

Wagga Wagga Planning Study

Environmental / Biodiversity report for Estella West

(Project No. 069-052)

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

March 2008

Document Tracking

Item	Detail	Signature
Project Name	Wagga Wagga Planning Study: Environmental/Biodiversity report for Estella West	
Project Number	069-052	
Prepared by	EL	
Prepared by	SL	
Approved by		
Status	FINAL	
Version Number	V1	
File location	G:\Current_Projects\Private Clients\Willana\Wagga Planning Studies\Reports	
Last saved on	11 March 2008	

Acknowledgements

This document has been prepared by Eco Logical Australia Pty Ltd with support from Willana Associates.

The study team would like to thank Wagga Wagga Council staff for their assistance in providing relevant information for this report.

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Willana Associates. The scope of services was defined in consultation with the client, by time and budgetary constraints imposed by the client, and the availability of reports and other data on Estella West. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.

Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

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 Estella West, 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 Estella West 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 Estella West 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 Estella West development site which will allow development of the site while avoiding impacts to native vegetation and threatened species habitats

Native vegetation occurred as isolated paddock trees and mixed native/exotic grassland across much of the site with smaller areas of remnant yellow box woodland vegetation. Tree species present within areas of scattered paddock trees indicate that much of the site would have been covered by yellow box woodland prior to clearing. Remnant woodland vegetation occurs along Pinegully Road, east of Pine Gully Road and along Harris Road.

Yellow box woodland forms part of the broader White Box, Yellow Box, Blakely's Red Gum Woodland (Box – Gum Woodland) which is listed as an endangered ecological community under the TSC Act.

Woodland remnants at the site have a high regional value as they occur within a landscape that has been extensively cleared for agricultural production. Moreover, the site is thought to have a moderate landscape value as remnant vegetation

within the site provides important linkages to vegetation outside the site boundaries. The site is a known flyway of the superb parrot and remnant eucalypts along Harris Street provide a potential corridor for movement of the threatened squirrel glider.

One threatened fauna species, the superb parrot, is known to utilise the site while another 9 threatened species are considered likely to occur. In addition, two species listed as migratory under the Commonwealth EPBC Act have the potential to occur at the site.

A structure plan has been produced which outlines the recommended location of potentially developable lands, lands to be retained and areas in which offsets may be located. In general, the location of retained lands and offset areas at the site aim to:

- Increase connectivity between currently isolated woodland patches within the site
- Increase connectivity of the site to areas of remnant vegetation outside the site boundaries
- Elevate patches of native vegetation from moderate to good condition
- Decrease edge effects currently experienced by native vegetation remnants

The development potential of the Estella West site is constrained by the presence of 6.22 ha of 'moderate to good' condition box – gum woodland which is listed as an endangered ecological community and provides potential habitat for a range of threatened species. 'Moderate to good' condition vegetation at the site is not available for development. The site contains 4.53 ha of low condition box – gum woodland which, while available for development, is recommended for retention at the site as it provides an important corridor for the movement of threatened species between patches of better quality woodland. Approximately 240 ha of scattered paddock trees and exotic grassland vegetation is considered potentially developable land at the site.

The loss of low condition remnant vegetation and remnant trees within potentially developable lands of Estella West will require offsetting to a ratio of 1.92 ha and 10:1 respectively. Moreover, remnant trees retained within a residential zoning will also require offsetting. It is unlikely that such offsets can be accommodated on site within 'moderate to good' condition vegetation. It is recommended that remnant trees within potentially developable lands be retained and incorporated into future Master Planning so as to maximise the retention of biodiversity values within any future urban landscape.

Contents

EXECUTIVE SUMMARY	1
1. INTRODUCTION	1
1.1 PROJECT BACKGROUND	1
1.2 PROJECT OBJECTIVES	1
1.3 STUDY AREA	2
1.4 LEGISLATIVE SUMMARY	4
1.5 REVIEW OF EXISTING INFORMATION	7
1.6 DESKTOP ASSESSMENT.....	7
1.7 FIELD SURVEY.....	7
1.8 DESKTOP REVIEW RESULTS	8
1.9 FIELD SURVEY RESULTS	10
1.9.1 Flora.....	10
1.9.2 Fauna	11
1.10 SPECIAL CONSIDERATIONS	14
1.11 CONSULTATION	14
2. ASSESSMENT OF VEGETATION	15
2.1 AREAS OF NATIVE VEGETATION	15
2.2 REGIONAL SCALE ASSESSMENT	15
2.2.1 Mitchell Landscapes	15
2.2.2 Vegetation Types.....	18
2.3 LANDSCAPE SCALE ASSESSMENT.....	20
2.3.1 Landscape Value	20
2.4 SITE SCALE ASSESSMENT	20
2.4.1 Assessment Zone Delineation	20
2.4.2 Condition and Quality of Vegetation.....	21
2.4.3 Vegetation Condition Categories.....	23
2.4.4 Summary of Assessment Zone Information	23
3. THREATENED SPECIES	25
3.1 THREATENED SPECIES.....	25
3.2 THREATENED POPULATIONS.....	31
3.3 ENDANGERED ECOLOGICAL COMMUNITIES	31
4. STRUCTURE PLAN	33
5. REFERENCES	37
6. APPENDICES	38

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 Estella West. 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 Estella West 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 Estella West 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 Estella West development site which will allow development of the site while avoiding impacts to native vegetation and threatened species habitats

1.3 Study Area

The Estella West site occurs immediately west of the existing suburb of Estella and approximately 2 km to the north of the existing urban area of Wagga Wagga (Map 1). The site occupies an area of approximately 250.9 ha and is bound by Old Narrandera Road to the south, part of Harris Road to the west, and parts of Pine Gully Road and Estella Road to the north east. The northern boundaries of the site are delineated by the property boundaries of Charles Sturt University. The south eastern boundary of the site is not well delineated and runs through Gracelands Estate. Pine Gully Road runs through the site in a north to south direction, while Harris Road runs through in a west to east direction.

Current land use at the site is predominately rural, with some residential development scattered across the site. Cropping and grazing are the predominant agricultural practices occurring at the site (Map 1). Land in areas surrounding the site is also rural, although some urban development occurs adjacent to the site to the east and campuses of Charles Sturt University are located to the west and north east of the site.

The site can be characterised as undulating land. Several peaks occur on the site (ranging from 212 to 236 m AHD) and elevation across the site ranges from 236 m AHD on the highest peak on the site to approximately 184 m AHD in the south east corner of the site. Drainage is by overland flow across much of the site. Two (2) minor watercourses also drain the site; one located in the north west of the site and draining west, the other draining north to south from Harris Street.

Soils on the site are predominantly East Bomen soils described by Chen and McKane (1997), although Pulletop soils, Lloyd soils and Becks Lane soils also occur on the eastern side of the site (Chen and McKane 1997). These soils are moderately acid and have moderate to high erosion hazard.



Map 1 – Location of proposed Estella West development site.

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).

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 Estella West 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)

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.

Description of Methods

1.5 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.

1.6 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 Estella West 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.

1.7 Field Survey

Survey of the site was conducted during the period between 15th and 24th August, 2007. Weather conditions ranged from fine and sunny to cold and rainy during the survey period. Weather conditions for the period are summarised in Table 1.

Table 1: Weather conditions for the survey period 15th – 24th August, 2007.

Date	Day	Temps (°C)		Rain (mm)
		Min	Max	
15	We	1.5	16	0
16	Th	2.3	16.6	0
17	Fr	5	12.2	14.2
18	Sa	5.5	14.4	1.8
19	Su	3.2	15.8	0.2
20	Mo	4.1	17.7	0.2
21	Tu	1.4	16.8	0
22	We	3.4	15.2	0
23	Th	2.8	16.6	0
24	Fr	7.3	17.2	0

Prior to field survey, aerial photography of the site was assessed and vegetation zones requiring survey mapped. Vegetation Zones were mapped according to the methods described in the *BioMetric Tool v1.8* (Ayers *et al.* 2005).

The aim of the field survey was to accurately and quantitatively record the type, condition and extent of vegetation at the site. Field survey also aimed to record the various types of fauna habitat present within the site and the types and degree of disturbance acting on ecological values at the site.

Targeted fauna surveys were not conducted in the current study, rather incidental fauna sightings were recorded.

Vegetation within the study area was assessed using two methods:

- Systematic Vegetation survey (vegetation plots)
- Vegetation Traverses
- Tree Counts

Systematic vegetation surveys were conducted using the methods described in Appendix 3 of the *BioMetric Tool v1.8* Operation Manual (Ayers *et al.* 2005). Due to the paucity of native vegetation at the site, only 1 vegetation plot was surveyed. The vegetation plot was located within an area of remnant tree cover along the narrow, vegetated corridor east of Pinegully Road (Map 2).

Land east of Pinegully Road was traversed as part of the field survey (Map 2). The traverse extended for more than 100 m and all visible vascular flora were recorded. Incidental sightings of fauna were also noted. Due to access constraints, only vegetation east of Pinegully Road was assessed through traverse and vegetation plots. Vegetation west of Pinegully Road was assessed visually from the Harris Road and Old Narrandera Road road reserves.

All large trees at the site (i.e. > 40 cm diameter at breast height (DBH)) were identified and their location recorded either via a handheld GPS unit or by marking their location on a high resolution aerial photograph. Large trees were assigned to a size class (Large - > 40 cm, < 80 cm DBH and Very Large - > 80 cm DBH).

Following completion of the field survey, data collected was used to run the *BioMetric Tool v1.8* (Ayers *et al.* 2005). *BioMetric* is a tool for assessing terrestrial biodiversity at the scale of patch, paddock or property (Ayers *et al.* 2005). Readers should consult the *BioMetric Tool Operational Manual* (Ayers *et al.* 2005) for a detailed discussion of the assessment process under the *BioMetric Tool v1.8*.

1.8 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 2.

Table 2: 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	
Threatened species				
<i>Stagonopleura guttata</i>	Diamond Firetail	V		Open eucalypt forests, woodlands.
<i>Hirundapus caudacutus</i>	White-throated Needletail		M	Open space above canopy. Forages over large areas
<i>Lathamus discolor</i>	Swift Parrot	E	E, M	Forests, woodlands, plantations, banksias, street trees and gardens on the mainland
<i>Polytelis swainsonii</i>	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.
<i>Merops ornatus</i>	Rainbow Bee-eater		M	Open woodlands with sandy, loamy soils, dunes, cliffs, mangroves golf courses
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		Inhabits open Box-gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Forages in areas of open understorey and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain, often along edges of woodland including roads. Roosts in tree large tree hollows.
<i>Petaurus norfolcensis</i>	Squirrel Glider	V		In the region occurs in Box-gum woodlands, box-ironbark woodlands and river red gum woodland.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail 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.
<i>Nyctophilus timoriensis</i> (south eastern form)	Eastern Long-eared Bat	V	V	Inhabits a variety of vegetation types, including mallee, bullock Allocasuarina luehmannii

Scientific Name	Common Name	Status		Habitat
		TSC Act	EPBC Act	
<i>Chalinolobus picatus</i>	Little Pied bat	V	-	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.
Threatened Ecological Communities				
	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	Western slopes and plains

1.9 Field Survey Results

1.9.1 Flora

A total of 29 flora species were identified at the site through vegetation plot and traverse surveys. Of the 29 species observed, only 14 were native to the Wagga Wagga area while the remaining 15 species were predominately exotic grasses and herbs. Common exotic species included Patterson's curse (*Echium plantagineum*), onion grass (*Romulea rosea*), clover (*Trifolium* spp.) capeweed (*Arctotheca calendula*) and small-flowered mallow (*Malva parviflora*). Common native species recorded at the site included yellow box (*Eucalyptus melliodora*), *Erodium* spp., wallaby grass (*Austrodanthonia* spp.) and *Austrostipa* spp.

Two weed species, Paterson's curse (*Echium plantagineum*) and St John's wort (*Hypericum perforatum*), recorded on site; are declared noxious weeds within the Wagga Wagga LGA (NSW DPI 2007).

A total of 90 large trees and 18 very large trees, of various species, were recorded at the site. These trees were generally located along Pine Gully Road, Harris Road and the vegetated corridor east of Pinegully Road. Numerous paddock trees were also scattered throughout the site. Table 3 provides a summary of the trees within the study site. Some of these trees were viewed from the roadside via binoculars, hence the range of sizes estimated in Table 3.

Table 3: Trees located on the study site.

Common Name	Species Name	No. of Individuals	
		Large (> 40cm and < 80 cm DBH)	Very Large (>80 cm DBH)
Blakely's Redgum	<i>Eucalyptus blakelyi</i>	13	7
Yellow Box	<i>Eucalyptus melliodora</i>	48	7
Grey Box	<i>Eucalyptus microcarpa</i>	5	4
Kurrajong	<i>Brachychiton populneus</i>	2	-
White Box	<i>Eucalyptus albens</i>	17	-
Drooping She-oak	<i>Allocasuarina verticillata</i>	5	-

1.9.2 Fauna

Targeted fauna surveys were not undertaken during the current study, rather incidental observations were recorded. Thirteen (13) fauna species were observed at the site, all of which were birds (Table 4). Birds commonly observed at the site included Australian raven (*Corvus coronoides*), galah (*Eolophus roseicapillus*), noisy miner (*Manorina melanocephala*) and Australian magpie (*Gymnorhina tibicen*). The common starling (*Sternus vulgaris*) an introduced species, was also commonly observed throughout the site.

Table 4: Bird species recorded during the field survey of the Estella West site.

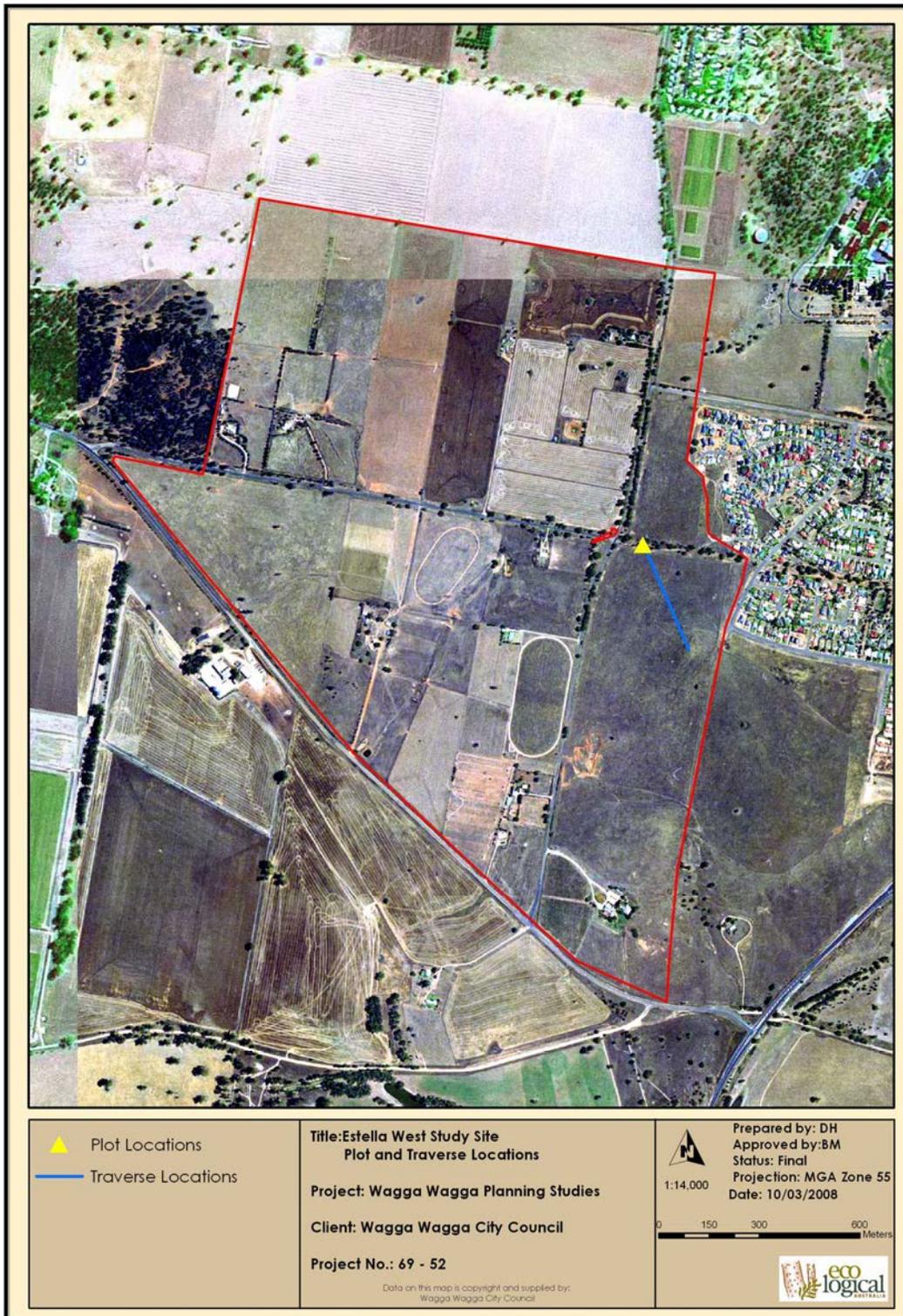
Species Name	Common Name
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
<i>Corvus coronoides</i>	Australian Raven
<i>Eolophus roseicapillus</i>	Galah
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Gymnorhina tibicen</i>	Australian Magpie
<i>Manorina melanocephala</i>	Noisy Miner
<i>Ocyphaps lophotes</i>	Crested Pigeon
<i>Pardalotus striatus</i>	Striated Pardalote
<i>Platycercus adscitus eximius</i>	Eastern Rosella
<i>Platycercus elegans flaveolus</i>	Yellow Rosella
<i>Sturnus vulgaris</i>	Common Starling
<i>Threskiornis spinicollis</i>	Sacred Ibis
<i>Vanellus miles</i>	Masked Lapwing

Fauna habitat at the site included:

- Isolated trees, some with hollows

- Grassland
- Disturbed woodland
- Large woody debris
- Surface rock

Isolated, hollow bearing trees likely provide 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*).



Map 2 – Location of vegetation plots and traverses.

1.10 Special Considerations

Vegetation survey was undertaken during late winter and therefore is 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.

Properties west of Pinegully Road were not accessible and so assessment was undertaken from road reserves and inferences using aerial photography. Visual assessment indicated that vegetation in this area, excluding road reserves, was typically highly modified. Vegetation within this area consisted of cropped or pasture-improved paddocks and was thus identified as exotic vegetation not requiring assessment using the *BioMetric* methodology.

1.11 Consultation

Eco Logical Australia discussed their approach 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).

2. Assessment of Vegetation

2.1 Areas of Native Vegetation

Native vegetation occurs as isolated paddock trees and mixed native/exotic grassland across much of the site with smaller areas of remnant woodland vegetation. Native woodland vegetation occurs along Pinegully Road and Harris Road (Map 3)

East of Pinegully Road, the site encompasses the western end of a vegetated corridor, running east to west through the existing Estella suburb. This vegetation corridor contains a narrow band of remnant woodland (Map 3).

2.2 Regional Scale Assessment

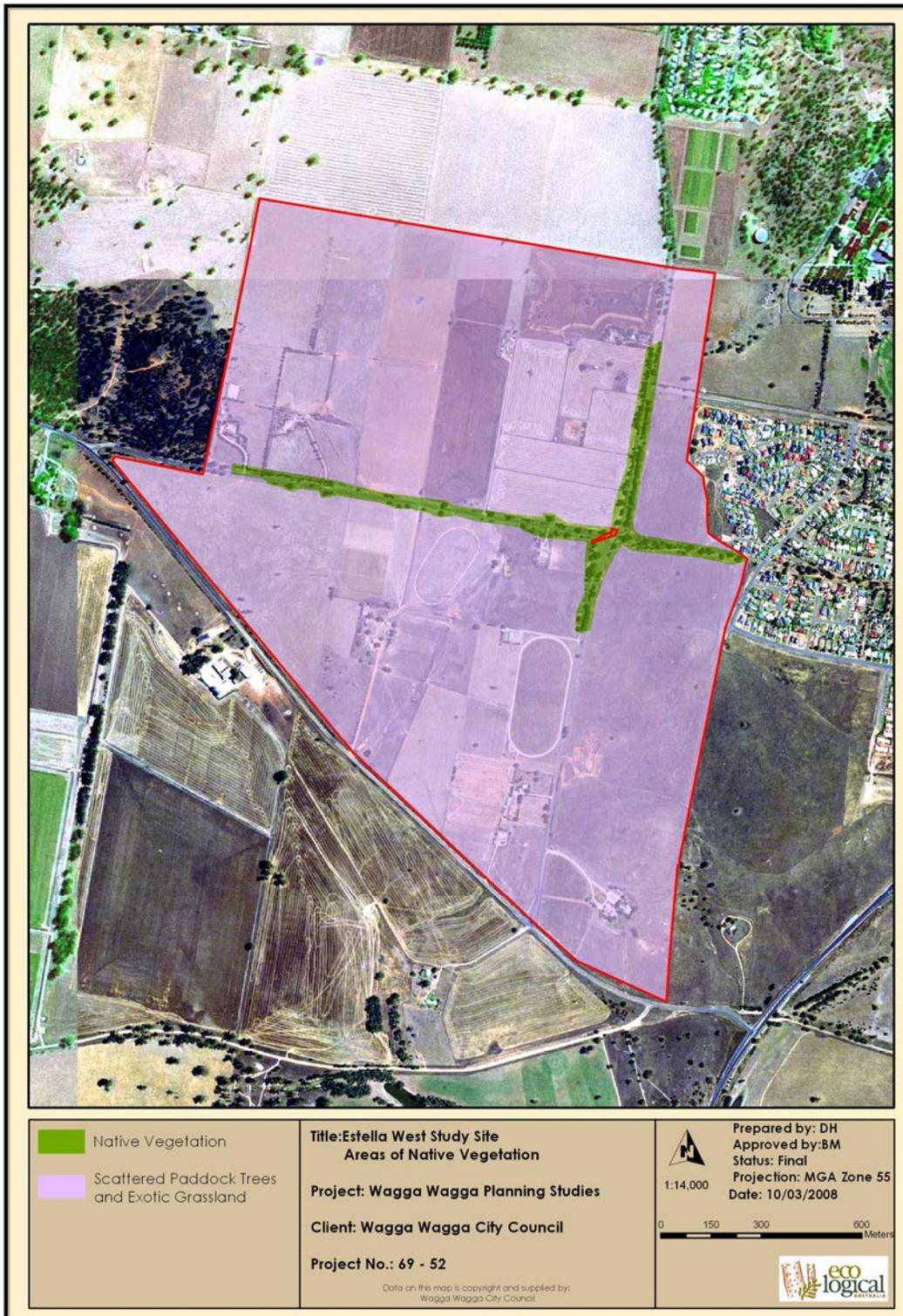
2.2.1 Mitchell Landscapes

A review of the Mitchell Landscapes mapping within the Wagga Wagga area found that one Mitchell Landscape occurs within the Estella West site. This landscape is the Junee Hills and Slopes Ecosystem in the NSW South West Slopes Bioregion (Mitchell 2002) (Map 4). The landscape is characterised by rolling hills, low ranges and undulating plain on Silurian-Devonian massive granite and granodiorite, generally lies at an elevation of 300 to 450m, and has coarse siliceous sands amongst rock outcrop and tors and thin gritty red and yellow texture-contrast soils on slopes with harsh blocky subsoil. Woodland of Dwyer's red gum and mugga generally occurs on high rocky areas. On slopes, open forest of grey box and red stringybark, with patches of black cypress pine in rocky outcrops, occur. River red gum and river oak occur along streams (Mitchell 2002).

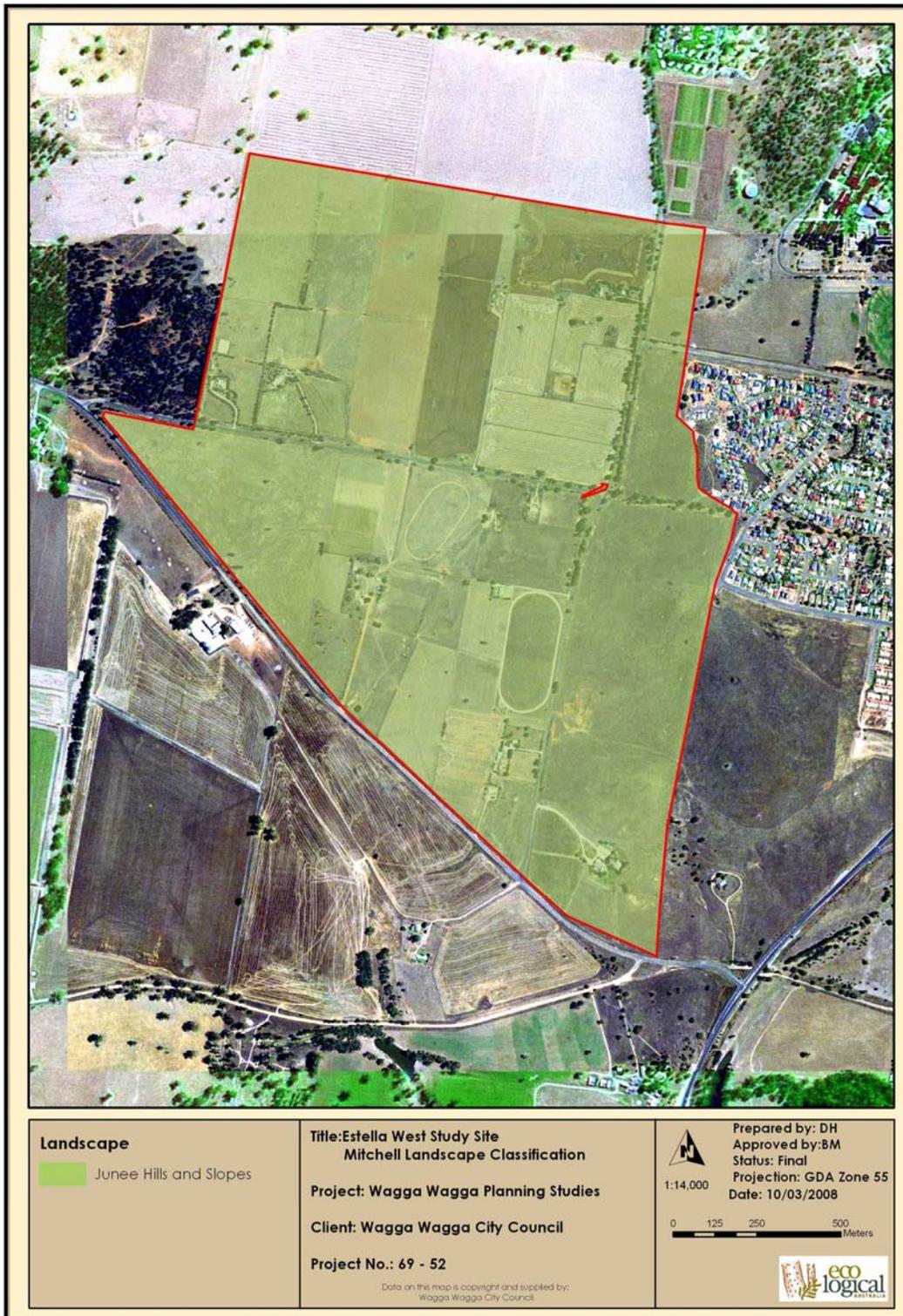
The degree of clearance for the Mitchell Landscapes and the amount and percentage of Mitchell Landscape present within the study site is shown in (Map 5). The Junee Hills and Slopes landscape has been extensive cleared in the past for agricultural production.

Table 5 – Mitchell landscapes within the study area

Mitchell Landscape	Degree of Clearance	Area within Study Area	% of Study Area
Junee Hills and Slopes Ecosystem	98 %	263 ha	100 %



Map 3 – Areas of native vegetation at the site.



Map 4 – Mitchell landscapes on the site

2.2.2 Vegetation Types

Two vegetation types occur at the site: Yellow Box Woodland and scattered paddock trees (Table 6). Yellow Box Woodland occurs along Pinegully Road and Harris Road and east of Pinegully Road, while scattered paddock trees occur over the remainder of the site (Map 5). Tree species present within areas of scattered paddock trees indicate that much of the site would have been covered by yellow box woodland prior to clearing. The woodland comprises a canopy dominated by yellow box (*Eucalyptus melliodora*) with Blakely's red gum (*E. blakelyi*) and white box (*E. albens*) also occurring.

The woodland is consistent with the Yellow Box Woodland described in Priday and Mulvaney (2005). This community forms part of the broader ecological community known as White Box, Yellow Box, Blakely's Red Gum Woodland (box – gum woodland) which is listed as an endangered ecological community under the TSC Act. Box – gum woodland is listed as a critically endangered ecological community White Box, Yellow Box, Blakely's Red Gum grassy woodland and derived native grassland under the Commonwealth EPBC Act. However, due to the predominately exotic composition of understorey vegetation, box – gum woodland within the Estella site is not considered part of the critically endangered box – gum woodland listed under the Commonwealth EPBC Act (1999).

Vegetation communities on site are degraded from prolonged agricultural use, but there are several elements of value. The woodlands have some native groundcover, with species present including *Austrodanthonia* spp. and *Austrostipa scabra*. Weed cover was generally high within woodland remnants with onion grass (*Romulea rosea* and *R. minutiflora*) and Patterson's curse the most common weed encountered.

The DECC has indicated that all remnants of the Box-gum woodland ecological community are of conservation value (Priday and Mulvaney 2005). This includes remnants ranging in condition from highly modified to near natural.

Table 6 – 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
Box – gum Woodland	95 %	10.8 ha	4.3 %
Scattered paddock trees and exotic grassland	N/A	142.9	95.7%



Map 5 – Vegetation types on site

2.3 Landscape Scale Assessment

2.3.1 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 (Ayers *et al.* 2005).

The study site is located within a rural environment, with some residential development to the east. The site is surrounded by similar rural land. Native vegetation cover in and outside the site is sparse and only a small remnants of yellow box woodland and isolated paddock trees are present on the site. Connectivity at the site is moderate and effected by road reserve vegetation along Pinegully Road north of the current site and by remnant vegetation along the corridor running east from the site through the suburb of Estella. These two corridors provide linkages to remnant vegetation within the Charles Sturt University campus north east of the site.

The site occupies an important location between woodland remnants north of the site (e.g. Charles Sturt University) and the Murrumbidgee River. As a result, the site contains an important flyway for threatened birds such as the superb parrot and swift parrot. The majority of woodland vegetation at the site occurs along the road reserves of Pinegully Road and Harris Road and the linear nature of these remnants further enhances their function as flyways.

A summary of the outcomes of the landscape scale assessment as described in Ayers *et al.* (2005) is provided in Table 7 below.

Table 7 – 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	Moderate
Total adjacent remnant area	Large
Calculated Landscape Value	27

2.4 Site Scale Assessment

2.4.1 Assessment Zone Delineation

Vegetation within the Estella site was broken up into 3 discrete assessment zones based on extant native vegetation at the site following examination of recent aerial photography (Map 6).

Vegetation Zones determined from aerial photography were:

- Zone 1 – Yellow Box Woodland – ‘moderate to good’ condition
- Zone 2 – Yellow Box Woodland – low condition
- Zone 2 – Scattered Paddock Trees and Exotic Grassland

The resulting assessment zones are presented in Table 8 below.

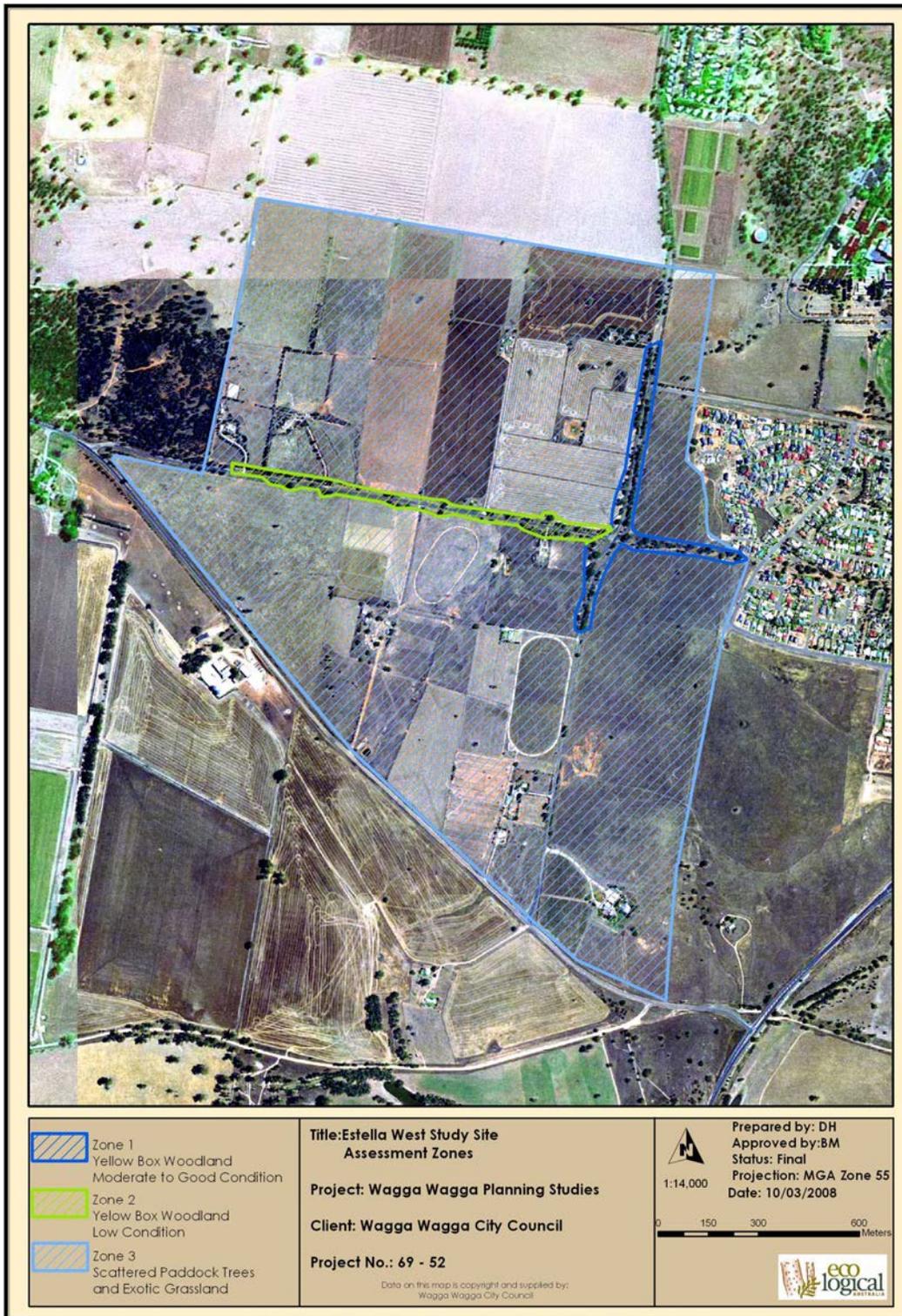
As stated in Section 1.7 **Error! Reference source not found.**, due to the dearth of native vegetation at the site and limitations regarding access to properties, vegetation survey at the site was limited to a single vegetation plot along the vegetation corridor east of Pinegully Road. Therefore, only Assessment Zone 1 was assessed in accordance with Ayers *et al.* (2005).

2.4.2 Condition and Quality of Vegetation

Vegetation survey using the *BioMetric* methodology (Ayers *et al.* 2005) indicated vegetation within Zone 1 was in ‘moderate to good’ condition with a well developed canopy cover. The understorey and groundcover vegetation within Zone 1 was dominated by exotic grasses and herbs with only a few native species recorded (Table 8).

Table 8 – Site Assessment for Zone 1 using the *BioMetric* Tool (see Ayers *et al.* 2005). The table shows the benchmark values for the relevant vegetation community and the assessed values generated from plots within each assessment zone.

Variables	Benchmarks			Vegetation Plots within Assessment Zone
				1
Native plant species		≥	19	4
Native over-storey cover	8	to	15	11
Native mid-storey cover	1	to	5	0
Native ground cover (grasses)	16	to	50	0
Native ground cover (shrubs)	0	to	4	0
Native ground cover (other)	1	to	5	0
Exotic plant cover				80
Number of trees with hollows		≥	5	1
Overstorey regeneration			1	0
Total length of fallen logs		≥	50	14



Map 6 – Assessment Zones at the site.

2.4.3 Vegetation Condition Categories

The condition of native vegetation at the site varied from 'moderate to good' condition Yellow Box Woodland along Pinegully Road and east of Pinegully Road (Zone 1), to scattered paddock trees above crops and pasture improved paddocks (Zone 3) (Map 7). A small area of low condition yellow box woodland (Zone 2) was identified along the Harris Road road reserve (Map 7).

The understorey of 'moderate to good' condition vegetation was predominately exotic grasses and herbs and dominated by weed species such as Patterson's curse, onion grass and capeweed. Some native grasses and herbs were also recorded including wallaby grass, *Austrostipa scabra* and *Erodium* spp.

Woody understorey vegetation was generally absent at the site however a small patch of eucalypt saplings was observed east of Pinegully Road and north of the vegetated corridor. This native regeneration had been severely compromised by stock (grazing and trampling).

2.4.4 Summary of Assessment Zone Information

Vegetation within the Estella site was dominated by exotic groundcovers (grasses, herbs etc) with occasional paddock trees consistent with box – gum woodland scattered across the site. Remnant woodland vegetation in low and 'moderate to good' condition was sparse and confined to road reserves adjacent to Harris Road and Pinegully Road (Table 9).

Woodland remnants at the site have a high regional value as they occur within a landscape that has been extensively cleared for agricultural production. Moreover, the site is thought to have a moderate landscape value as remnant vegetation within the site provides important linkages to vegetation outside the site boundaries.

Table 9 – Summary Information on Vegetation Assessment

Assessment Zone No.	Area (ha)	Vegetation Type	Vegetation Condition	Landscape Value	Biometric Score	No. Large and very large trees
1	6.22	Box – Gum Woodland	'Moderate to good'	27	22	53
2	4.53	Box – Gum Woodland	Low		N/A	17
3	240.13	Scattered Paddock Trees	N/A		N/A	38



Map 7 Vegetation condition at the site.

3. Threatened Species

3.1 Threatened Species

No threatened species were observed at the site during the current study however the superb parrot (*Polytelis swainsonii*) is known to utilise the flyway along Pine Gully Road created by remnant eucalypts within the road reserve. A review of state and federal threatened species databases identified 9 species; diamond firetail (*Stagonopleura guttata*), brown tree creeper (eastern subspecies) (*Climacteris picumnus victoriae*), grey-crowned babbler (*Pomatostomus temporalis temporalis*), swift parrot (*Lathamus discolor*), masked owl (*Tyto novaehollandiae*), squirrel glider (*Petaurus norfolcensis*), yellow-bellied sheath-tail bat *Saccolaimus flaviventris*, little pied bat (*Chalinolobus picatus*) and eastern long-eared bat (*Nyctophilus timoriensis*) as likely, or with the potential to, occur at the site (see Appendix 2). The site is considered to provide potential foraging habitat for two bird species, white-throated needle-tail and Rainbow Bee-eater (*Merops ornatus*), listed as migratory under the Commonwealth EPBC Act.

One threatened species, superb parrot (*Polytelis swainsonii*), has been previously recorded at the study site and is known to regularly utilise the site as a flyway to and from the Murrumbidgee River (Leigh Thompson pers. comm.). This species utilises remnant woodland along Pinegully Road as a flyway before turning south west toward the Murrumbidgee River.

No threatened flora were considered likely or with the potential to occur at the site.

One endangered ecological community, yellow box – white box – Blakely's redgum grassy woodland and derived native grassland (commonly referred to as box – gum woodland) occurred at the site. Box – gum woodland is listed as a critically endangered ecological community under the EPBC Act.

The extent of habitat available for threatened species known, or with the potential, to occur at the site is presented in Table 10 below. Available habitat for threatened species is generally low across the site.

Table 10 – Extent of habitat available at the site for threatened species known, likely or with the potential to utilise 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)
Diamond Firetail	Open eucalypt forests, woodlands,	No	As per breeding habitat.	Yes, approx. 10.8 ha	As per breeding habitat.	No

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)
	either in the shrubby understorey, or higher up, especially under hawk's or raven's nests.					
Squirrel Glider	Trees with hollows > 5 cm diameter in eucalypt forests and woodlands (i.e. not in paddock trees)	Yes – approx. 10.8 ha	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 in dry forests with ironbarks, box and bloodwoods and can use patches < 1 ha and isolated trees if within 75 m of other patches.	Yes – approx. 10.8 ha	As per breeding and foraging habitat.	Yes – approx. 10.8 ha
Brown Treecreeper	Nests in tree hollows within grassy woodland	Yes – approx. 10.8 ha	Open grassy woodlands with fallen logs including	Yes – approx. 10.8 ha	As per breeding and foraging habitat.	Yes – approx. 10.8 ha

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)
	vegetation. patches of remnant woodland greater than 5ha that contain hollow bearing trees.		remnants with a very sparse shrub and small tree layer.			
Grey Crowned Babbler	Nests in shrubs and eucalypt saplings or outermost leaves of low branches of mature eucalypts.	No	Inhabits open Box-gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands	Yes, approx. 10.8 ha	Inhabits open Box-gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands	Yes, approx. 10.8 ha
Little Pied bat	Tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts, tunnels.	Yes, 108 large and very large trees which are either hollow bearing or likely to develop hollows in the future.	Dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box.	Yes, approx. 263 ha	Tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts, tunnels for roosting.	Yes, 108 large and very large trees which are either hollow bearing or likely to develop hollows in the future.
Swift parrot	Does not breed in mainland Australia	No	Forests, woodlands, plantations, banksias, street trees and gardens on the	Yes, approx. 10.8 ha	As per foraging habitat.	Yes, approx. 10.8 ha

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)
			mainland			
Superb Parrot	Breeds along inland rivers in river red gum. Living or dead trees with hollows > 5 cm diameter.	No	Feeds in box woodland with 10km of nest tree. West of dividing range.	Yes, approx. 10.8 ha	As per foraging type.	Yes, approx. 10.8 ha
Masked Owl	Old hollow eucalypts, live or dead but commonly live, in a variety of topographic positions from gully to upper slope, with hollows greater than 40 cm wide and greater than 100 cm deep	Potential, 108 large and very large trees which are either hollow bearing or likely to develop hollows in the future.	Forages in areas of open understorey and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain, often along edges of woodland including roads.	Yes, approx. 263 ha	Hollows in live or occasionally dead eucalypts; dense foliage in gullies; and caves or recesses in cliffs. Similar to breeding habitat.	Potential, 108 large and very large trees which are either hollow bearing or likely to develop hollows in the future.
Yellow bellied Sheathtail bat	Live or dead hollow bearing trees	Yes, 108 large and very large trees which are either hollow bearing or likely to develop hollows in the future.	Forages in most habitats across its very wide range, with and without trees.	Yes, approx. 263 ha	Live or dead hollow bearing trees, under exfoliating bark, in burrows of terrestrial mammals in treeless areas, bird nests or sugar glider	Yes, 108 large and very large trees which are either hollow bearing or likely to develop hollows in the future.

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)
					nests.	

Proposed development of the study site may result in the loss of 38 paddock trees and 4.5 ha of yellow box woodland in low condition. For the majority of threatened species identified as potentially occurring at the site, the loss of this habitat is not likely to result in a significant impact provided that appropriate offsets are established and maintained. However, the loss of remnant trees within low condition woodland along Harris Road may significantly impact the connectivity of squirrel glider habitat east and west of the site. The extent of habitat with the potential to be removed under the current proposal is summarised in Table 11 below together with an assessment of whether this loss would be acceptable and whether the loss would require offsetting.

Table 11 – Standards for maintaining threatened species habitats (shows 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
Diamond Firetail	Yes – up to 10 % loss but no loss of riparian habitats	4.5 ha of marginal habitat.	Yes, with offset
Squirrel Glider	Yes - loss of 10 % of foraging habitat provided that clearing does not create treeless barriers to dispersal greater than 30 – 50 m wide. Sap feeding trees within 50 m of retained habitat to be protected. No loss of breeding habitat.	4.5 ha of marginal habitat	No, clearing of low condition native woodland will result in a treeless barrier to dispersal between 'moderate to good' condition woodland in the east of the site and woodland adjacent to the western boundary of the site.
Brown Treecreeper	No loss of breeding habitat	4.5 ha of marginal habitat	Yes, with offset.
Grey Crowned Babbler	Yes – up to 10 % loss of habitat, but no loss of	4.5 ha of marginal habitat.	Yes, with offset

	connectivity.		
Little Pied bat	Yes	4.5 ha and up to 38 paddock trees	Yes, with offset
Superb Parrot	Upper and lower slopes of Murrumbidgee: no loss of <i>Eucalyptus camaldulensis</i> 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.	4.5 ha of marginal habitat.	Yes, with offset
Swift parrot	Yes – 5 % loss of foraging habitat except for mature <i>Eucalyptus albens</i> and <i>E. sideroxylon</i> .	4.5 ha of marginal habitat.	Yes, with offset
Masked Owl	No loss of breeding habitat (large (>40cm DBH) hollow bearing trees)	4.5 ha of marginal habitat.	Yes, with offset.
Yellow bellied Sheathtail bat	Up to 10 % loss of foraging habitat. Up to 10 % loss of hollow bearing trees.	4.5 ha and up to 38 paddock trees	Yes, with offset

3.2 Threatened Populations

One threatened population, squirrel glider population in the Wagga Wagga LGA, listed under Part 2 of Schedule 1 of the TSC Act is considered to potentially occur at the site.

Hollow bearing trees occur within the proposal site and may be used by squirrel gliders for denning. Remnant box – gum woodland along Pine Gully Road may provide foraging habitat for the species and low condition woodland along Harris Street may act as a corridor for movement of squirrel gliders across the site.

3.3 Endangered Ecological Communities

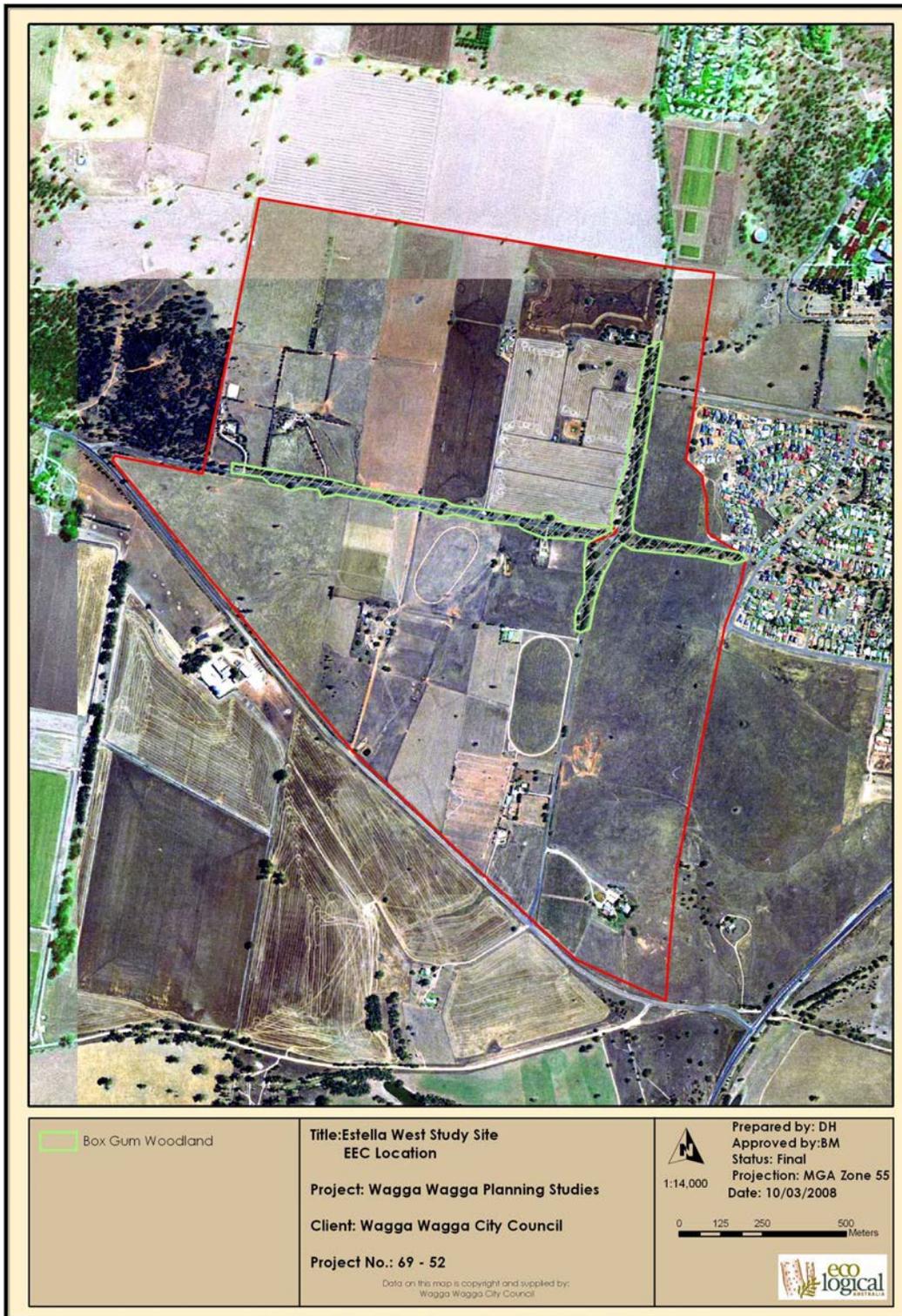
The Yellow Box woodland vegetation type recorded within the site is consistent with the white box, yellow box, Blakely's redgum ecological community which is listed as endangered under Part 3, Schedule 1 of the TSC Act. Yellow box woodland at the site is not consistent with the critically endangered box – gum woodland ecological community listed under the Commonwealth EPBC Act.

White Box, Yellow Box, Blakely's Red Gum woodland (box – gum woodland) occurs in the study area as a narrow band of 'moderate to good' condition woodland following the Pinegully Road road reserve in a north – south direction (Map 8). Remnant woodland within the vegetation corridor east of Pinegully Road also contains 'moderate to good' condition box – gum woodland. 'moderate to good' condition box – gum woodland occupies an area of approximately 6.2 ha across the site while the low condition woodland occupies an area of approximately 4.5 ha (Table 12).

This community is generally highly modified with respect to species composition. Both low and 'moderate to good' condition box – gum woodland at the site is characterised by mixed native and exotic groundcover and very sparse to absent shrublayer vegetation. Despite the disturbed nature of the community at the site, the box – gum woodland EEC has been depleted to such an extent throughout its range that all remnants are of conservation significance (Priday and Mulvaney 2005).

Table 12 – Area of EECs at the site.

EEC	Area of EEC		
	Moderate to good condition	Low condition	Total
Box – gum Woodland	6.2 ha	4.5 ha	10.8 ha



Map 8 – Extent of EECs at the site.

4. Structure Plan

The site contains an area of 'moderate to good' condition box – gum woodland along Pinegully Road and east of Pinegully Road as well as low condition box – gum woodland within the road reserve of Harris Road. Under the Native Vegetation Act (2003), 'moderate to good' condition box-gum woodland at the site is not permitted to be cleared, regardless of available offsets or management actions because:

- It is in 'moderate to good' condition
- Is listed as an endangered ecological community under the TSC Act (1995).
- Is of a vegetation type that is greater than 70% cleared across its range (see Section 2.2.2)
- It occurs within 2 Mitchell landscapes which are greater than 70% cleared (see Section 2.2.1)

'Moderate to good' condition box – gum woodland along and east of Pine Gully Road is of high conservation value and should be retained for conservation (Map 9). This area is of high biodiversity value and occurs within a landscape which has been heavily cleared of native vegetation. 'Moderate to good' condition box – gum woodland within the Estella West site is therefore considered highly constrained and unavailable for development (Map 9).

In addition to retaining 'moderate to good' condition woodland at the site, it is strongly recommended that low condition box-gum woodland along the road reserve of Harris Road be retained at the site (Map 9). Retention of this vegetation will help to maintain connectivity between 'moderate to good' box – gum woodland in the east of the site and good condition vegetation which borders the western boundary of the site. The Harris Road road reserve contains woodland vegetation that provides habitat for a range of threatened species and endangered squirrel glider population. Remnant trees along Harris Road are likely to provide an important corridor for the movement of squirrel gliders and birds such as the grey-crowned babbler across the Estella West site.

Retained vegetation at the site is unlikely to provide a sufficient offset to the removal of low condition box – gum woodland at the site. DECC has stated that an offset ratio of 1.92:1 for box – gum woodland in low condition. An offset of 8.64 ha of box – gum woodland would therefore be required if low condition vegetation at the site was not retained. It is unlikely that offsets would maintain or improve east-west connectivity for threatened species, in particular, the squirrel glider which potentially occurs at the site.

The majority of the site consists of large, cropped or grazed paddocks which are not considered to offer any significant biodiversity values apart from occasional paddock trees which may provide habitat for a number of threatened fauna. These areas are considered potentially developable provided that appropriate offsets for losses of remnant paddock trees are available.

An offset ratio of 10:1 is required for scattered paddock trees at the Estella West 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. As a consequence of the above, any low condition vegetation not located within 'conservation' area must be considered as cleared and the loss offset using the above 1.92:1 ratio. Similarly, scattered paddock trees must be located in 'open space' or 'conservation' areas (i.e. not residential or similar) otherwise they must be offset using the 10:1 offset ratio for paddock trees.

The total loss of paddock trees, assuming that low and 'moderate to good' condition native vegetation is retained, is presented in Table 13 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 13: Proposed loss and required offset of paddock trees at the proposed Estella West development site.

Common Name	Species Name	No. of Trees		Required Offsets		Total
		Large	Very Large	Large	Very Large	
Blakely's Redgum	<i>Eucalyptus blakelyi</i>	2	-	20	-	20
Yellow Box	<i>Eucalyptus melliodora</i>	5	-	50	-	50
Grey Box	<i>Eucalyptus microcarpa</i>	2	-	20	-	20
Kurrajong	<i>Brachychiton populneus</i>	2	-	20	-	20
White Box	<i>Eucalyptus albens</i>	1	-	10	-	10
Drooping She-oak	<i>Allocasuarina verticillata</i>	4	-	40	-	40
Overall Total						160

Sufficient offsets for the loss of paddock trees and low condition woodland is not likely to be available within retained lands at the site, particularly if low condition box – gum woodland is not retained along Harris Road. The retention of some paddock trees, particularly those that are hollow bearing may be required, if sufficient offsets can not be achieved, so as to minimise impacts on threatened species that may utilise the site.

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.

The areas proposed for retention, development and offsets at Estella West, as determined on the basis of current investigation at the site, are presented in Map 9 below. The site is an important flyway for superb parrots travelling to and from the Murrumbidgee River. A major offset area is recommended for land east of Pinegully Road which will enhance connectivity of vegetation along the existing flyway. In general, the location of offsets at the site should aim to:

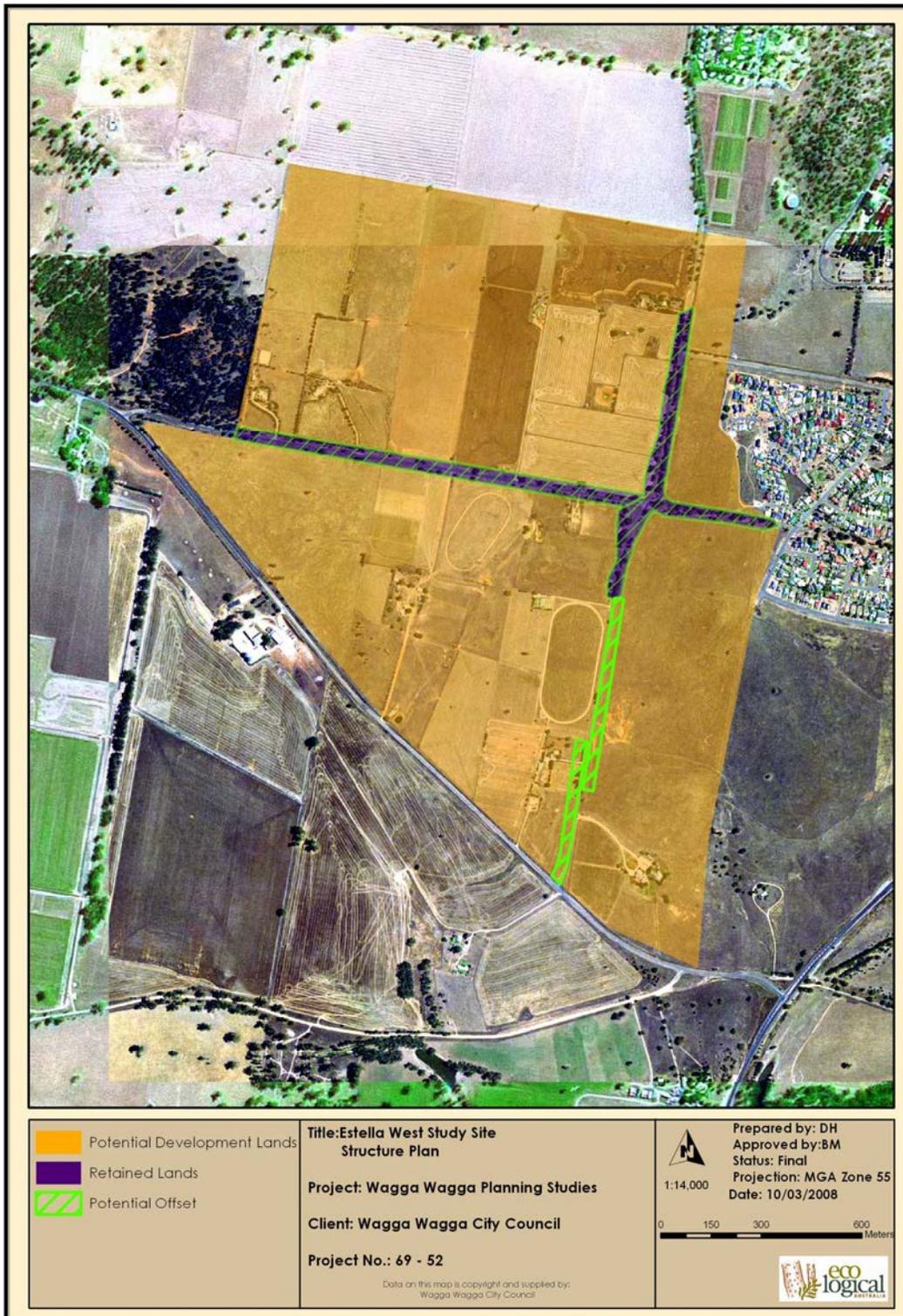
- Increase connectivity between currently isolated woodland patches within the site
- Increase connectivity of the site to areas of remnant vegetation outside the site boundaries
- Elevate patches of native vegetation from moderate to good condition
- Decrease edge effects currently experienced by native vegetation remnants

The retention of low condition remnant woodland along Harris Road (Map 9) would help to maintain the existing connectivity between woodland remnants east and west of the Estella West site. This vegetated corridor is thought to be important for the movement of threatened species, particularly the squirrel glider.

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.

Management actions within retained vegetation at the site will further help to offset loss of scattered paddock trees across the site. Woodland vegetation at the site is resilient and likely to regenerate over time provided that factors currently preventing regeneration are managed. Management actions could include:

- Fencing and protection of the site
- Grazing exclusion (initial 3 years) and grazing control
- Control of feral pests
- Erosion control
- Retention of dead timber
- Control of weeds
- Retention of all native regrowth
- Fire management / ecological burning
- Replanting of shrub and understorey species in treed areas
- Revegetation



Map 9 – Structure plan for the site

5. References

Ayers, G.P., Seddon, J., Doyle, S. and Briggs, S. (2005) *BioMetric Version 1.8 – A terrestrial biodiversity assessment tool for the Property Vegetation Plan Developer – Operational Manual*. Prepared for the NSW Department of Environment and Conservation.

Chen, X.Y. and McKane, D. (1997) *Wagga Wagga 1: 100 000 Soil Landscape Map*. Department of Land and Water Conservation, NSW.

Mitchell, P. (2002) *NSW Ecosystems Database Mapping Unit Descriptions*. Groundtruth Consulting

NSW Department of Primary Industries (DPI) - Noxious weed declarations for Wagga Wagga City Council [Online]. Available: <http://www.dpi.nsw.gov.au/agriculture/farm/pest-weeds-management/weeds/noxweed>. (7/8/2007)

NSW Department of Environment and Climate Change (DECC) (2005) *Threatened Species Assessment Tool Version 1-7 – An assessment tool for use in the NSW Property Vegetation Plan developer: Operational Manual*. Department of Environment and Climate Change, formerly Department of Environment and Conservation, Sydney, 2005.

Priday, S. and Mulvaney, M. (2005) *The native vegetation and threatened species of the city of Wagga Wagga*. Department of Environment and Conservation, Queanbeyan NSW.

Wagga Wagga City Council (2006) *Draft Wagga Wagga Spatial Plan, 2007*.

6. Appendices

Appendix 1: Flora species recorded at the site.

Species Name	Common Name	Survey Type	
		Vegetation Plot	Traverse
<i>Arctotheca calendula</i> #	Capeweed	√	√
<i>Austrodanthonia</i> spp.		√	
<i>Austrostipa scabra</i>	Speargrass	√	
<i>Avena fatua</i> #	Wild Oats		√
<i>Bromus</i> spp.#		√	√
<i>Conyza</i> spp.#		√	
<i>Crassula decumbens</i>			√
<i>Crassula sieberiana</i>	Australian Stonecrop	√	
<i>Echium plantagineum</i> #	Patterson's Curse	√	√
<i>Eleusine indica</i>	Crowsfoot Grass	√	
<i>Erodium cicutarium</i>	Common Crowfoot		√
<i>Erodium crinitum</i>	Blue Storksbill		√
<i>Eucalyptus blakelyi</i>	Blakely's Redgum		√
<i>Eucalyptus melliodora</i>	Yellow Box	√	
<i>Hypericum perforatum</i> #	St. Johns Wort	√	
<i>Lepidium pseudohyssopifolium</i>	Peppergrass	√	
<i>Lolium rigidum</i> #	Wimmera Ryegrass	√	√
<i>Lycium ferocissimum</i> #	African Boxthorn	√	
<i>Malva parviflora</i> #	Small-flowered Mallow	√	√
<i>Poa annua</i>	Winter Grass	√	
<i>Polygonum aviculare</i> #	Wireweed	√	
<i>Romulea rosea</i> #		√	√
<i>Rumex brownii</i>	Swamp Dock		√
<i>Salvia verbenaca</i> #	Wild Sage	√	
<i>Stellaria media</i>	Common Chickweed		√
<i>Trifolium arvense</i> #	Haresfoot Clover	√	
<i>Trifolium</i> spp.#		√	√
<i>Trifolium subterraneum</i> #	Subterranean Clover	√	
<i>Urtica urens</i>	Small Nettle		√

#Exotic species

Appendix 2: Likelihood of occurrence for threatened species, populations and communities on the Estella West site.

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Threatened species - Fish					
<i>Maccullochella peelii peelii</i>	Murray Cod		V	Unlikely	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.
<i>Macquarie australasica</i>	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					
<i>Litoria booroolongensis</i>	Booroolong Frog	E		Unlikely	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
<i>Litoria raniformis</i>	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 river valleys. They are also found in irrigated rice crops, particularly

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

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		M	No	Rivers, large dams. Roost and nest on large platforms built in large Eucalypts
<i>Hirundapus caudacutus</i>	White-throated Needle-tail		M	Potential	Open space above canopy. Forages over large areas
<i>Lathamus discolor</i>	Swift Parrot	E	E, M	Yes	Forests, woodlands, plantations, banksias, street trees and gardens on the mainland
<i>Leipoa ocellata</i>	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
<i>Melanodryas cucullata</i>	Hooded Robin	V		Unlikely	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V		Unlikely	Ironbark woodlands, extensively wooded areas
<i>Merops ornatus</i>	Rainbow Bee-eater		M	Potential	Open woodlands with sandy, loamy soils, dunes, cliffs, mangroves golf courses
<i>Myiagra cyanoleuca</i>	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
<i>Neophema pulchella</i>	Turquoise Parrot	V		Unlikely	Open grassy woodland, with dead trees, near permanent water and forested hills.
<i>Ninox connivens</i>	Barking Owl	V		Unlikely	Open forests, woodlands, dense scrubs, other large trees near watercourses. Nest

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					in tree hollow.
<i>Pachycephala inornata</i>	Gilbert's Whistler	V		Unlikely	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.
<i>Pedionomus torquatus</i>	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
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	Yes	Breeds along inland rivers in river red gum, feeding in box woodland with 10km of nest tree. West of dividing range.
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		Potential	Inhabits open Box-gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains
<i>Pyrholaemus sagittatus</i>	Speckled Warbler	V		Unlikely	Well vegetated woodlands, diverse structure
<i>Rostratula australis</i>	Australian Painted Snipe		V	Unlikely	Well vegetated margins of wetlands
<i>Rostratula benghalensis australis</i>	Painted Snipe (Australian subspecies)	E	V, M	Unlikely	Well vegetated margins of wetlands
<i>Stagonopleura guttata</i>	Diamond Firetail	V		Potential	Open eucalypt forests, woodlands.
<i>Stictonetta naevosa</i>	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 breeding swamps to more permanent waters such as lakes, reservoirs,

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					farm dams and sewage ponds
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Potential	Forages in areas of open understorey and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain, often along edges of woodland including roads. Roosts in tree large tree hollows.
<i>Grantiella picta</i>	Painted Honeyeater	V	-	Unlikely	Boree, Brigalow and Box-gum woodlands and box-ironbark forests. Inhabits vegetation with 5 or more mistletoe per hectare.
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E	E, M	Unlikely	Dry open forests, woodlands, especially red ironbark, yellow box, yellow gum
Threatened species - Mammals					
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	No	Occurs in wide variety of habitats in large remnants. Dens in tree hollows, hollow log or rock crevice
<i>Macrotis lagotis</i>	Bilby	Ex	V	No	Sandy desert areas in spinifex (<i>Triodia</i> species) grasslands
<i>Myotis adversus</i>	Large-footed Myotis	V		No	Known from a range of habitats close to water from lakes, small creeks to large lakes and mangrove lined estuaries
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail 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.
<i>Chalinolobus picatus</i>	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,

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					buildings, power poles, fence posts, caves, cliff crevices, mineshafts and tunnels.
<i>Nyctophilus timoriensis</i> (south eastern form)	Eastern Long-eared Bat	V	V	Potential	Inhabits a variety of vegetation types, including mallee, bullock 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
<i>Petaurus norfolcensis</i>	Squirrel Glider	V		Potential	In the region occurs in Box-gum woodlands, box-ironbark woodlands and river red gum woodland.
<i>Phascolarctos cinereus</i>	Koala	V		No	Inhabit eucalypt woodlands and forests
<i>Phascogale tapoatafa</i>	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					
<i>Ammobium craspedioides</i>	Yass Daisy	V	V	No	Known from natural temperate grassland sites.
<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass	V	V	No	Swamps or low-lying areas which become periodically water-logged, usually on clayey soils.
<i>Austrostipa wakoolica</i>		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

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					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 rise
<i>Brachycome muelleroides</i>	Claypan Daisy	V	V	No	Grows in damp areas on the margins of claypans in moist grassland with <i>Pycnosorus globosus</i> , <i>Agrostis avenacea</i> and <i>Austrodanthonia duttoniana</i>
<i>Brachycome papillosa</i>	Mossigiel Daisy	V	V	No	Recorded primarily in clay soils on Bladder Saltbush (<i>Atriplex vesicaria</i>) and <i>Maireana aphylla</i> plains, but also in grassland and in Grey Box (<i>Eucalyptus microcarpa</i>) - Cypress Pine (<i>Callitris spp.</i>) woodland
<i>Diuris sheaffiana</i>	Tricolour Diuris	V	V	No	Sporadically distributed on the western slopes of NSW. Associated species include <i>Callitris glaucophylla</i> , <i>Eucalyptus populnea</i> , <i>Eucalyptus intertexta</i> , Ironbark and Acacia shrubland. The understorey is often grassy with herbaceous plants such as Bulbine species
<i>Senecio garlandii</i>	Woolly Ragwort	V	V	No	Woolly Ragwort occurs on sheltered slopes of rocky outcrops
<i>Swainsona murrayana</i>	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 <i>Maireana</i> species. Plants have been found in remnant native grasslands or

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
					grassy woodlands that have been intermittently grazed or cultivated.
<i>Swainsona recta</i>	Small Purple-pea	E	E	No	Before European settlement Mountain Swainson-pea occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum <i>Eucalyptus blakelyi</i> , Yellow Box <i>E. melliodora</i> , Candlebark Gum <i>E. rubida</i> and Long-leaf Box <i>E. goniocalyx</i>
<i>Thesium australe</i>	Austral Toadflax	V	V	No	Often found in damp sites in association with Kangaroo Grass (<i>Themeda australis</i>)
Threatened Ecological Populations					
<i>Petaurus norfolcensis</i> – 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	Yes	Western slopes and plains