V	V	Absent	No
-	<i>Micromyrtus minutiflora</i>	V	V	Absent	No
-	<i>Persoonia hirsute</i>	E	E	Absent	No
-	<i>Persoonia nutans</i>	E	E	Absent	No
-	<i>Pimelea curviflora</i> var. <i>curviflora</i>	V	V	Absent	No
-	<i>Pimelea spicata</i>	E	E	Moderate	Yes
-	<i>Pterostylis saxicola</i>	E	E	Low	No
-	<i>Pultenaea parviflora</i>	E	V	Moderate	Yes
-	<i>Tetraloche glandulosa</i>	V	V	Absent	No

E – Endangered V = Vulnerable

Targeted surveys identified one of the above listed species in the Study Area (*Grevillea juniperina* spp. *juniperina*). Accordingly, this species will be retained as a potential sensitive species. A discussion of the Study Area's habitat values for the remaining species listed in **Table 6** is provided below including any justifications for the inclusion or exclusion of these species.

Acacia bynoeana is known to occur on a variety of geological formations from the Tertiary alluviums of the Castlereagh and Kurri Kurri localities to Hawkesbury and Narrabeen sandstones. Typically, this species is observed in heath woodlands dominated by Scribbly Gum (*Eucalyptus haemastoma*), Bloodwood (*Corymbia gummifera*) and *Eucalyptus capitellata* on clayey sand over sandstone or shale/sandstone transition. No habitats of this description occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for harm through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Acacia pubescens is found within open sclerophyll forests and woodlands on clay soils from the Georges River to Bilpin (Harden 2002). Benson and McDFougal (1996) describe the habitat as open forest with Red Ironbark (*Eucalyptus fibrosa*) – Grey Box (*E. Moluccana*) with an understorey of Blackthorn (*Bursaria spinosa*) and *Melaleuca decora* that occur on well drained gravelly clay soils on the Wianamatta Shale and Tertiary Alluvium. Habitats of this description occur within the eastern parts of the Study Area. Given the presence of potential habitat, it is considered that there is a potential for this species to be impacted through development of the Development Zone. Accordingly, this species will be further considered as a potential sensitive species.

Allocasuarina glareicola occupies a very specific niche in the Castlereagh Woodlands of western Sydney, which is characterised by yellow clay soils with sandy topsoil overlaying Tertiary alluvium where the water table and nutriment level is low. Dominant canopy species are said to be *Angophora bakeri* and *Eucalyptus sclerophylla* with a heath understorey. No habitats of this description occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Cynanchum elegans grows in rainforest gullies, scrub and scree slopes. It is distributed from the Gloucester district to Wollongong and inland to Mt Danger (Harden 1992). No habitats of this description occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Darwinia biflora is restricted to sandy, rocky heath and scrub that is typically characterised by Scribbly Gum (*E. haemastoma*) Bloodwood (*C. Gummifera*) and *E. capitellata* on clayey sand over sandstone or shale/sandstone transition. No habitats of this description occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Dillwynia tenuifolia is found in a range of habitats that is typically characterised by dry sclerophyll woodland on sandstone, shale or laterite (Harden 2002). In western Sydney, *D. tenuifolia* is associated with the Tertiary Alluviums of the Castlereagh locality, which supports species such as *E. sclerophylla*, *A. bakeri*, *Eucalyptus fibrosa*, *M. Decora* with an understorey of *M. nodosa*, *H. sericea*, *Micromyrtus minutifolia* and *Banksia spinulosa*. This species is also irregularly found in habitats characterised by open forest with broad-leaved Ironbark (*Eucalyptus fibrosa*) – Grey Box (*E. moluccana*) with an understorey of Blackthorn (*Bursaria*

spinosa) and *Melaleuca decora* on well drained gravelly clay soils on the Wianamatta Shale and Tertiary Alluvium. Habitats of this description occur within the eastern parts of the Study Area. Given the presence of potential habitat, it is considered that there is a potential for this species to be impacted through development of the Development Zone. Accordingly, this species will be further considered as a potential sensitive species.

Grevillea parvifolia subsp. *parvifolia* is a low open to erect shrub to 1 m in the Prospect to Camden and Appin areas with disjunct populations near Putty, Cessnock and Cooranbong. It grows in woodlands on light clayey soils. Habitats of this description occur within the parts of the Study Area. Given the presence of potential habitat, it is considered that there is a potential for this species to be impacted through development of the Development Zone. Accordingly, this species will be further considered as a potential sensitive species.

Hypsela sessiliflora is currently known from a single location less than 10x15m on the Cumberland Plain in western Sydney. It has been reported from damp places. Known habitats of this description occur immediately to the south of the Study Area. Given the presence of known habitat in close proximity to the Study Area, it is considered that there is a potential for this species or its habitats to be impacted through development of the Development Zone. Accordingly, this species will be further considered as a potential sensitive species.

Melaleuca deanei is restricted to sandy, rocky heath and scrub that is typically characterised by Scribbly Gum (*E. haemastoma*), *Banksia serrata*, Bloodwood (*C. Gummiifera*) and *E. Capitellata* on clayey sand over sandstone or shale/sandstone transition. No habitats of this description occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Micromyrtus minutiflora grows in the woodlands and dry sclerophyll forests of the Castlereagh locality in western Sydney. The locality is characterised by low nutrient sandy clay or gravelly soils over Tertiary Alluviums, which supports species such as *E. sclerophylla*, *A. bakeri*, *E. fibrosa*, *M. decora* with an understorey of *M. nodosa*, *H. sericea*, *D. tenuifolia*, *M. minutifolia* and *B. spinulosa*. No habitats of this description occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Persoonia hirsute occupies woodlands and dry sclerophyll forest on sandstone and rarely shale (NSW Scientific Committee 1998). No habitats of this description occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Persoonia nutans grows in the woodlands and dry sclerophyll forests of the Castlereagh locality in western Sydney. This locality is characterised by low nutrient sand clay or gravelly soils over Tertiary Alluviums, which supports species such as *E. sclerophylla*, *A. bakeri*, *E. fibrosa*, *M. decora* with an understorey of *M. nodosa*, *H. sericea*, *D. tenuifolia*, *M. minutifolia* and *B. spinulosa*. No habitats of this description occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Pimelea curviflora var. *curviflora* grows in sandstone landscapes (Harden 2000), shaly or lateritic soils over sandstone or shale/sandstone transitional forest (Benson and McDougall 2001). More specifically, this species has been observed in association with Yellow Bloodwood

(*Corymbia eximia*), Grey Gum (*E. punctata*) and Bloodwood (*C. gummifera*). No habitats of this description occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Pimelea spicata grows amongst grasses in open forests with clay soils throughout the Cumberland Plain Woodland complex, which is typically characterised by Forest Redgum (*E. tereticornis*) and Grey Box (*E. moluccana*). More specifically, this species has been most frequently observed in suitable open forest situated on creek banks and alluvial terraces that adjoin major drainage corridors of the Cumberland Plan (eg South Creek). Habitats of this description occur within the central parts of the Study Area. Given the presence of potential habitat, it is considered that there is a potential for this species to be impacted through development of the Development Zone. Accordingly, this species will be further considered as a potential sensitive species.

Table 7: Threatened Fauna Species of the Erskine Park Locality

Common Name	Scientific Name	Legislative Status		Study Area Habitat Values	Potential Sensitive Species Yes / No
		TSC Act	EPBC Act		
Green and Golden Bell Frog	<i>Litoria aurea</i>	E	V	Low	No
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	V	V	Absent	No
Southern Barred Frog	<i>Mixophyes iterates</i>	E	V	Absent	No
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	E	V	Absent	No
Bush Stone-curlew	<i>Burhinus grallarius</i>	E	-	Moderate	Yes
Freckled Duck	<i>Stictonetta naevosa</i>	V	-	Absent	No
Australian Painted Snipe	<i>Rostratula australis</i>	E	V	Absent	No
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	V	-	Low	No
Turquoise Parrot	<i>Neophema pulchella</i>	V	-	Low	No
Swift Parrot	<i>Lathamus discolor</i>	E	E	Absent	No
Regent Honeyeater	<i>Xanthomyza Phrygia</i>	E	E	Absent	No
Brush-tailed Rock-wallaby	<i>Petrogale penicillata</i>	E	V	Absent	No
Long-nosed Potoroo	<i>Potorous tridactylus</i>	E	V	Absent	No
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	E	Absent	No
Squirrel Glider	<i>Petaurus norfolcensis</i>	V	-	Low	No
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	Moderate	Yes
Large Pied Bat	<i>Chalinolobus dwyeri</i>	V	V	Low	No
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V	-	Moderate	Yes
Eastern Bent-wing Bat	<i>Miniopterus schreibersii</i>	V	-	Low	No
Eastern Free-tail Bat	<i>Mormopterus norfolkensis</i>	V	-	Moderate	Yes
Large-footed Myotis	<i>Myotis adversus</i>	V	-	Low	No

Common Name	Scientific Name	Legislative Status		Study Area Habitat Values	Potential Sensitive Species Yes / No
		TSC Act	EPBC Act		
Cumberland Plain Land Snail	<i>Meridolum Corneovirens</i>	E	E	Moderate	Yes
Australian Grayling	<i>Prototroctes maraena</i>	-	V	Absent	No
Macquarie Perch	<i>Macquaria australasica</i>	-	V	Absent	No

E – Endangered V = Vulnerable

No habitats of sufficient complexity are present within the Study Area to support the Green and Golden Bell Frog (*L. aurea*). Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

The Giant Burrowing Frog (*H. australiacus*) occupies habitats characterised by sandstone geological formations, which are absent from the Study Area. Similarly, the Sydney Broad-headed Snake (*H. bungaroides*) also occupies habitats of similar character. No habitats of suitable character for this species occur within the Study Area. Given the absence of potential habitat, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, these species will not be further considered as potential sensitive species.

The Southern Barred Frog (*M. iterates*) occupies semipermanent to permanent riparian habitats characterised by closed forest vegetation formation, which are absent from the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated. Low. Accordingly, this species will not be further considered as a potential sensitive species.

The Freckled Duck (*S. Naevosa*) is a seasonal migratory species that occupies flooded lignum swamps of western NSW that disperses to coastal districts, particularly during prolonged dry periods. Habitat is typically defined as large vegetated swamps, with open lakes forming refuge during drought conditions. No habitats of suitable character for this species occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

The Bush Stone-curlew (*Burhinus grallarius*) occupies a variety of habitats including open woodlands; dry water courses with fallen timber and a well developed leaf litter layer; sand plains with Spinifex and mallee; coastal scrub; mangrove fringes; golf courses; rail and road reserve; orchards and plantations (Pizzey and Knight, 1999). Suitable habitats of open woodlands and dry watercourses occur within the Study Area. However, the absence of fallen timber and a well-developed leaf litter layer substantially reduces the value of this habitat. Given the presence of potential habitat within the Study Area it is considered that there is a potential for this species to be impacted through development of the Development Zone. Accordingly, this species will be further considered as a potential sensitive species.

Study Area habitats for migratory wader species such as the Australian Painted Snipe (*R. australis*) are unsuitable for the presence of the species. Thus, these species will not be further considered as a potential sensitive species. Similarly, habitat values for the migratory Swift

Parrot (*L. discolor*) and Regent Honeyeater (*X. Phrygia*) are regarded as absent due to the absence of winter flowering eucalypts. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, these species will not be further considered as potential sensitive species.

Threatened species requiring large tree hollows for breeding purposes, such as Glossy Black-Cockatoo (*C. lathamii*) are unlikely to occupy the Study Area due to the absence of this habitat feature. Further, it is regarded that the low density of Black She oak (*Allocasuarina littoralis*) specimens is insufficient to sustain foraging activity by this species. Accordingly, it is considered that the potential breeding and foraging conditions of the Study Area for the Glossy Black-Cockatoo (*C. lathamii*) are low. Fragmented wildlife corridors of the locality further reduce the potential viability of local populations. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

The Turquoise Parrot (*N. pulchella*) has been reported to occur within close proximity to the Study Area within the adjoining Austral lands (Biosis, 1999). This species occupies grassy woodlands and open forest that contain small tree hollows, usually in the trunk near the shrub canopy strata. While the Study Area is characterised by grassy woodlands and open forest, it is regarded that the absence of suitable breeding hollows limits the potential for this species to occupy the Study Area. It is regarded that the Study Area offers foraging habitat values only. Given the absence of potential breeding habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

The Brush-tailed Rock-wallaby (*P. penicillata*) was once a widespread species throughout rocky habitats within rainforest gullies, open woodland and sclerophyllous forest. The species favours places with numerous ledges crevices and caves on a northern aspect that allow the species to bask (Strahan, 1998). The Study Area does not contain rocky environments that typically characterise the known habitat of this species. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

The Long-nosed Potoroo (*P. tridactylus*) is generally restricted to areas with annual rainfall greater than 760 mm, where it inhabits heath and sclerophyllous forests. A major habitat requirement is the persistence of a relatively thick cover of grasses, herbs and shrubs in areas where the soil is light and sandy. This species digs small holes in a ground to feed on fungi, roots, tubers, insects and their larvae and other soft-bodied animals (Strahan, 2998). The Study Area is characterised by grassy woodlands and open forest, which is generally regarded as unsuitable for this species. The open habitats combined with the limited amount of wildlife connectivity and presence of the European Fox (*V. vulpes*) substantially reduces the potential for viable populations of this species to occupy the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Habitat for the Spotted-tailed Quoll (*D. maculate*) throughout the Study Area is low given the absence of fallen timber for shelter, connected vegetation and the presence of the Fox (*V. vulpes*). Catling and Burt (1995) identified a presence/absence relationship between the Fox (*V. vulpes*) and Spotted-tailed Quoll (*D. maculate*). The Spotted-tailed Quoll (*D. maculate*) is out competed by the Fox (*V. vulpes*) due to the ability of latter species to survive on a more

diverse diet. The Spotted-tailed Quoll (*D. maculate*) principally forages on small to medium sized mammals, which are largely absent from the Study Area, while the Fox (*V. vulpes*) is capable of surviving on other food sources such as berries, carrion and other vegetation matter. The absence of foraging resources for the Spotted-tail Quoll (*D. maculate*) combined with the presence of the Fox (*V. vulpes*) indicates a low potential for this threatened species to occur within the Study Area. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

Viable populations of the Squirrel Glider (*P. norfolcensis*) require moderate to large sized vegetation remnants (larger than 5 ha in area) containing a diverse range of foraging material such as winter/summer flowering eucalypts, a well developed shrub understorey and suitable tree hollows for diurnal shelters and breeding Study Areas. The Study Area contains areas of seasonally high quality foraging materials for this species (ie spring-summer flowering eucalypts). However, the relative absence of mature tree with hollows and supply of foraging resources during the autumn-winter period substantially restricts the potential occupation on the Study Area by this species. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

The Grey-headed Flying Fox (*P. poliocephalus*) roosts by day in communal camps (ie such as the diurnal roost Study Area at Gordon – Turrumurra on Sydney's north shore), only to disperse at night to foraging grounds within the local area (usually within a 15 km radius of the diurnal camp site). This species usually seeks seasonally abundant foraging resources such as nectar from flowering eucalypts and rainforest fruits. The Study Area contains summer flowering eucalypts that may promote foraging activity by this species and as such, it may be potentially impacted by the development of the Development Zone. Thus, this species will be further considered as a potential sensitive species.

A number of microchiropteran bats species, such as the Large Pied Bat (*C. dwyeri*), Eastern Bent-wing Bat (*M. schreibersii*), Eastern Free-tailed Bat (*M. norfolkensis*), Eastern False Pipistrelle (*F tasmaniensis*) and Large-footed Myotis (*M. adversus*) may utilise the Study Area for foraging and or breeding purposes.

The Large Pied Bat (*C. dwyeri*) and Eastern Bent-wing Bat (*M. schreibersii*) require caves for roosting and breeding, a habitat feature that is absent from the Study Area. Further, this habitat feature is largely absent from the locality given the prevailing geological characteristics of the Cumberland Plain. Given the absence of potential roost habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, these species will not be further considered as potential sensitive species.

The Eastern Free-tailed Bat (*M. norfolkensis*) and Eastern False Pipistrelle (*F tasmaniensis*) forage throughout the eucalypt canopy and use tree hollows for diurnal roosts. While there is an abundance of potential foraging habitat throughout the Study Area, the availability of diurnal roosts (i.e. small tree hollows) is low. Given the low abundance of small sized tree hollows throughout the Study Area, it is considered that the potential for impact to these species through development of the Development Zone is rated as low. However, potential foraging habitat may be potentially harmed by the development of the Development Zone. Thus, these species will be further considered as potential sensitive species.

Large-footed Myotis (*M. adversus*) inhabits a range of habitats from rainforests to sclerophyll forests in close proximity to creeks and lakes over which it forages for aquatic insects and small fish (Churchill, 1998). This species is known to roost in caves, mines and tunnels with tree hollow roosts recorded throughout its southern range (Menkhorst and Knight, 2001). Potential foraging habitat is restricted to two farm dams located in the southwestern corner of the Study

Area. Potential diurnal roost sites are also similarly limited (i.e. low abundance of small tree hollows). Given the low abundance of small sized tree hollows and limited quantity of potential foraging habitat throughout the Study Area, it is considered that the potential for impact to this species through development of the Development Zone is rated as low. Thus, these species will not be further considered as a potential sensitive species.

The Cumberland Plain Land Snail (*M. corneovirens*) is restricted to the Cumberland Plain of western Sydney, where it principally occupies shale open forests and woodlands otherwise described as Cumberland Plain Woodland. This species is often found beneath fallen timber and debris in vegetated areas that contain a healthy leaf litter layer and lichens. This species is mostly found near dry drainage lines. Historically, this species has been found in high numbers throughout the Study Area. Since the survey conducted by Biosis Research (1999), the habitat values of the Study Area have been substantially influenced by fire (i.e. simplification of understorey and groundcover stratum) and removal of scattered debris (rubber tyres). This simplification of the Study Area's habitats has reduced the capacity of the Study Area to contain viable populations of this species. However, given that the Study Area has been known to support populations of this species, it is considered that the further impact of current habitat values through development of the Development Zone may further impact the viability of local populations. Thus, this species will be further considered as a potential sensitive species.

Macquarie Perch (*M. australasica*) are found particularly in the upstream reaches and tributaries of the Murray-Darling Basin and parts of southeastern coastal NSW, including the Hawkesbury catchment. Macquarie Perch feed on aquatic insects, crustaceans and molluscs and spawn in spring or summer in shallow upland streams or flowing parts of rivers. Given the absence of semi-permanent to permanent drainage corridors, it is regarded that the Study Area offers no potential habitat values for this species. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

The Australian Grayling (*P. maraena*) inhabits coastal rivers of southern NSW, Victoria and Tasmania, but have declined and now are known in large numbers in a few river catchments. The species migrate to and from sea to complete their lifecycle, however saltation and the construction of dams and weirs have degraded habitat and prevented the species from reaching spawning grounds. Given the absence of potential habitat from the Study Area, it is considered that the potential for impact through development of the Development Zone is rated low. Accordingly, this species will not be further considered as a potential sensitive species.

7.2 EPs, EECS and Critical Habitat

No listed EPs or areas of critical habitat were identified within a 10 km radius of the Study Area (NPWS, 2004). Conversely, the 10 km radius search identified the occurrence of Cumberland Plain Woodland, Shale/Gravel Transition Forest, Castlereagh Woodlands, Freshwater Wetlands of the Sydney Basin Bioregion and Sydney Coastal River Flat Forest EECS in the Erskine Park locality. Targeted surveys of the Study Area identified the occurrence of only two EECS within the Study Area being Cumberland Plain Woodland and Shale/Gravel Transition Forest EECS. Further impact assessment for these EECS is warranted in this report.

7.3 Sensitive Species

A review of the potential sensitive species (**Tables 6 and Table 7**) is provided in **Table 8** below to determine those species relevant to this impact assessment.

The following Study Area characteristics were used to assist in the identification of sensitive species:

- A sparse to open, fragmented cover of native trees and shrubs;
- Open coverage of grasses and herbs;
- Scattered and restricted occurrences of small sized tree hollows;
- Presence of freshwater aquatic environments;
- Absence of closed and wet sclerophyll forests;
- Absence of winter flowering eucalypts; and
- Ongoing agricultural impacts such as grazing.

The selection process involves a subjective risk analysis of potential impacts relative to critical life cycle elements for each species. Matters considered important to this evaluation are:

- Value of foraging and breeding habitat relative to species requirements;
- Potential presence within the seed bank (flora);
- Presence of effective wildlife linkages;
- Potential presence of the species within the Study Area;
- Potential impact of the proposed development; and probable impact on off-Study Area areas of potential habitat.

Table 8: Sensitive Threatened Species

Species	Non-Breeding Habitat Quality	Breeding Habitat Quality	Wildlife Link	Potential Presence	Potential Impact	Sensitive Species Yes/No
<i>Acacia pubescens</i>	Moderate	Moderate	Fragmented	Absent	Low	No
<i>Dillwynia tenuifolia</i>	Moderate	Moderate	Fragmented	Absent	Low	No
<i>Grevillea juniperina</i>	High	High	Fragmented	Known	High	Yes
<i>Grevillea parviflora</i>	Moderate	Low	Fragmented	Absent	Low	No
<i>Hypsela sessiliflora</i>	Moderate	Low	Fragmented	Absent	Low	No
<i>Pimelea spicata</i>	Moderate	Moderate	Fragmented	Absent	Low	No
<i>Pultenaea parvifolia</i>	Moderate	Moderate	Fragmented	Absent	Low	No
<i>Bush Stone-curlew</i>	Moderate	Low	Fragmented	Low	Low	No
<i>Grey-headed Flying-fox</i>	Moderate	Low	Intact	Moderate	Low	No
<i>Eastern False Pipistrelle</i>	High	Low	Intact	Moderate	Moderate	Yes
<i>Eastern Free-tail Bat</i>	High	Low	Intact	Moderate	Moderate	Yes
<i>Cumberland Plain Land Snail</i>	Moderate	Moderate	Fragmented	Known	High	Yes

A discussion regarding the threatened species identified as 'sensitive species' in the above table is provided in **Section 9.1.1** relative to the proposed recommendations outlined in

Section 8.0. Justifications for eliminating the remaining species from the 'potential sensitive species list' are provided below.

Acacia pubescens

Historical records place this species within or nearby the Study Area. However, detailed surveys of potential habitat located in the east and southeast failed to identify any populations of this species within the Study Area. Thus, development related impacts would be exclusively restricted to areas of potential habitat.

Proposed Mitigation

Some vegetation supporting potential habitat for this species is likely to be retained in the proposed biodiversity corridor. No other mitigation is proposed or warranted given the absence of this species from the Study Area.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area (i.e. proposed biodiversity corridor), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas or wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

Dillwynia tenuifolia

Detailed surveys of potential habitat located in the east and southeast failed to identify any populations of this species within the Study Area. Thus, development related impacts are likely to be exclusively restricted to areas of potential habitat.

Proposed Mitigation

Some vegetation supporting potential habitat for this species is likely to be retained in the proposed biodiversity corridor. No other mitigation is proposed or warranted given the absence of this species from the Study Area.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area (i.e. proposed biodiversity corridor), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas or wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

Grevillea parviflora ssp. parviflora

Detailed surveys of potential habitat located throughout the Study Area failed to identify any populations of this species within the Study Area. Thus, development related impacts are likely to be exclusively restricted to areas of potential habitat.

Proposed Mitigation

Some vegetation supporting potential habitat for this species is likely to be retained in the proposed biodiversity corridor. No other mitigation is proposed or warranted given the absence of this species from the Study Area.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area (i.e. proposed biodiversity corridor), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas or wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

Hypsela sessiliflora

Detailed surveys of potential habitat located in the central and western parts failed to identify any populations of this species within the Study Area. Thus, development related impacts are likely to be exclusively restricted to areas of potential habitat.

Proposed Mitigation

Some vegetation supporting potential habitat for this species is likely to be retained in the proposed biodiversity corridor. No other mitigation is proposed or warranted given the absence of this species from the Study Area.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area (i.e. proposed biodiversity corridor), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas of wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

Pimelea spicata

Detailed surveys of potential habitat located in the central and southern parts of the Study Area failed to identify any populations of this species within the Study Area. Thus, development related impacts are likely to be exclusively restricted to areas of potential habitat.

Proposed Mitigation

Some vegetation supporting potential habitat for this species is likely to be retained in the proposed biodiversity corridor. No other mitigation is proposed or warranted given the absence of this species from the Study Area.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area (i.e. proposed biodiversity corridor), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas or wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

Pultenaea parvifolia

Detailed surveys of potential habitat located in the east and southeast failed to identify any populations of this species within the Study Area. Thus, development related impacts are likely to be exclusively restricted to areas of potential habitat.

Proposed Mitigation

Some vegetation supporting potential habitat for this species is likely to be retained in the proposed biodiversity corridor. No other mitigation is proposed or warranted given the absence of this species from the Study Area.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area (i.e. proposed biodiversity corridor), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas or wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

Bush Stone-curlew (*B. grallarius*)

The Study Area contains potential foraging and breeding habitat for the Bush Stone-curlew (*B. grallarius*). However, the influence of fire and grazing activities has substantially reduced the potential for this Study Area to support viable populations of this species. Vegetation of the Study Area forms part of a fragmented local wildlife corridor, with the majority of wildlife connectivity proposed to be retained in the proposed biodiversity corridor.

Proposed Mitigation

Some vegetation supporting potential foraging and breeding habitat for this species is likely to be retained in the proposed biodiversity corridor.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area (i.e. proposed biodiversity corridor), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas or wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

Grey-headed Flying Fox (*P. poliocephalus*)

Foraging activity by this species has been recorded throughout treed areas of the Study Area (Biosis Research, 1999). Eucalypts of the Study Area will provide a dependable foraging resource during the summer period, with the proposed development resulting in the displacement of some 36% of this foraging habitat. Movement throughout the locality should not be adversely affected by the proposed development as the proposed biodiversity corridor that passes through the south of the Study Area will maintain wildlife connectivity between Ropes and South Creeks.

Proposed Mitigation

Vegetation supporting potential foraging habitat for this species will be retained in the proposed biodiversity corridor located in the residual allotment. It is also recommended that landscaping works within the Development Zone consider the planting of native trees capable of supporting summer foraging activities. No other mitigation is proposed or warranted given the low breeding habitat values of the Study Area.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area (i.e. proposed biodiversity corridor), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas or wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

7.4 SEPP 44 – Koala Habitat Protection

Surveys for Koala trees and activity were undertaken to determine the presence of potential or core Koala habitat. One species (Forest Redgum) was detected in moderate densities throughout the Study Area. Further consideration of this matter is presented in **Section 9.2**.

7.5 EPBC Act

The Study Area is not located in a:

- Declared world heritage property;
- Ramsar wetland; or
- Commonwealth marine area

The proposed development of the Development Zone does not impact on a National Heritage Place and does not involve a nuclear action.

A discussion on the listed threatened species EPs and EECs is provided in **Section 7.1**. It is concluded that the proposed development is likely to result in the displacement of the nationally endangered Cumberland Plain Woodland community. Parts of this community will be retained and re-established within the Biodiversity Conservation Corridor. Limited habitat values for migratory species listed within the schedules of the EPBC Act occur in the Study Area. These matters will be addressed in a 'significance assessment' to determine whether a referral to Environment Australia is warranted.

8 MANAGEMENT STRATEGIES

It is recommended that as part of the development of the Development Zone within the Study Area, the following management strategies, which have been developed in accordance with the principles of ecologically sustainable development, be incorporated to offset the impacts of proposed development.

- Erect appropriately dimensioned and designed nest boxes in suitable locations within the proposed Biodiversity Conservation Corridor to offset the loss of trees containing hollows. These artificial hollows should be designed to favour roosting habitat for indigenous species;
- Utilise *Grevillea juniperina* ssp. *juniperina* within the landscape planting scheme of the proposed developed areas;
- Relocate tree trunks felled during the establishment of the development footprint for use in the proposed Biodiversity Conservation Corridor, to improve the complexity of ground fauna habitats, particularly for the Cumberland Plain Land Snail (*M. corneovirens*);
- Carry out salvage survey, prior to clearing and earthworks, to relocate any live specimens of the Cumberland Plain Land Snail (*M. corneovirens*) to the proposed Biodiversity Conservation Corridor (it is noted that no specimens of the Cumberland Plain Land Snail were identified in the Development Zone of the Study Area; and
- Establishment of a Biodiversity Conservation Corridor in accordance with the proposal contained in the Biodiversity Management Plan, endorsed in principle by PCC and DEC.

9 IMPACT ASSESSMENT

Species sensitive to the impacts discussed in **Section 6** are assessed in this section. Assessments assume implementation of the management strategies discussed in **Section 8**.

9.1 NSW Listed Species

9.1.1 Sensitive Species

Sensitive species identified in **Section 7.3** are discussed below in further detail.

Grevillea juniperina ssp. juniperina

The Study Area contains known habitat for this species at the northern boundary of the Study Area. The majority of this population, approximately 30 individuals, is located adjacent to Lenore Lane, outside the Development Zone.

Development Related Threats

The proposed development will not result in the removal of the identified habitat or specimens of this species. The local population is likely to be conserved within any vegetation buffer that is created adjacent to Lenore Lane as part of future development of the EPEA, or within the proposed Biodiversity Conservation Corridor.

Proposed Mitigation

The proposed retention of vegetation within the proposed Biodiversity Conservation Corridor and planting of this species within the developed landscape should satisfactorily mitigate development impacts. A large part of this species' distribution should be conserved through the translocation of propagated material to areas of the Study Area dedicated to landscaping or biodiversity conservation.

It is considered that the management strategies presented in **Section 8.0** are sufficient to avoid a significant impact on this species.

Impact Assessment

Although the proposed development will not result in the loss of specimens of this species and their habitat from the Study Area, this species will be retained as a 'Sensitive Species'. An eight-part test of significance will be prepared for this species. Refer to **Section 9.1.3** for details.

Eastern False Pipistrell (*F. tasmaniensis*)

The Study Area contains potential foraging and breeding habitat for the Eastern False Pipistrelle (*F. tasmaniensis*). However, the limited occurrence of tree hollows, which are critical to the presence of roosting populations, substantially reduces the potential for the Study Area to support viable populations of this species. Potential foraging habitats will be reduced in the developed landscape. Vegetation of the Study Area forms part of a fragmented local wildlife corridor, with the majority of wildlife connectivity to be retained in the proposed Biodiversity Conservation Corridor.

Proposed Mitigation

Vegetation supporting potential foraging habitat for this species would be retained in the proposed Biodiversity Conservation Corridor. Trees and stags that contain hollows are rare within the Study Area. The removal of these habitat features should be compensated by the installation of suitably sized nest boxes (simulating the tree hollow) in the proposed Biodiversity

Conservation Corridor. These nest boxes should be designed to prevent occupation by undesirable species such as the Starling or Indian Myna. No other mitigation is proposed or warranted given the sensitivities of this species to the impacts.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area in the proposed Biodiversity Conservation Corridor and the provision of compensatory habitat (including nest boxes), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas or wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

Eastern Free-tail Bat (*M. norfolcensis*)

The Study Area contains potential foraging and breeding habitat for the Eastern Free-tail Bat (*M. norfolcensis*). However, the limited occurrence of tree hollows, which are critical to the presence of roosting populations, substantially reduces the potential for the Study Area to support viable populations of this species. Potential foraging habitats will be reduced in the developed landscape. Vegetation of the Study Area forms part of the fragmented local wildlife corridor, with the majority of wildlife connectivity likely to be retained in the post development landscape within the proposed Biodiversity Conservation Corridor.

Proposed Mitigation

Vegetation supporting potential foraging habitat for this species would be retained in the proposed Biodiversity Conservation Corridor. Trees and stags that contain hollows are rare within the Study Area. The removal of these habitat features should be compensated by the installation of suitable sized nest boxes (simulating the tree hollow) in the proposed Biodiversity Conservation Corridor. These nest boxes should be designed to prevent occupation by undesirable species such as the Starling or Indian Myna. No other mitigation is proposed or warranted given the sensitivities of this species to the impacts.

Impact Assessment

Given the proposed retention of native vegetation throughout the southern part of the Study Area in the proposed Biodiversity Conservation Corridor and the provision of compensatory habitat (including nest boxes), it is concluded that the local and regional habitats of this species are not likely to be adversely impacted by the proposed development. No core breeding areas or wildlife corridors are likely to be adversely affected. Thus, it is proposed to eliminate this species from the impact assessment.

Cumberland Plain Land Snail (*M. corneovirens*)

The Study Area contains known foraging and breeding habitat for Cumberland Plain Land Snail (*M. corneovirens*). However, the influence of fire and grazing activities has substantially reduced the potential for the Study Area to support viable populations of this species. This survey failed to detect any live or dead specimens within the Study Area, a result that is likely to be directly attributed to the action of recent fires and grazing activity. Vegetation of the Study Area forms part of a fragmented local wildlife corridor, with the majority of wildlife connectivity proposed to be retained in the post development landscape in the proposed Biodiversity Conservation Corridor.

Proposed Mitigation

Vegetation supporting known foraging and breeding habitat for this species would be retained in the proposed Biodiversity Conservation Corridor. It is also recommended that felled trees and shrub material be relocated to the Biodiversity Conservation Corridor to reinstate the complex leaf litter layer required to support known populations of this species. Specimens located within the Development Zone should be collected and relocated to the proposed Biodiversity

Conservation Corridor prior to clearing and earthworks, to maintain the integrity of the local genetic pool.

Impact Assessment

Given the likely loss of this species and habitat from the Development Zone, it is concluded that this species will be retained as a 'Sensitive Species'. An eight-part test of significance will be prepared for this species. Refer to **Section 9.1.3** for details.

Cumberland Plain Woodland

Cumberland Plain Woodland is located throughout the Study Area, with the exception of the eastern boundary. The mapped Study Area distribution of this community is shown in **Figure 2** as Grey Box – Forest Redgum Open Forest. The community is relatively intact despite disturbances such as past clearing, fire and grazing by goats and sheep.

Development Related Threats

The proposed development of the Development Zone will result in the removal of known habitat from the Study Area. It is recommended that sufficient mitigation be afforded to this EEC to ensure that the long-term local impacts are minimised such that an appropriate representation of this community is retained and managed within the local area.

Proposed Mitigation

The loss of approximately of this EEC from the Study Area is regarded as requiring mitigation to minimise the potential for a significant impact on this community.

The proposed Biodiversity Conservation Corridor provides a framework for development within the EPEA to occur in association with positive long-term conservation outcomes that benefit the local occurrence of this EEC. Mitigation such as the establishment and management of a universally endorsed Biodiversity Conservation Corridor, such as that endorsed in principle by PCC and DEC, is considered a satisfactory method for the mitigation of development related impacts. Incorporating an endorsed Biodiversity Conservation Corridor strategy as a mitigation measure is likely to result in a low insignificant impact.

Shale/Gravel Transition Forest

Shale/Gravel Transition Forest is located along the eastern boundary of the Study Area. The mapped Study Area distribution of this community is shown in **Figure 2** as Broad-leaved Ironbark – Grey Box – Forest Redgum Open Forest. The community is relatively intact despite disturbances such as past clearing, fire and grazing by goats and sheep.

Development Related Threats

The proposed development will result in the removal of known habitat from the Study Area to accommodate the proposed development. The proposed retention and planting of similar vegetation types throughout the proposed Biodiversity Conservation Corridor will mitigate the potential development impacts. It is recommended that sufficient mitigation be afforded to this EEC to ensure that the long-term local impacts are minimised such that an appropriate representation of this community is retained and managed within the local area.

Proposed Mitigation

The loss of habitat of this EEC from the Study Area is regarded as requiring mitigation to minimise the potential for a significant impact on this community.

The proposed Biodiversity Conservation Corridor provides a framework for development within the EPEA to occur in association with positive long-term conservation outcomes that benefit the local occurrence of this EEC. Mitigation such as the establishment and management of a universally endorsed Biodiversity Conservation Corridor, such as that endorsed in principle by

PCC and DEC, is considered a satisfactory method for the mitigation of development related impacts. Incorporating an endorsed Biodiversity Conservation Corridor strategy as a mitigation measure is likely to result in a low insignificant impact.

9.1.2 Impact Mitigation

The provision of the Biodiversity Conservation Corridor as mitigation is a concept that has been negotiated with PCC and DEC.

9.1.3 Significance

The assessment of the significance of the impact of the proposed project on flora and fauna listed under NSW legislation has been prepared on a balance of the development impacts discussed in **Section 6.0** and the management strategies presented in **Section 8.0**. **Tables 9 - 12** summarise the results.

Table 9: Significance of Impact – *Grevillea juniperina* ssp. *juniperina*

Criterion	Relevance
a) In the case of a threatened species, whether the proposal is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Known population within the Study Area. Retention of plants adjacent to Lenore Lane and retention of habitat within proposed Biodiversity Conservation Corridor sufficient to offset impact. Not likely to be placed at risk of local extinction.
b) In the case of an endangered population, whether the proposal is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not listed as an EP
c) In relation to the regional distribution of the habitat to be modified / removed.	Small area affected. Net loss of potential habitat limited relative to known regional habitat.
d) Whether an area is to become isolated for a threatened species.	Vegetation connectively to remain intact. Local wildlife corridors unlikely to be adversely affected. Regional wildlife corridors unlikely to be adversely impacted.
e) Whether critical habitat will be affected.	No critical habitat declared in the area
f) Whether a threatened species is adequately represented in the regions conservation reserves.	Not adequately represented in conservation reserves of the Sydney Basin Bioregion.
g) Whether the development or activity recognised as a threatening process	Land clearing unlikely to have a significant impact on this species and its habitat provided mitigation identified in Section 8.0 is undertaken.
h) Whether any threatened species is at the limit of its known distribution.	Species not at its natural limit of distribution.

Table 10: Significance of Impact – Cumberland Plain Land Snail

Criterion	Relevance
a) In the case of a threatened species, whether the proposal is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Known population. Known habitat to be removed. Retention and enhancement of vegetation in proposed Biodiversity Conservation Corridor to protect remaining population and known habitat. Not likely to be placed at risk of local extinction.
b) In the case of an endangered population, whether the proposal is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not listed as an EP.

Criterion	Relevance
c) In relation to the regional distribution of the habitat to be modified / removed.	Small area of known habitat to be affected. Net loss of habitat limited relative to known regional habitat.
d) Whether an area is to become isolated for a threatened species.	Vegetation connectively to remain intact. Local wildlife corridors unlikely to be adversely affected. Regional wildlife corridors unlikely to be adversely impacted.
e) Whether critical habitat will be affected.	No critical habitat declared in the area.
f) Whether a threatened species is adequately represented in the regions conservation reserves.	Not adequately represented in conservation reserves of the Sydney Basin Bioregion.
g) Whether the development or activity recognised as a threatening process	Land clearing unlikely to have a significant impact on this species and its habitat provided mitigation identified in Section 8.0 is undertaken.
h) Whether any threatened species is at the limit of its known distribution.	Species not at its natural limit of distribution.

Table 11: Significance of Impact – Cumberland Plain Woodland EEC

Criterion	Relevance
a) In the case of a threatened species, whether the proposal is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Not a listed threatened species.
b) In the case of an endangered population, whether the proposal is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not listed as an EP.

Criterion	Relevance
c) In relation to the regional distribution of the habitat to be modified / removed.	Loss of known habitat mitigated by establishment of Biodiversity Conservation Corridor. Not likely to result in a significant modification of this community's local and regional distribution.
d) Whether an area is to become isolated for a threatened species.	Vegetation connectively to remain intact. Local wildlife corridors unlikely to be adversely affected. Regional wildlife corridors unlikely to be adversely impacted.
e) Whether critical habitat will be affected.	No critical habitat declared in the area.
f) Whether a threatened species is adequately represented in the regions conservation reserves.	Not adequately represented in conservation reserves of the Sydney Basin Bioregion.
g) Whether the development or activity recognised as a threatening process	Land clearing unlikely to have a significant impact on this EEC and its habitat provided mitigation identified in Section 8.0 is undertaken.
h) Whether any threatened species is at the limit of its known distribution.	EEC not at its natural limit of distribution.

Table 12: Significance of Impact – Shale/Gravel Transition Forest EEC

Criterion	Relevance
a) In the case of a threatened species, whether the proposal is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Not a listed threatened species.
b) In the case of an endangered population, whether the proposal is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not listed as an EP.
c) In relation to the regional distribution of the habitat to be modified / removed	Loss of known habitat mitigated by establishment of Biodiversity Conservation Corridor. Not likely to result in a significant modification of this community's local and regional distribution.
d) Whether an area is to become isolated for a threatened species.	Vegetation connectively to remain intact. Local wildlife corridors unlikely to be adversely affected. Regional wildlife corridors unlikely to be adversely impacted.
e) Whether critical habitat will be affected.	No critical habitat declared in the area
f) Whether a threatened species is adequately represented in the regions conservation reserves.	Not adequately represented in conservation reserves of the Sydney Basin Bioregion.

Criterion	Relevance
g) Whether the development or activity recognised as a threatening process	Land clearing unlikely to have a significant impact on this EEC and its habitat provided mitigation identified in Section 8.0 is undertaken.
h) Whether any threatened species is at the limit of its known distribution.	EEC not at its natural limit of distribution.

From this assessment, it is concluded that the net impact of the proposed project is unlikely to have a significant impact on *Grevillea juniperina ssp. Juniperina*, Cumberland Plain Land Snail (*M. corneovirens*) habitat (previously observed in the Study Area by Biosis), Cumberland Plain Woodland and Shale/Gravel Transition Forest provided mitigation measures identified in Section 8.0 are implemented. Key to this is a universally endorsed Biodiversity Conservation Corridor.

9.2 SEPP 44 – Koala Habitat Protection

The Study Area was assessed for Koala activity using the following methods:

- A search of the NPWS Wildlife Atlas Database (NPWS, 2004);
- Previous survey of koala food trees located within Lot 5 for signs of koala use. Tree trunk and their bases were inspected for the presence of scratch/claw marks and faecal pellets characteristic of this species; and
- A previous estimate and assessment of tree density (stems/ha) relative to the preferred listed Koala feed trees.

The survey identified the presence of one Koala feed tree species, listed on Schedule 2 of SEPP 44, this being the Forest Redgum (*E. tereticornis*). The density of this tree species, relative to other trees of the Study Area, is estimated to be greater than 15% of the total tree canopy. Therefore, the vegetation of the Study Area may constitute potential Koala habitat. However, no Koalas or evidence of recent Koala activity was observed during the survey HLA (2005). Given the proposed conservation of Forest Redgum (*E. tereticornis*) and absence of Koala activity, it is concluded that no specific requirements for the protection of Koala habitat need to be implemented for the proposed project.

9.3 EPBC Act

9.3.1 Listed Threatened Species and Communities

Two nationally threatened species are identified for the Study Area, these being the Grey-headed Flying Fox (*P. poliocephalus*) and Cumberland Plain Land Snail (*M. corneovirens*), and one EEC (Cumberland Plain Woodland). The Grey-headed Flying Fox (*P. poliocephalus*) is a nationally vulnerable threatened species that may potentially utilise the Study Area for foraging purposes. The Cumberland Plain Land Snail (*M. corneovirens*) is a nationally endangered species that is also known to use the Study Area for its entire lifecycle (Biosis Research, 1999).

Potential foraging habitat is widespread throughout the Study Area. Cumberland Plain Woodland, a nationally EEC is present within the Study Area. A more detailed discussion on

these matters is provided in the previous section. Therefore, these matters will be addressed in the significance assessment.

9.3.2 Listed Migratory Species

Eight migratory species (terrestrial and wetland) and eight listed marine species were identified in the EPBC Act Protected Matters Report as potentially occurring in the locality. One of these species, Latham's Snipe (*Gallinago hardwickii*), has been observed in the Study Area during previous surveys (Biosis Research, 1999). None of the other listed migratory or marine species or their habitats were identified within the Study Area during the survey. This matter will be discussed in the significance assessment.

9.3.3 Significance Assessment

In determining the nature and magnitude of the potential impact of the proposed project, it is important to consider matters such as:

- All on-site and off-site impacts;
- All direct and indirect impacts;
- The frequency and duration of the action;
- The total impact, which can be attributed to that action over the entire geographic area affected, and over time;
- The sensitivity of the receiving environment, and
- The degree of confidence with which the impacts of the action are known and understood.

The significance assessment for MNES is provided in **Table 13**.

In summary, it is concluded that there will be a low significant impact on the local foraging resources for the Grey-headed Flying Fox (*P. poliocephalus*). No impact on breeding or core roost sites is expected. Similarly, no migratory species (terrestrial and wetland) or marine species are likely to experience an adverse impact through the proposed development of the Development Zone.

Table 13: Significance Assessment of MNES

All on-site and off-site impacts	The development of Study Area will result in the removal of known Grey-headed Flying Fox foraging habitat. No campsites for the species are to be adversely affected by the proposed development. On-site impacts are likely to be adequately mitigated with the establishment of the proposed biodiversity conservation corridor. The impact on regional resources will be low. Previously identified known Cumberland Plain Land Snail habitat, which is characterised by the Cumberland Plain Woodland EEC, will also be disturbed. This disturbance would be mitigated by the establishment of the biodiversity conservation corridor and is not likely to result in a substantial impact on the local distribution of Cumberland Plain Land Snail habitat and Cumberland Plain Woodland EEC.
All direct and indirect impacts	The proposed development will not remove a significant area of potential foraging habitat for the Grey-headed Flying Fox. The removal of Cumberland Plain Woodland from the Development Zone would be mitigated by the establishment of the biodiversity conservation corridor, which would not result in a substantial adjustment of the community's local and regional status. The Cumberland Plain Land Snail will be similarly affected.
The frequency and duration of the action	The proposed development is planned to be a single event and will be permanent.
The total impact which can be attributed to that action over the entire geographic area affected	High.
The sensitivity of the receiving environment	The sensitivity of the receiving environment is high given that the habitat proposed for removal is connected with other tracts of vegetation of similar ecological value.
The degree of confidence with which the impacts of the action are known and understood	A high degree of confidence is placed on this assessment.

It is also concluded that the proposed disturbance to the local extent of Cumberland Plain Woodland and Cumberland Plain Land Snail (*M. corneovirens*) habitats is not substantial, providing mitigation measures identified in **Section 8.0** are undertaken.

10 CONCLUSIONS

The results of the field survey and impact assessment support the following conclusions.

- One threatened species (*Grevillea juniperina* ssp. *juniperina*) of State environmental significance was observed within the Study Area during the survey period. The Grey-headed Flying Fox (*P. poliocephalus*) and Cumberland Plain Land Snail (*M. cornevirens*) have been observed in the Study Area during previous surveys;
- No EPs or critical habitat occurs within the Study Area;
- Two EECs (Cumberland Plain Woodland and Shale/Gravel Transition Forest) were observed within the Study Area during the survey period;
- The extent of native vegetation clearing associated with this proposed project would be offset through the establishment of the proposed biodiversity conservation corridor;
- Mitigation is required to offset the biological impacts of the proposed project on the Cumberland Plain Land Snail (*M. cornevirens*), Cumberland Plain Woodland and Shale/Gravel Transition Forest EECs; and
- The establishment of a Biodiversity Conservation Corridor, as endorsed in principle by PCC and DEC, is a key element of any mitigation measures.



Figures



PROJECT-FILE NAME S6000631
 DATE 18 August 2006
 DRAWN TO
 APPROVED

- Approximate bulk earthworks area
- Quadrat location
- + Survey site



**Proposed Development Zone
 and Survey Locations**
 CSR
 Flora and Fauna Survey
 The Eastern Erskine Park Lands





PROJECT-FILE NAME S6000631
 DATE 18 August 2006
 DRAWN TO
 APPROVED

- Approximate bulk earthworks area
- Riparian corridor
- Grey Box - Iron Bark
- Grey Box - Forest Red Gum
- Open Grassland



**Existing Vegetation Communities
 CSR**
 Flora and Fauna Survey
 The Eastern Erskine Park Lands



FIGURE

2



Appendix 1

Flora list

Sites were in the following communities:

Site 1. Broad-leaved Ironbark – Grey Box

Site 2. Grey Box – Forest Redgum Open Forest

Site 3. Aquatic Herblands and Wetlands

Site 4. Riparian Forest dominated by Swamp Oak and Eucalypts

Table 1: Native Flora Species of the Site

Common name	Scientific name	Site present
Black sheoak	<i>Allocasuarina littoralis</i>	4
Broom surge	<i>Amperea xiphoclada</i>	1
Wiregrass	<i>Aristida vagans</i>	1, 2
Common woodruff	<i>Asperula conferta</i>	1
Wallaby grass	<i>Austrodanthonia linkii</i>	1
-	<i>Bossiaea prostrata</i>	1
Blackthorn	<i>Bursaria spinosa</i>	1, 2
Pennywort	<i>Centella asiatica</i>	4
Native thistle	<i>Cymbonotus lawsonianus</i>	4
Couch	<i>Cynodon dactylon</i>	1
-	<i>Cyperus difformis</i>	3
Star fruit	<i>Damasonium minus</i>	3
-	<i>Desmodium rhytidophyllum</i>	2
-	<i>Desmodium brachypodum</i>	2, 4
Kidney weed	<i>Dichondra repens</i>	1, 2, 3, 4
Hop Bush	<i>Dodonaea viscosa ssp. cuneata</i>	4
Nodding saltbush	<i>Einadia nutans</i>	1
-	<i>Eleocharis cylindrostachys</i>	3
-	<i>Eragrostis sp.</i>	3
Broad-leaved ironbark	<i>Eucalyptus fibrosa</i>	1
Grey Box	<i>Eucalyptus moluccana</i>	1, 2, 3, 4
Forest redgum	<i>Eucalyptus tereticornis</i>	3, 4
Violet leaved goodenia	<i>Goodenia hederacea</i>	1
Grevillea	<i>Grevillea juniperina ssp. juniperina</i>	1
Juncus	<i>Juncus usitatus</i>	4
Mat rush	<i>Lomandra longifolia</i>	2
Paper bark	<i>Melaleuca decora</i>	4
Paper bark	<i>Melaleuca nodosa</i>	4
	<i>Myriophyllum variifolium</i>	4
Two colour panic	<i>Panicum simile</i>	2
Frogsmouth	<i>Philydrum lanuginosum</i>	3
-	<i>Plantago gaudichaudii</i>	2
-	<i>Plantago varia</i>	3
Pond weed	<i>Potamogeton tricarlinatus</i>	3
Rough groundsel	<i>Senecio hispidulus</i>	2
-	<i>Senecio diaschides</i>	3
Kangaroo grass	<i>Themeda australis</i>	1,2, 3
-	<i>Trifolium sp.</i>	2
-	<i>Vittandinia sulcata</i>	2
-	<i>Xanthosia tridentata</i>	1

Table 2: Exotic Flora Species of the Site

Common name	Scientific name	Site present
Rhodes grass	<i>Chloris gayana</i>	1, 3
Scotch thistle	<i>Cirsium vulgare</i>	4
Spiny rush	<i>Juncus acutus</i>	3
Paspalum	<i>Paspalum dilatatum</i>	2, 3
Ribwort	<i>Plantago lanceolata</i>	1
Blackberry	<i>Rubus ulmifolius</i>	3, 4
Fire weed	<i>Senecio madagascariensis</i>	2, 4
Paddy's lucern	<i>Sida rhombifolia</i>	4

Fauna list

Table 1: Fauna Species of the Site

Common name	Scientific name
Birds	
Black-faced Cuckoo-shrike	<i>Coracina novahollandiae</i>
White-winged Chough	<i>Corcorax melanorhamphos</i>
Australian Raven	<i>Corvus coronoides</i>
Pied Butcherbird	<i>Cracticus nigrogularis</i>
Maggie-lark	<i>Grallina cyanoleuca</i>
Magpie	<i>Gymnorhyna tibicen</i>
Noisy Miner	<i>Manorina melanocephala</i>
Eastern Rosella	<i>Platycercus eximus</i>
Willie Wagtail	<i>Rhipidura fuliginosa</i>
Mammals	
Eastern Grey Kangaroo	<i>Macropus giganteus</i>
Fox	<i>Vulpes vulpes</i>
Rabbit	<i>Oryctolagus cuniculus</i>
Amphibians	
Eastern Froglet	<i>Crinia signifera</i>