ASSESSMENT | PLANNING | MANAGEMENT

Wagga Wagga Planning Study

Environmental / Biodiversity report for Moorong Street

(Project No. 069-052)

Report prepared for:
Willana Associates
on behalf of Wagga Wagga City Council

March 2008

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Executive Summary

Wagga Wagga City Council (WWCC) is in the process of preparing a draft Local Environment Plan (LEP) for the Wagga Wagga Local Government Area (WWLGA). The draft plan is intended to implement the strategic planning undertaken in the Wagga Wagga Spatial Plan 2007 (WWCC 2006) and will be prepared in accordance with the *Standard Instrument (Local Environmental Plans) Order 2006*.

Eco Logical Australia Pty Ltd was commissioned by Wagga Wagga City Council to prepare a study of the biodiversity values of a site at Moorong Street, Wagga Wagga, along with seven other sites (each subject to an individual report). The biodiversity studies will feed into the broader environmental study for each proposed development site. Each biodiversity report presents the ecological values of the subject lands and whether development of the site will "maintain or improve" biodiversity.

This biodiversity report seeks to present the ecological values of the Moorong Street development site and to discuss the potential impacts on ecological values, including threatened species, endangered populations and endangered ecological communities, arising from development of the site. Moreover the report seeks to provide a framework for maintaining and improving biodiversity at the Moorong Street site.

The specific objectives of the project are to:

- Describe the ecological values of the site
- Describe potential impacts of proposed development
- Recommend ways to minimise impacts on ecological values of the site
- Where impacts are unavoidable, to recommend offsets which ensure larger, viable areas of native vegetation and habitat are retained in such a way as to enhance landscape connectivity.

The report aims to provide a structure plan for the Moorong Street development site which will allow development of the site while avoiding impacts to native vegetation and threatened species habitats

The site was primarily covered with exotic species and had a history of agricultural use. Some yellow box (*Eucalyptus melliodora*) and river Redgum (*Eucalyptus camaldulensis*) occurred on site with an exotic understorey and were classified as scattered paddock tree based on the projected foliage cover and floristic composition. While these species may have been part of the endangered White Box, Yellow Box, Blakely's Red Gum woodland, they have been degraded to a state where they no longer represent the community.

No threatened species were recorded during the survey, however, there is habitat potential for five threatened fauna, little pied bat, yellow-bellied sheathtail bat, superb parrot, squirrel glider, large-footed myotis.

Consequently, the development potential of the site is extensive, however, the loss of remnant trees will require offsetting. It is recommended that remnant trees (6 of

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which are hollow bearing) be incorporated into future Master Planning to retain their values in the landscape.

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1. Introduction

1.1 Project Background

Wagga Wagga City Council (WWCC) is in the process of preparing a draft Local Environment Plan (LEP) for the Wagga Wagga Local Government Area (WWLGA). The draft plan is intended to implement the strategic planning undertaken in the Wagga Wagga Spatial Plan 2007 (WWCC 2006) and will be prepared in accordance with the *Standard Instrument (Local Environmental Plans) Order 2006*.

Preparation of the draft LEP requires that 8 environmental studies be undertaken at sites within the WWLGA that are proposed to be subject to significant zoning changes. These sites are:

- Boorooma East
- Estella West
- Lloyd
- Bomen
- Eastern Industrial – Copland Street South
- Eastern Industrial – Hammond Avenue North
- Edison Road
- Moorong Street

Eco Logical Australia Pty Ltd has been commissioned by Wagga Wagga City Council to prepare a study of the biodiversity values of each of the above sites. The biodiversity studies will feed into the broader environmental study for each proposed development site. Each biodiversity report will present the ecological values of the subject lands and whether development of the site will "maintain or improve" biodiversity.

The current document presents the biodiversity report for the proposed development site known as Moorong Street. Biodiversity reports for each of the 7 additional development sites are presented as separate documents.

1.2 Project Objectives

This biodiversity report seeks to present the ecological values of the Moorong Street development site and to discuss the potential impacts on ecological values, including threatened species, endangered populations and endangered ecological communities, arising from development of the site. Moreover the report seeks to provide a framework for maintaining and improving biodiversity at the Moorong Street site.

The specific objectives of the project are to:

- Describe the ecological values of the site
- Describe potential impacts of proposed development
- Recommend ways to minimise impacts on ecological values of the site
- Where impacts are unavoidable, to recommend offsets which ensure larger, viable areas of native vegetation and habitat are retained in such a way as to enhance landscape connectivity.

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The report aims to provide a structure plan for the Moorong Street development site which will allow development of the site while avoiding impacts to native vegetation and threatened species habitats

1.3 Study Area

The Moorong Street site occurs to the north west of the existing urban area of the city of Wagga Wagga. The site occupies an area of approximately 11.6 ha and is bound by the Sturt Highway to the south, Olympic Highway to the east, and the Wiradjuri walking track on the western side (Map 1).

Current land use at the site is predominately rural, with cropping and improved pasture the predominant agricultural practices. Land in areas surrounding the site is mainly used for industrial purposes, although some residential development occurs south west of the site (Map 1).

No water bodies are present on the site, although the Flowerdale Lagoon occurs close to the site on the west and provides an area of passive recreation.

The site is flat with an elevation of 176 m AHD. Soils on the site are Kurrajong Plain soils described by Chen and McKane (1997). These soils are silty clays, quite fertile and have low erosion hazard.

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Map 1 – Location of proposed Moorong Street development site.

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1.4 Legislative Summary

The following provides a brief summary of the main pieces of legislation relevant to biodiversity conservation within the study area.

NSW Native Vegetation Act, 2003 (NV Act)
The objects of the *Native Vegetation Act, 2003* (NV Act) are to manage native vegetation on a regional basis through bringing an end to broadscale clearing and seeking to protect and improve areas of existing native vegetation, particularly those areas of high conservation value. The NV Act also seeks to encourage the revegetation and rehabilitation of land in accordance with the principles of ecologically sustainable development.

Under the NV Act, clearing of native vegetation is not permitted unless the clearing is in accordance with a development consent granted in accordance with the NV Act or unless the clearing is in accordance with a property vegetation plan (PVP). Clearing of unprotected regrowth, of certain groundcover and clearing associated with routine agricultural management activities (RAMAs) does not constitute clearing of native vegetation under the Act and therefore does not require a consent approval or PVP.

Under the NV Act, clearing of native vegetation cannot be undertaken unless it **improves or maintains environment outcomes**. Mitigating actions or offsets which provide gains equal to, or exceeding, losses from clearing, may be required in order for clearing of native vegetation to improve or maintain biodiversity values under the Act. Under the Act, native vegetation which is in **moderate to good condition** and is of a type, or within a landscape that is highly cleared (>70%), can not be offset and is not permitted to be cleared.

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

The LES is being prepared in accordance with section 57 of the EP&A Act. Issues to be addressed in the LES were raised during consultation with agencies (conducted in accordance with sections 34A and 62 of the EP&A Act).

NSW Threatened Species Conservation Act, 1995 (TSC Act)
The TSC Act aims to protect and encourage the recovery of threatened species, populations and ecological communities listed under the Act. The integration of the TSC Act with the NSW Environmental Planning and Assessment Act (EP&A Act) requires consideration of the likelihood of a development (Part 4 of the EP&A Act) or an activity (Part 5 of the EP&A Act) significantly affecting threatened species, populations and ecological communities or their habitat. This is undertaken through the preparation of a '7-part test' (Section 5A).

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Schedule 1 of the TSC Act lists threatened species, populations and ecological communities and species that are endangered or presumed extinct. Schedule 2 lists vulnerable species and Schedule 3 lists key threatening processes.

The TSC Act defines 'endangered' as a species, population or ecological community that is likely to become extinct or is in immediate danger of extinction. A species that is 'presumed extinct' has not been located in nature during the preceding fifty years despite the searching of known and likely habitats. A 'vulnerable' species is likely to become endangered unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

The site is known or potential habitat for a number of threatened species, ecological communities and/or migratory species listed under the Act.

The TSC Act provides for the preparation of recovery plans and threat abatement plans, some of which apply to the site. Biodiversity certification of Local Environment Plans (LEPs) is also facilitated through this Act.

Commonwealth Environment Protection & Biodiversity Conservation Act, 1999 (EPBC Act)

Approval from the Commonwealth Environment Minister is required under the EPBC Act if an action (can include a project, development, undertaking or activity) will, or is likely to, have a significant impact on matters considered to be of national environmental significance (NES matters). NES matters relevant to this study include threatened species, ecological communities and migratory (JAMBA/CAMBA) species that are listed under the Act.

The EPBC Act does not define significant impact but identifies matters that are necessary to take into consideration. If the matter is referred to the Minister a decision is generally required within 20 days in relation to whether an action requires Commonwealth approval.

The site is known or potential habitat for a number of threatened species, ecological communities and/or migratory species listed under the Act.

NSW Noxious Weeds Act, 1993 (NW Act)

The objectives of the Noxious Weeds Act are to identify which noxious weeds require control measures, identify control measures suitable to those species and to specify the responsibilities of both public and private landholders for noxious weed control.

The Noxious Weeds Act allows for the declaration of weeds as noxious within a Local Control Area (LCA) and assigns a weed control class to each declared noxious weeds. The Moorong Street site is located within the Wagga Wagga City Council LCA. Currently 106 species or groups of species are listed as noxious weeds within the Wagga Wagga City Council LCA. 3 noxious weeds are known to occur on the site.

Water Management Act 2000 (WM Act)

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The Water Management *Act 2000* and *Water Act 1912* control the extraction of water, the use of water, the construction of works such as dams and weirs and the carrying out of activities in or near water sources in New South Wales. 'Water sources' include any river, lake, estuary, place where water occurs naturally on or below the surface of the ground and New South Wales coastal waters.

Approval is required under the *Water Management Act* for carrying out of a 'controlled activity' on 'waterfront land' (s91). Controlled activities' include:

- the construction of buildings or carrying out of works;
- the removal of material or vegetation from land by excavation or any other means;
- the deposition of material on land by landfill or otherwise; or
- any activity that affects the quantity or flow of water in a water source.

'Waterfront land' is defined as the bed of any river or lake, and any land lying between any permanent or intermittent waterbody or lake and a line drawn parallel to and forty metres inland from either the highest bank or shore (in relation to non-tidal waters) or the mean high water mark (in relation to tidal waters). The distance of forty metres can be reduced by the regulations. Depending upon the regulations, land adjoining coastal waters may also be waterfront land.

It is an offence to carry out a controlled activity on waterfront land except in accordance with an approval.

The removal of vegetation or material from within 40 m of waterbodies within the site would require approval under the Act.

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2. Description of Methods

2.1 Review of existing information

A review of the Atlas of NSW Wildlife was undertaken for the site and determined that while there are many records of threatened species in the Wagga LGA, most of these are associated with patches of remnant vegetation.

Aerial photography was supplied by Wagga Wagga City Council and reviewed prior to field survey.

2.2 Desktop Assessment

The NSW National Parks and Wildlife Atlas of NSW Wildlife and Commonwealth Environmental Protection and Biodiversity Conservation Act (1999) Protected Matters Search Tool were used to supplement surveys undertaken in this site in order to compile a comprehensive list of flora and fauna likely or with the potential to occur at the site. The searches were performed on 4/09/2007 for the Wagga Wagga LGA. Likelihood of occurrences for threatened species, populations and communities for the Moorong Street site were then made based on the habitat characteristics of the site, results of the field survey and professional judgement (Appendix 1). Five terms for the likelihood of occurrence of species were used and are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

2.3 Field Survey

The proposal site was inspected on 15th August 2007 by Sam Luccitti and Bruce Mullins of Eco Logical Australia.

A random traverse was undertaken across the site. The traverses extended for more that 100 m and all visible vascular flora were recorded (Map 2). Incidental sightings of fauna were also noted. The survey extended for approximately 2 person hours.

Tree counts were undertaken at the site with the location of each tree marked on a high resolution map. For each tree an estimation of height, diameter at breast height and number of small, medium and large hollows was made. Trees were considered large if they had a DBH greater than 40 cm and less than 80 cm. Trees with DBH greater than 80 cm were recorded as very large trees.

2.4 Desktop review results

The species, populations and communities considered to have the potential to occur on the site based on the habitat present are outlined in Table 1.

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Table 1: Species, populations and communities listed under the TSC Act and EPBC Act for which the site represents habitat

Scientific Name	Common Name	Status		Habitat
		TSC Act	EPBC Act	
Ardea ibis	Cattle Egret		M	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats
Hirundapus caudacutus	White-throated Needletail		M	Open space above canopy. Forages over large areas
Polytelis swainsonii	Superb Parrot	V	V	Breeds along inland rivers in river red gum, feeding in box woodland with 10km of nest tree. West of dividing range.
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V	-	Forages in most habitats across its very wide range, with and without trees. Roosts and breeds in living or dead hollow bearing trees.
Myotis adversus	Large-footed Myotis	V		Known from a range of habitats close to water from lakes, small creeks to large lakes and mangrove lined estuaries
Chalinolobus picatus	Little Pied bat	V	-	Dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest, mallee and bramble box. Roosts and breeds in tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts and tunnels.
Petaurus norfolcensis	Squirrel Glider	V		In the region occurs in Box-gum woodlands, box-ironbark woodlands and river red gum woodland.

2.5 Field Survey Results

2.5.1 Flora

The survey identified 26 species, ten of which were native (Appendix 2).

Common species recorded on the site during the current survey included Paterson's curse (*Echium plantagineum*), wild oats (*Avena fatua*), *Romulea rosea*, ryegrass

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(*Lolium rigidum*), and capeweed (*Arctotheca calendula*), all exotic species. Native species that commonly occurred included *Crassula colorata*.

13 remnant large or very large trees and four stags were scattered across the site. Hollows were frequently observed in trees across the site. Table 2 provides a summary of the large and very large trees within the study site.

Table 2: Large and very large trees located on the study site.

Species	Height (m)	Diameter at breast height (cm)	Presence of hollows
River Red Gum *Eucalyptus camaldulensis*	10-15	40	No hollows
River Red Gum *Eucalyptus camaldulensis*	20	120	A few large and medium hollows
River Red Gum *Eucalyptus camaldulensis*	6	40	No hollows
River Red Gum *Eucalyptus camaldulensis*	6	40	No hollows
River Red Gum *Eucalyptus camaldulensis*	20	80	A few small hollows
River Red Gum *Eucalyptus camaldulensis*	20	120	No hollows
River Red Gum *Eucalyptus camaldulensis*	18	80	No hollows
River Red Gum *Eucalyptus camaldulensis*	16	60	No hollows
River Red Gum *Eucalyptus camaldulensis*	15	60	No hollows
Yellow Box *Eucalyptus melliodora*	14	100	No hollows
Yellow Box *Eucalyptus melliodora*	15	60	No hollows
Yellow Box *Eucalyptus melliodora*	20	150	A few small hollows
Yellow Box *Eucalyptus melliodora*	20	100	No hollows
Stag (Eucalyptus melliodora)	18	140	A few small hollow
Stag (Eucalyptus melliodora	20	160	Abundant small, medium and few large hollows.
Stag (species unknown)	5	100	No hollows
Stag (species unknown)	16	100	Few small hollows

Fifteen river redgum trees with DBH less than 40 cm (i.e. not large) were also recorded at the site, the majority north of the irrigation channel in the north of the site.

Three noxious weeds were recorded on site; Paterson's curse (*Echium plantagineum*), St. John's wort (*Hypericum perforatum*), and horehound (*Marrubium vulgare*).

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2.5.2 Fauna

Incidental sightings of fauna were recorded whilst on site (Table 3). Consequently, only 12 fauna species were observed, all of which were birds. Of the species observed, the common starling (*Sturnus vulgaris*) is introduced, with the remaining species native species and common to the area.

Table 3: Bird species recorded during the field survey of the Moorong Street site.

Species Name	Common Name
Cacatua galerita	Sulphur-crested Cockatoo
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Corvus coronoides	Australian Raven
Cracticus nigrogularis	Pied Butcherbird
Eolophus roseicapillus	Galah
Grallina cyanoleuca	Magpie-lark
Lichenostomus penicillatus	White-plumed Honeyeater
Pardalotus striatus	Striated Pardolote
Platycercus elegans	Yellow Rosella
Psephotus haematonotus	Red-rumped Parrot
Sturnus vulgaris	Common Starling
Threskiornis spinicollis	Sacred Ibis

Fauna habitat was limited on site and included:

- Isolated trees, some with hollows
- Grassland
- Large woody debris

The hollow-bearing trees likely provides breeding and roosting habitat for some birds and reptiles, while the grassland likely provides foraging and refuge habitat for a variety of birds and some common frogs (such as *Limnodynastes tasmaniensis*). Large woody debris may provide habitat for a number of common reptile and amphibian species.

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Map 2 – Location of vegetation traverses.

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2.6 Special Considerations

Vegetation surveys were undertaken during late winter and are, therefore, likely to underestimate native groundcover due to the many non-native annuals that grow in the region at that time. The region is currently experiencing average rainfall after an extended period of drought which may also favour the dominance of exotic species during the time of survey.

2.7 Consultation

Eco Logical Australia discussed their approached to the project, and in particular field survey, with Mark Sheahan (DECC), Dr David Read, and David Walker (Wagga Wagga City Council), Darren Wallett (DWE), and Rachel Short, Vicki Shirlaw and Stuart Harding (Willana Associates).

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3. Assessment of Vegetation

3.1 Areas of Native Vegetation

The study site is devoid of native vegetation communities and comprises improved pasture and cropped areas with isolated remnant paddock trees (Map 3). The traverse was conducted in previously improved pasture that has remained unmanaged for many years. Consequently, the vegetation comprised predominantly exotic species with occasional native elements.

3.2 Regional Scale Assessment

3.2.1 Mitchell Landscapes

A review of the Mitchell Landscapes mapping within the Wagga Wagga area found that one Mitchell Landscape occurs within the Moorong Street site. This landscape is the Murrumbidgee – Tarcutta Channels and Floodplains Ecosystem in the NSW South West Slopes Bioregion (Mitchell 2002) (Map 4). The landscape is characterised by channels, floodplain and terraces of Murrumbidgee tributaries on Quaternary alluvium, generally lies at an elevation of between 200 to 400m, and has undifferentiated organic sand and loam on the floodplain, brown gradational loam and yellow texture-contrast soils on higher terraces. River red gum gallery woodland generally occurs on banks in this landscape, and yellow box and grey box open woodland occur on floodplain and terraces (Mitchell 2002). The Murrumbidgee – Tarcutta Channels and Floodplains landscape has been extensively cleared for agricultural production (Table 4).

Table 4: Mitchell landscapes within the study area

Mitchell Landscape	Degree of Clearance	Area within Study Area	% of Study Area
Murrumbidgee – Tarcutta Channels and Floodplains Ecosystem	91 %	11.6 ha	100 %

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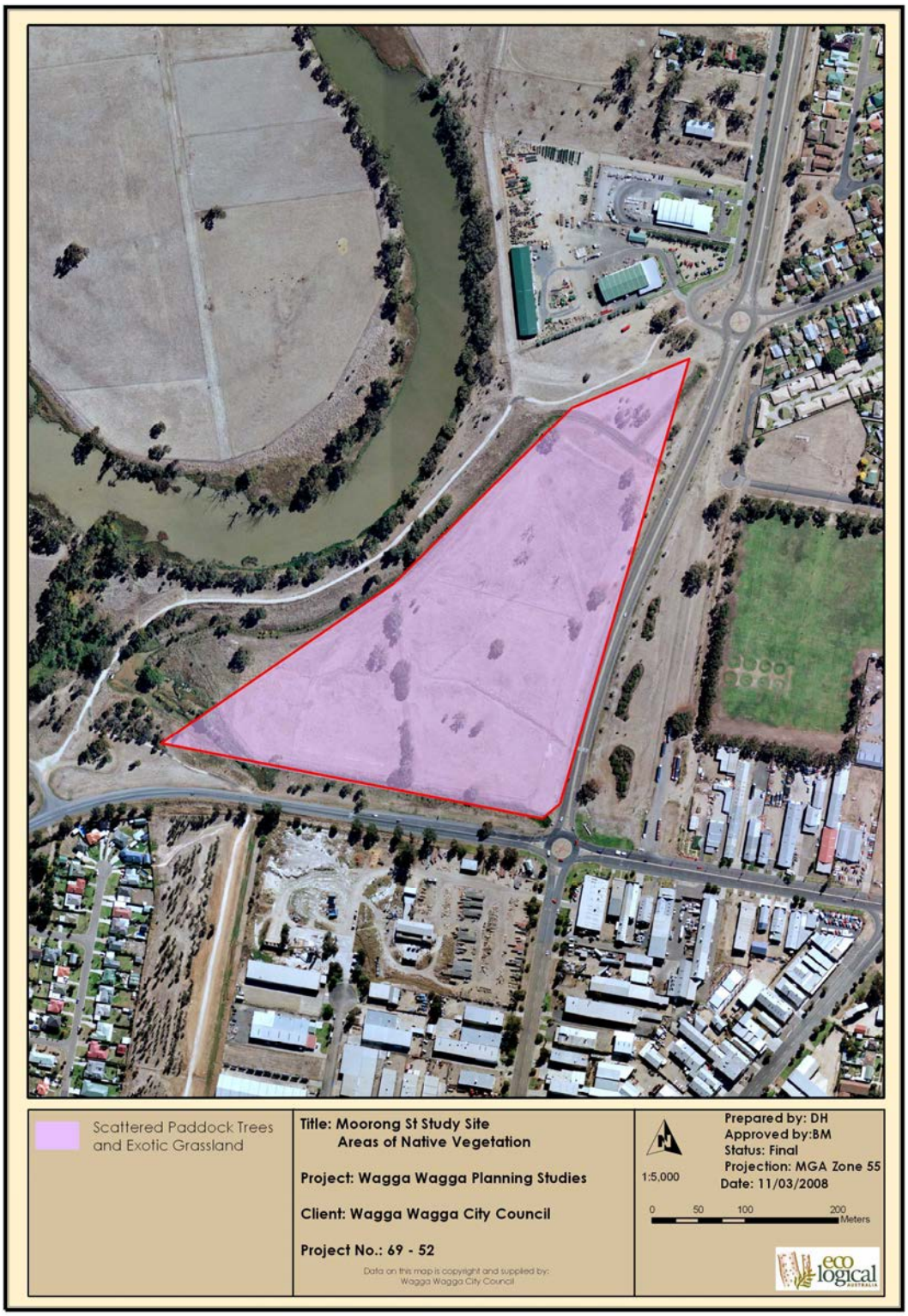

Map 3 – Areas of native vegetation at the site.

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Map 4 – Mitchell landscapes on the site

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3.2.2 Vegetation Types

The site contains isolated paddock trees consistent with the river redgum forest vegetation community however due to the highly modified nature of the site the paddock trees are not considered to comprise a native vegetation community (Table 5). The site is rural and modified by agricultural activities (Map 5).

Table 5 – Vegetation types on site, their area within the site and the degree to which this landscape type has been cleared from its previous extent

Vegetation Type	Degree of Clearance	Area within Study Area	% of Study Area
Scattered Paddock Trees and Exotic Grassland	N/A	11.6 ha	100 %

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Map 5 – Vegetation types on site.

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3.3 Landscape Scale Assessment

3.3.1 Landscape Value

The landscape value of the site is defined by Ayers *et al.* (2005) as the extent of vegetation cover, the connectivity of vegetation within the site to patches of native vegetation outside the site and the overall size of remnant vegetation patches connected to the site. In determining the landscape value of the site, the extent of vegetation cover is estimated for three scales (within 10, 100 and 1000 ha areas) to recognise the different ranges of various biota and scale of impacts of activities on biota in the area.

The study site is located within a rural environment, with some industrial and urban development to the north east and south, and south west, respectively. Native vegetation cover in and outside the site is sparse and only 16 large or very large isolated paddock trees are present in the site. Little to no connectivity exists between native vegetation within or outside the site boundaries. As such, the site does not appear to play an important role as a corridor or provide key habitat for threatened and non-threatened species.

Flowerdale Lagoon is immediately adjacent to the site on the western side, and appropriate management is required to ensure that uncontrolled runoff does not enter the lagoon from the site.

A summary of the outcomes of the landscape scale assessment as descried in Ayers *et al.* (2005) is provided in Table 6 below.

Table 6: Landscape Value of Vegetation.

Landscape Attribute	Current Score
% Cover within 1.75 km radius (1000 ha)	< 10 %
% Cover within 0.55 km radius (100 ha)	< 10 %
% Cover within 0.2 km radius (10 ha)	< 10 %
Connectivity value	Nil
Total adjacent remnant area	Small
Calculated Landscape Value	**0**

3.4 Site Scale Assessment

The survey determined that the site was dominated by exotic pasture with scattered paddock trees, and the site can be classified as entirely rural.

3.4.1 *Assessment Zone Delineation*

The site was zoned as Scattered Paddock Trees and Exotic Grassland. No other assessment zones were attributed to the site.

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3.4.2 Condition and Quality of Vegetation

Condition of the vegetation in the Scattered Paddock Trees and Exotic Grassland was generally low, as determined by the amount of overstorey cover and proportion of native to exotic species within the groundcover (Ayers *et al.* 2005).

3.4.3 Summary of Assessment Zone Information

Vegetation at the site was found to be in poor condition, with the majority of the site devoid of native vegetation. The condition of the native vegetation was found to be scattered paddock trees (Map 6 and Map 7) due to the sparse overstorey cover and exotic dominated groundcover.

Little to no connectivity exists between native vegetation within or outside the site boundaries. The site does not appear to play an important role as a corridor or provide key habitat for threatened and non-threatened species. Table 7 summarises the results of the above vegetation assessment.

Table 7 – Summary Information on Vegetation Assessment

Assessment Zone No.	Area (ha)	Vegetation Type	Vegetation Condition	Landscape Value	Biometric Score	No. Large trees.
1	11.6 ha	Scattered Paddock Trees and Exotic Grassland	Paddock Trees	0	N/A	16

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Map 6: Assessment zones at the site

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Map 7: Assessment zone condition.

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4. Threatened Species

4.1 Threatened Species

No threatened species have been recorded on the site. The study area is devoid of native vegetation communities and comprises paddock trees. These trees may represent habitat for some species, but the use is likely to be infrequent to non-existent. Species identified as having the potential to occur at the site include superb parrot (*Polytelis swainsonii*), yellow bellied sheathtail bat (*Saccolaimus flaviventris*), large-footed myotis (*Myotis macropus*) and little pied bat (*Chalinolobus picatus*).

Two species listed as migratory under the EPBC Act may also occur at the site. The species are: white-throated needletail (*Hirundapus caudacutus*) and cattle egret (*Ardea ibis*). As with threatened species above, the use of the site by these species is likely to be infrequent to non-existent.

The extent of habitat available for threatened species known, or with the potential, to occur at the site is presented in Table 8 below. Available habitat for threatened species is generally low across the site.

Table 8 – Habitat available for Threatened species considered likely, or with the potential to occur at the site.

Species	Breeding Habitat		Foraging Habitat		Roosting/Shelter Habitat	
	Description	Habitat on Site (ha or No. trees)	Description	Habitat on Site (ha or No. trees)	Description	Habitat on Site (ha or No. trees)
Squirrel Glider	Trees with hollows > 5 cm diameter in eucalypt forests and woodlands (i.e. not in paddock trees)	Yes – 6 hollow bearing trees	Mature or mixed age eucalypt woodland, especially with flowering shrubs and wattles in the understorey. Will occur where there is no understorey if there is > 1 species of Eucalypt. Occur	Yes – 20 large and very large trees	As per breeding and foraging habitat.	Yes – 6 hollow bearing trees

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Species	Breeding Habitat		Foraging Habitat		Roosting/Shelter Habitat	
	Description	Habitat on Site (ha or No. trees)	Description	Habitat on Site (ha or No. trees)	Description	Habitat on Site (ha or No. trees)
			in dry forests with ironbarks, box and bloodwoods and can use patches < 1 ha and isolated trees if within 75 m of other patches.			
Little Pied bat	Tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts, tunnels.	Yes – 6 hollow bearing trees	Dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box.	Yes – entire site	Tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts, tunnels for roosting.	Yes – 6 hollow bearing trees
Superb Parrot	Live or dead hollow bearing trees	None	Feeds in box woodland with 10km of nest tree. West of dividing range.	Yes but dependence on the site likely to be low. Site is poorly connected to remnants off site.	Living or dead trees with hollows > 5 cm diameter.	Yes, but dependence on the site likely to be low. Site is poorly connected to remnants off site.
Large-footed Myotis	Live or dead hollow bearing trees within 200 m of waterbody	Yes – 6 hollow bearing trees	Lakes, small creeks, farm dams and other waterbodies	No, but near by at Flowerdale Lagoon.	As per breeding habitat.	Yes – 6 hollow bearing trees
Yellow bellied Sheathtail bat	Live or dead hollow bearing	Yes – 6 hollow bearing trees	Forages in most habitats across its	Yes.	Live or dead hollow bearing	Yes – 6 hollow bearing trees

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Species	Breeding Habitat		Foraging Habitat		Roosting/Shelter Habitat	
	Description	Habitat on Site (ha or No. trees)	Description	Habitat on Site (ha or No. trees)	Description	Habitat on Site (ha or No. trees)
	trees		very wide range, with and without trees.		trees, under exfoliating bark, in burrows of terrestrial mammals in treeless areas, bird nests or sugar glider nests.	

Proposed development of the study site may result in the loss of 20 large and very large paddock trees including 4 stags. For threatened species identified as potentially occurring at the site, the loss of this habitat is not likely to result in a significant impact. The extent of habitat with the potential to be removed under the current proposal is summarised in Error! Reference source not found. **below together with an assessment of whether this loss would be acceptable and whether the loss would require offsetting.**

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Table 9 – Standards for maintaining threatened species habitats (show whether these species are able to sustain losses of habitat and quantifies the degree of habitat loss)

Species	Ability to sustain a temporary reduction in the population / habitat on this property	Loss of habitat by proposal	Acceptability of loss/ Offset
Little Pied bat	Yes	6 hollow bearing trees	Yes
Superb Parrot	Upper and lower slopes of Murrumbidgee: no loss of *Eucalyptus camaldulensis* with hollows > 5cm (ECH) and < 100 m from the Murrumbidgee River, 100m – 200m from the river up to 7 % loss ECH, > 200m from the river up to 10 % loss ECH. 10 % loss of foraging habitat.	1 ECH. Tree and numerous possible foraging trees	Yes, with offsetting.
Yellow bellied Sheathtail bat	Up to 10 % loss of foraging habitat. Up to 10 % loss of hollow bearing trees.	Loss of 6 hollow bearing trees	Yes, with offsetting

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4.2 Threatened Populations

The Wagga Wagga population of squirrel glider (*Petaurus norfolcensis*) is listed as an endangered population. However, there is no habitat for this species on site.

4.3 Endangered Ecological Communities

Remnant paddock trees at the site are a mixture of river redgum and yellow box. These species are consistent with the river redgum forest vegetation community and location of the site, on the floodplain of the Murrumbidgee River, further supports this interpretation. River redgum forest is not part of an endangered ecological community as listed under Part 3, Schedule 1 of the TSC Act or under the Commonwealth EPBC Act.

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5. Structure Plan

The study site contains 20 paddock trees (including 4 stags) overlying cropped and pasture improved paddocks. The paddock trees are considered to have limited conservation value within the landscape as the long-term viability of the vegetation is considered low. The site is therefore potentially suitable for residential/industrial development provided that relevant offsets to the loss of native vegetation are achieved.

An offset ratio of 10:1 is required for scattered paddock at the Moorong Street site DEC (2005). This means that for every large tree (i.e. > 40 cm diameter at breast height DBH) removed, 10 large trees of the same species must be retained at the site. Furthermore, the removal of a small tree (i.e. < 40 cm DBH) must be offset through the planting of 10 trees of the same species.

Offset areas are required to be reserved and managed for conservation. This means that 'open space' zoning is not sufficient for offset areas, rather zoning must reflect the conservation objectives of the offset area and a conservation management plan for offset areas must be prepared and implemented. In addition to the above, any scattered paddock trees not located within 'open space' or 'conservation' area must be considered as cleared and their loss offset using the above ratios.

The total loss of paddock trees, assuming full development of the site, is presented in Table 10 below. Also shown is the number of trees required to be retained, for each species, in order to achieve the offset ratio of 10:1.

Table 10: Proposed loss and required offset of paddock trees at the proposed Moorong Street development site.

		No. of trees		Required Offset		
Species Name	**Common Name**	**Large**	**Very Large**	**Large**	**Very Large**	**Total Offset**
Eucalyptus melliodora	Yellow Box	5	4	50	40	**90**
Eucalyptus camaldulensis	River Redgum	1	3	10	30	**40**
Unknown	Stag	0	4	0	40	**40**
					Overall Total	**170**

Sufficient offsets for the loss of paddock trees are not available within retained lands at the site and so offsets in other areas would be required. The precise extent of retained areas relative to potentially developable areas will need to be determined in the context of other constraints to development (*i.e.* geotechnical, flooding, bushfire, etc), the impacts on threatened species and the potential to provide offsets to the losses associated with the potentially developable areas. The determination of the appropriate mix of retained areas and potentially developable areas is an iterative process that will require further liaison between DECC and WWCC. As part of this process, the quantum of offsets associated with each potential mix of retained areas and potentially developable areas will need to be calculated. The data that has been collected for this report provides a basis for these calculations.

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While paddock trees positioned within residential zoned land (or similar) are required to be offset, it is recommended that paddock trees –particularly those containing hollows – be retained where possible at the site. Future master planning should aim to incorporate existing paddock trees into the urban/industrial landscape and so retain their values as fauna habitat.

The areas proposed for development, as determined on the basis of current investigation at the site, are presented in Map 8 below.

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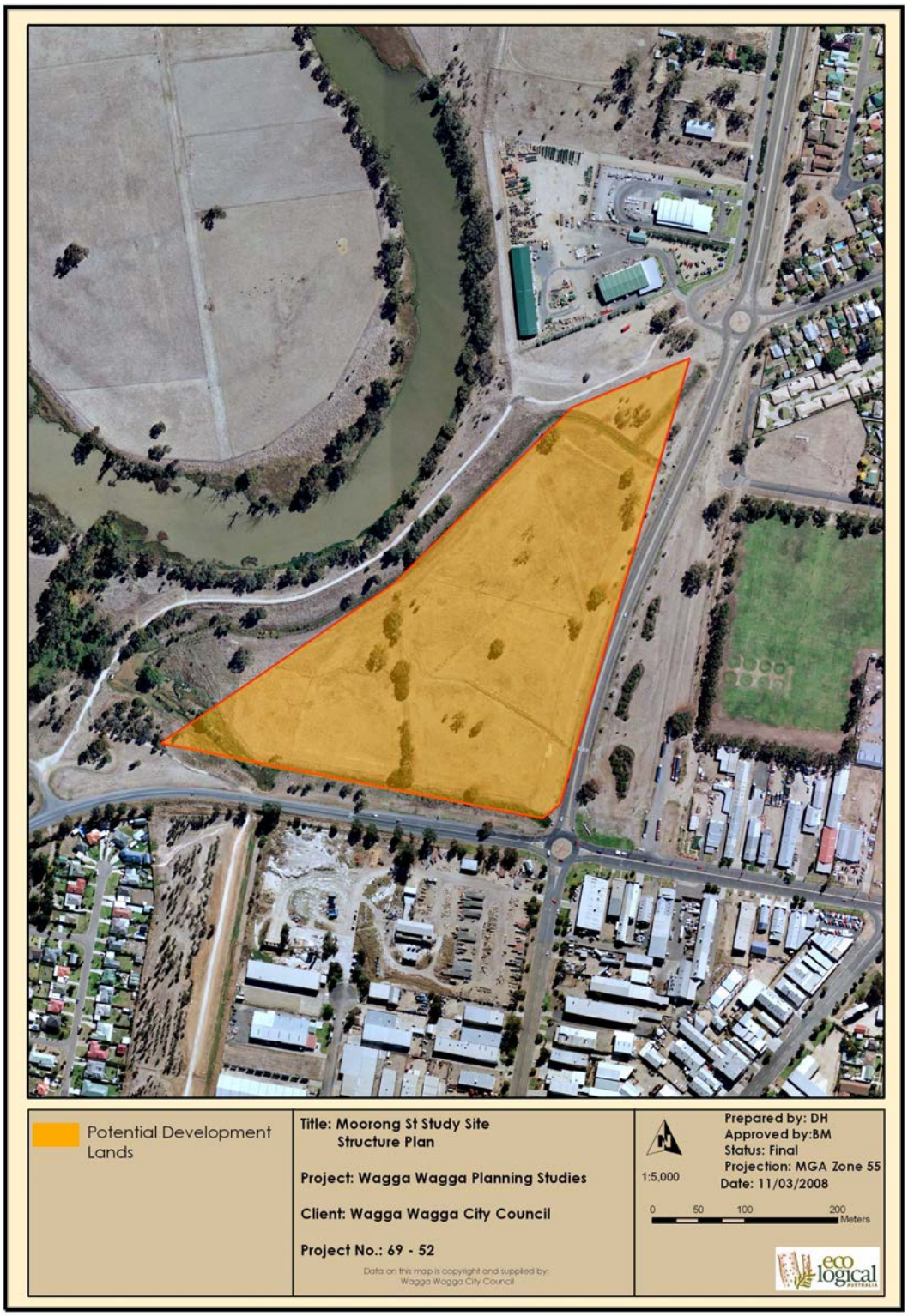

Map 8: Structure Plan for the site.

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7. Appendices

Appendix 1: Likelihood of occurrence for threatened species, populations and communities on the Moorong Street site.

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Threatened species - Fish					
Maccullochella peelii peelii	Murray Cod		V	No	Waterways of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs. The upper reaches of the Murray and Murrumbidgee Rivers are considered too cold to contain suitable habitat.
Macquarie australasica	Macquarie Perch		E	No	Occurs widely in riverine and lake habitats. In Sydney basin only known from Cataract and Cordeaux River catchments. Upland streams and migrates upstream to gravel beds to spawn.
Threatened species - Frogs					
Litoria booroolongensis	Booroolong Frog	E		No	Restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses
Litoria raniformis	Southern Bell Frog	E	V	No	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and

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Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat
Threatened species - Snakes					
Aprasia parapulchella	Pink-tailed Worm-lizard	V	V	No	In general, lizards occur in open grassland habitats that have a substantial cover of small rocks
Delma impar	Striped Legless Lizard	V	V	No	Lowland native grasslands
Threatened species - Birds					
Ardea alba	Great Egret, White Egret		M	No	Shallows of rivers, estuaries, tidal mudflats, freshwater wetlands, larger dams
Ardea ibis	Cattle Egret		M	Potential	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats
Burhinus grallarius	Bush Stone-curlew	E		No	Well wooded floodplain forests, amongst fallen timber
Cacatua leadbeateri	Major Mitchell's Cockatoo	V		No	Near water on timbered watercourses
Callocephalon fimbriatum	Gang-gang Cockatoo	V		No	Wetter forests, and woodlands, from sea level to 2000m on divide. From timbered foothills and valleys to suburban gardens.
Climacteris picumnus victoriae	Eastern subspecies of Brown Treecreeper	V		No	Drier forests / woodlands / scrubs with fallen branches.
Gallinago hardwickii	Latham's Snipe, Japanese Snipe		M	No	Soft wet ground or shallow water with tussocks and other green and dead growth. Wet drainage areas
Grus rubicundis	Brolga	V		No	Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially

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Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					shallow swamps, where they will forage with their head entirely submerged
Haliaeetus leucogaster	White-bellied Sea-Eagle		M	No	Rivers, large dams. Roost and nest on large platforms built in large Eucalypts
Hirundapus caudacutus	White-throated Needletail		M	Potential	Open space above canopy. Forages over large areas
Lathamus discolor	Swift Parrot	E	E, M	Unlikely	Forests, woodlands, plantations, banksias, street trees and gardens on the mainland
Leipoa ocellata	Malleefowl	E	V, M	No	Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300-450 mm mean annual rainfall) areas. Less frequently found in other eucalypt woodlands
Melanodryas cucullata	Hooded Robin	V		No	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V		Unlikely	Ironbark woodlands, extensively wooded areas
Merops ornatus	Rainbow Bee-eater		M	Unlikely	Open woodlands with sandy, loamy soils, dunes, cliffs, mangroves golf courses
Myiagra cyanoleuca	Satin Flycatcher		M	Unlikely	Heavily vegetated gullies in forests, and taller woodlands of coastal south-east Australia. Also occurs in various sites during migration including farms and parks
Neophema pulchella	Turquoise Parrot	V		Unlikely	Open grassy woodland, with dead trees, near permanent water and forested hills.
Ninox connivens	Barking Owl	V		Unlikely	Open forests,

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Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					woodlands, dense scrubs, other large trees near watercourses. Nest in tree hollow.
Pachycephala inornata	Gilbert's Whistler	V		No	The Gilbert's Whistler occurs in ranges, plains and foothills in arid and semi-arid timbered habitats. In NSW it occurs mostly in mallee shrubland, but also in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests.
Pedionomus torquatus	Plains Wanderer	E	V	No	Most of the vegetation is <5 cm high but some vegetation up to a maximum of 30 cm is important for concealment, grass tussocks are spaced 10-20 cm apart
Polytelis swainsonii	Superb Parrot	V	V	Potential	Breeds along inland rivers in river red gum, feeding in box woodland with 10km of nest tree. West of dividing range.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V		Unlikely	Inhabits open Box-gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains
Pyrrholaemus sagittatus	Speckled Warbler	V		Unlikely	Well vegetated woodlands, diverse structure
Rostratula australis	Australian Painted Snipe		V	Unlikely	Well vegetated margins of wetlands
Rostratula benghalensis australis	Painted Snipe (Australian subspecies)	E	V, M	Unlikely	Well vegetated margins of wetlands
Stagonopleura guttata	Diamond Firetail	V		Unlikely	Open eucalypt forests, woodlands.
Stictonetta naevosa	Freckled Duck	V		No	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral

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Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds
Grantiella picta	Painted Honeyeater	V	-	Unlikely	Boree, Brigalow and Box-gum woodlands and box –ironbark forests. Inhabits vegetation with 5 or more mistletoe per hectare.
Xanthomyza phrygia	Regent Honeyeater	E	E, M	Unlikely	Dry open forests, woodlands, especially red ironbark, yellow box, yellow gum
Threatened species - Mammals					
Dasyurus maculatus	Spotted-tailed Quoll	V	E	No	Occurs in wide variety of habitats in large remnants. Dens in tree hollows, hollow log or rock crevice
Macrotis lagotis	Bilby	Ex	V	No	Sandy desert areas in spinifex (*Triodia* species) grasslands
Myotis adversus	Large-footed Myotis	V		Potential	Known from a range of habitats close to water from lakes, small creeks to large lakes and mangrove lined estuaries
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V	-	Potential	Forages in most habitats across its very wide range, with and without trees. Roosts and breeds in living or dead hollow bearing trees.
Chalinobolus picatus	Little Pied bat	V	-	Potential	Dry open forest, open woodland , mulga woodlands, chenopod shrublands, cypress pine forest, malle and bramble box. Roosts and breeds in tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts and tunnels.
Nyctophilus timoriensis (south	Eastern Long-eared Bat	V	V	Unlikely	Inhabits a variety of vegetation types,

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Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
eastern form)					including mallee, bulloak Allocasuarina luehmannii and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland
Petaurus norfolcensis	Squirrel Glider	V		Unlikely	In the region occurs in Box-gum woodlands, box-ironbark woodlands and river red gum woodland.
Phascolarctos cinereus	Koala	V		No	Inhabit eucalypt woodlands and forests
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	No	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.
Threatened species - Plants					
Ammobium craspedioides	Yass Daisy	V	V	No	Known from natural temperate grassland sites.
Amphibromus fluitans	River Swamp Wallaby-grass	V	V	No	Swamps or low-lying areas which become periodically water-logged, usually on clayey soils.
Austrostipa wakoolica		E	E	No	Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky

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Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					rise
Brachycome muelleroides	Claypan Daisy	V	V	No	Grows in damp areas on the margins of claypans in moist grassland with *Pycnosorus globosus*, *Agrostis avenacea* and *Austrodanthonia duttoniana*
Brachycome papillosa	Mossigiel Daisy	V	V	No	Recorded primarily in clay soils on Bladder Saltbush (*Atriplex vesicaria*) and *Maireana aphylla* plains, but also in grassland and in Grey Box (*Eucalyptus microcarpa*) - Cypress Pine (*Callitris spp*.) woodland
Diuris sheaffiana	Tricolour Diuris	V	V	No	Sporadically distributed on the western slopes of NSW. Associated species include Callitris glaucophylla, Eucalyptus populnea, Eucalyptus intertexta, Ironbark and Acacia shrubland. The understorey is often grassy with herbaceous plants such as Bulbine species
Senecio garlandii	Wooly Ragwort	V	V	No	Woolly Ragwort occurs on sheltered slopes of rocky outcrops
Swainsona murrayana	Slender Darling-pea	V	V	No	Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with *Maireana* species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated.
Swainsona recta	Small Purple-pea	E	E	No	Before European settlement Mountain Swainson-pea occurred

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Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum *Eucalyptus blakelyi*, Yellow Box *E. melliodora*, Candlebark Gum *E. rubida* and Long-leaf Box *E. goniocalyx*
Thesium australe	Austral Toadflax	V	V	No	Often found in damp sites in association with Kangaroo Grass (*Themeda australis*)
Threatened Ecological Populations					
Petaurus norfolcensis – endangered population Wagga Wagga	Squirrel Glider population in the Wagga Wagga LGA	E		Unlikely	Inhabits a wide range of open forest, woodland and riverine forest habitats. Utilise remnants of various sizes, including small remnants and even small stands of trees within Travelling Stock Reserves, roadside reserves or private land. Often utilise linear remnant vegetation along roadsides or rivers and streams
Threatened Ecological Communities					
	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	No	Western slopes and plains

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Appendix 2: Flora species recorded on the Moorong Street site.

Species Name	Common Name
Arctotheca calendula#	Capeweed
Austrodanthonia spp.	
Austrostipa bigeniculata	
Avena fatua#	Wild Oats
Bromus catharticus#	
Bromus diandrus#	Great Brome
Chloris truncata	Windmill Grass
Cirsium vulgare#	Spear Thistle
Crassula colorata	
Crassula decumbens	
Echium plantagineum#	Patterson's Curse
Erodium cicutarium	Common Crowfoot
Eucalyptus camaldulensis	River Red Gum
Eucalyptus melliodora	Yellow Box
Hypericum perforatum#	St. Johns Wort
Lolium rigidum#	Wimmera Ryegrass
Malva parviflora#	Small-flowered Mallow
Marrubium vulgare#	Horehound
Medicago polymorpha#	Burr Medic
Medicago sativa#	Lucerne
Plantago lanceolata#	Lamb's Tongues
Poa annua	Winter Grass
Romulea rosea#	
Rumex crispus	Curled Dock
Salvia verbenaca#	Wild Sage
Sonchus oleraceus#	Common Sowthistle

#Exotic species

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