WAGGA WAGGA URBAN LANDCARE

FLORA AND FAUNA SURVEYS 2014

SIX CASE STUDIES

JUNE 2014

Contents

Contents (cont.)

Flowerdale Lagoon

2014 Flora and Fauna Survey

1. Flowerdale Lagoon

1.1. Site Description

Flowerdale Lagoon is located on the north-western edge of Wagga Wagga, south of the Murrumbidgee River. It represents a significant flora and fauna preserve within the Wagga Wagga Local Government Area, with a typical wetland flora consisting chiefly of river red gum (*Eucalyptus camaldulensis*), river she-oak (*Casuarina cunninghamiana*), cumbungi (*Typha* sp.), knotweeds (*Persicaria* spp.) and tall spike-rush (*Eleocharis sphacelata*). The lagoon also acts as a stormwater drain for Wagga's western suburbs.

Access to Flowerdale Lagoon is available at the southern, eastern and north-eastern points, via Edward St. West, Moorong St. and Flowerdale Rd. respectively. The Wiradjuri Walking Track and the Flowerdale Bikeway pass along the southern bank.

1.2. Landcare Work

In 2000, Wagga Wagga Urban Landcare planted trees in an area south of the Lagoon after earlier plantings were destroyed during maintenance of the levee bank. The new site is located near the stormwater inlet from Ashmont and Glenfield. It is easily accessible via Edward St. West and is immediately adjacent to a parking lot and a bicycle track. Site GPS coordinates are -35.114346, 147.340307 (site midpoint). For site details, including a map, see pg. 75.

The planting consists chiefly of river red gums (*Eucalyptus camaldulensis*) and river she oak (*Casuarina cunninghamiana*), with a small number of additional species. Most of these additional species, while native to Australia, are not found elsewhere near Flowerdale Lagoon and are not recorded occurring naturally within the Wagga Wagga LGA. Contrary to site descriptions given elsewhere (NGH), no banksias were recorded at the site. Also recorded in or near the site were two mature bottlebrushes (*Callistemon* sp.), a number of *Eucalyptus* trees that appear to predate the plantings, and two introduced trees (a species of **Prunus* and a narrow-leafed ash, **Fraxinus angustifolia*). The eucalypts appear to have been seeded by a nearby tree from a much earlier planting.

The planting was surveyed on January 29, 2014, and a headcount taken (Table 1.1). Additional plantings were noted along the south-eastern bank of the lagoon. These were sparser and at an earlier developmental stage, and were not surveyed.

Table 1.1. Survivorship of plantings at Flowerdale Lagoon

Common name	Scientific name	Height	DBH[1]	Living	Dead	Survivorship
River red gum	*Eucalyptus camaldulensis*	8-12 m	<40 cm	43	3	93%
River she-oak	*Casuarina cunninghamiana*	6-8 m	<10 cm	11	1	91%
Paperbark	*Melaleuca* species	3-6 m	-	4	0	100%
Bottlebrush	*Callistemon* species	2-4 m	-	3	0	100%
Hakea	*Hakea* species	3 m	-	2[2]	0	100%
She-oak	*Allocasuarina* species	3 m	-	2	1	67%

Silver wattle	*Acacia decora*	3 m	-	1	0	100%

[1]Species with >1 trunk were not measured for diameter at breast height (DBH). [2]One 60 cm seedling also recorded.

Survivorship was generally high, though average diameter at breast height (DBH) was low and canopies were often sparse. This may indicate a degree of competition between plants.

Three dead plants were reported that could not be identified.

1.3. Flora

Understorey within the site is sparse, consisting of patchy grasses with a few herbaceous weeds. The eastern half of the planting is dominated by native species, namely wallaby grass (*Rytidosperma* sp.) and rough speargrass (*Austrostipa scabra*), while the western half is dominated by the exotic grasses brome (**Bromus* sp.) and wild oat (**Avena fatua*), and the herbaceous weeds narrow-leaf plantain (**Plantago lanceolata*), wireweed (**Polygonum aviculare*), onion grass (**Romulea rosea*), and prickly lettuce (**Lactuca serriola*). Two small patches of St. John's wort (**Hypericum perforatum*) occur on the north-eastern edge of the planting and a third in the western half of the planting. St. John's wort is a Class 4 noxious weed in the Wagga Wagga area, and must be suppressed (DPI).

The condition of the understorey deteriorates towards the periphery of the site, especially on the northern edge near the banks of the inlet. These areas contain dense infestations of exotic species, chiefly the grasses **Phalaris* sp., **Bromus* sp. , and **Avena fatua*. The condition of the stormwater inlet is variable, with significant native remnants (including *Typha* sp.) alongside exotic grasses and herbaceous weeds.

The bank on the opposite side of the stormwater inlet to the planting shows a dense infestation of the introduced narrow-leafed ash (**Fraxinus angustifolia*) as well as a large weeping willow (**Salix babylonica*).

1.4. Fauna

Flowerdale Lagoon offers habitat to suit a diverse array of animal species, including open water, reed beds, grasslands, and mature trees with hollows suitable for nesting. The fauna is correspondingly diverse, with more than 80 native bird species and a range of reptiles and mammals recorded from the site. This list, drawn from personal observation (2010-2013) and *Atlas of Living Australia* (ALA) data, is given in 1.6 below. The site also offers habitat for many insect species, including large populations of dragonflies and damselflies.

Significant species recorded for the site include the superb parrot (*Polytelis swainsonii*) and the diamond firetail (*Stagonopleura guttata*). The superb parrot has been declared *vulnerable* nation-wide, while the diamond firetail is vulnerable in New South Wales (ENV). *Atlas of Living Australia* data records the brown treecreeper at the site, but this is the secure western subspecies (*Climacteris picumnus picumnus*), not the vulnerable eastern subspecies (*C. p. victoriae*). Both subspecies are known from the Wagga area. Additionally, the bluebonnet (*Northiella haematogaster*) can be regarded as significant, as it is near the eastern limit of its range. Owing to the scarcity of wetland habitats in the Wagga Wagga area, the platypus (*Ornithorhynchos anatinus*) and wetland bird

species (migratory and sedentary waders, ducks, reed-warblers and so on) may be considered significant.

By contrast, the revegetation area currently possesses relatively little habitat value. The understorey and mid-storey are sparse, and the canopy trees are too young to support nest hollows. It would be expected at this stage that very few bird, mammal or reptile species would be making use of the site. Bird and insect surveys were conducted at the site to investigate this. Incidental observations of other fauna species were also recorded.

1.4.1. Birds. Two thirty-minute bird surveys were conducted at the site. Birds were recorded if they could be detected (either visually or by call) from within the planting. Species were recorded as occurring *in* or *near* the planting and a rough count was taken. Where possible, location and behavioural details were noted. The first survey was conducted in the early morning (0700) and the second in the evening (2030). Results are given in Table 1.2.

Table 1.2. Results of bird surveys

Common name	Scientific name	In	Near	A.M.	P.M.	Notes
Australian wood duck	*Chenonetta jubata*	N	Y	20+	20+	Stormwater inlet.
Grey teal	*Anas gracilis*	N	Y	6	-	Stormwater inlet.
Pacific black duck	*Anas superciliosa*	N	Y	20+	20+	Stormwater inlet.
Crested pigeon	*Ocyphaps lophotes*	N	Y	2	-	Nearby grassland.
Eastern great egret	*Egretta modesta*	N	Y	1	-	Stormwater inlet.
Nankeen night-heron	*Nycticorax caledonicus*	N	Y	-	2	In trees opposite planting.
Yellow-billed spoonbill	*Platalea flavipes*	N	Y	2	-	Stormwater inlet.
Purple swamphen	*Porphyrio porphyria*	N	Y	4	Y	Stormwater inlet.
Dusky moorhen	*Gallinula tenebrosa*	N	Y	1	-	Stormwater inlet.
Eurasian coot	*Fulica atra*	N	Y	2	Y	Stormwater inlet.
Masked lapwing	*Vanellus miles*	N	Y	4	Y	Nearby grassland.
Red-rumped parrot	*Psephotus haematonotus*	Y	N	4	-	Feeding in exotic grasses.
Eastern barn owl	*Tyto javanica*	N	Y	-	1	Transient, flying overhead.
Superb fairy-wren	*Malurus cyaneus*	N	Y	6	-	Stormwater bank.
Yellow thornbill	*Acanthiza nana*	N	Y	4	-	Nearby grassland.
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Y	N	3	-	Transient, moving between shrubs.
Striated pardalote	*Pardalotus striatus*	N	Y	2?	2?	Calling from nearby red gums.
White-plumed honeyeater	*Lichenostomus penicillatus*	N	Y	3?	3?	Calling from nearby red gums.
Blue-faced honeyeater	*Entomyzon cyanotus*	N	Y	1	-	Transient.
Australian magpie	*Cracticus tibicen*	Y	Y	4	4	Foraging amongst grasses.
Willie wagtail	*Rhipidura leucophrys*	Y	N	1	1	Transient, moving between shrubs.

Australian raven	*Corvus coronoides*	N	Y	2	-	Nearby grassland.
Magpie-lark	*Grallina cyanoleuca*	N	Y	3	1	Nearby grassland.
White-winged chough	*Corcorax melanorhamphos*	N	Y	8	-	Nearby grassland.
Australian reed-warbler	*Acrocephalus australis*	N	Y	6?	6?	Nearby reeds.
Common blackbird	**Turdus merula*	N	Y	2	-	Nearby grassland.
Common starling	**Sturnus vulgaris*	N	Y	12	-	Transient, flying overhead.
European goldfinch	**Carduelis carduelis*	Y	Y	4?	-	Transient, flying overhead.
Native: 25. Introduced: 3.						

In all, 28 bird species were recorded, of which 25 were native. Most of these, however, were recorded outside of the revegetation area. Only five species were recorded in the replanting area and most did not remain there long.

1.4.2. Mammals. No mammal species were recorded during the surveys. The common brushtail possum (*Trichosurus vulpecula*) and water-rat (*Hydromys chrysogaster*) have been recorded previously around Flowerdale Lagoon (Pers. obs.), as has the platypus (*Ornithorhynchos anatinus*) (ALA), but these were not observed in or around the survey site.

1.4.3. Reptiles. Two reptile species were recorded during the survey period (Table 1.3). Additional species known from Flowerdale Lagoon are given in 1.6 below.

Table 1.3. Reptile species recorded from Flowerdale Lagoon site

Common name	Scientific name	Count	In	Near	Notes
Carnaby's wall skink	*Cryptoblepharus australis*	2	Y	N	On the trunk of a larger river red gum.
Copper-tailed skink	*Ctenotus taeniolatus*	1	N	Y	Leaf litter near parking area.

1.4.4. Insects. Two sticky traps were placed on-site to determine the size and composition of the insect population. Fewer than 10 insects of three species were recorded after 48 hours, suggesting that insect density within the site is very low.

1.5. Issues and Future Work

River red gums take many decades to reach maturity, and the Flowerdale Lagoon planting will not achieve its maximum value until this happens. Nevertheless, several activities could be undertaken to improve the condition of the planting in the shorter term and enhance the Flowerdale Lagoon site more generally.

1.5.1. Grassy weed removal. Sections of the site (see map, pg. 75) are dominated by introduced grass species, principally **Bromus* sp., **Phalaris* sp., and **Avena fatua*. While the weed problem within the site is less pronounced than in the surrounding area, the planting still serves as a reservoir of weed seeds that may exacerbate the weed problem elsewhere. This would need to be

carried out without disturbing surviving populations of native plants, eg. cumbungi (*Typha* sp.) and dock (*Rumex* sp.). Manual removal is impractical, and, owing to the proximity of the site to water, application of herbicide may not be appropriate. An alternative may be to plant appropriate local understorey species, chiefly grasses and forbs, in order to suppress weeds and improve habitat values.

1.5.2. St. John's wort removal. Three small patches of St. John's wort (**Hypericum perforatum*) occur within the planting. While the population size is currently very small, St. John's wort is a Class 4 noxious weed, and should be suppressed if at all possible. Manual removal may be achievable, but this will not prevent the population from re-establishing from seed. Once again, replanting with suitable understorey species may prevent re-emergence of **H. perforatum*.

1.5.3. Exotic tree removal. A small number of introduced trees (**Prunus* species and **Fraxinus angustifolia*) occur within the planting. These could be removed with ease while carrying out other works at the site.

1.5.4. Willow and narrow-leafed ash removal. The bank opposite the planting is densely infested with a population of an exotic street tree, the narrow-leafed ash (**Fraxinus angustifolia*). Additionally, a very large weeping willow (**Salix babylonica*) occurs in this area. While these plants may act to stabilise the bank and provide habitat for birds, they also displace native plant species. Removal of these plants would need to be carried out with care, to avoid encouraging stream-bank erosion and the addition of herbicides to the water. It may be possible to kill the trees while leaving their roots in place, so that they may continue to provide stability while suitable native species (e.g. *Eucalyptus camaldulensis* and *Casuarina cunninghamiana*) are planted, but expert advice would be needed. The situation is further complicated by poor access, as there is no path leading directly to the site.

1.5.5. Litter. A small but noticeable litter problem – chiefly paper and plastic – exists in and around the site. Additionally, the nearby stormwater inlet has been used as a dumping ground for larger waste. Larger household items have been dumped at several points along the southern edge of the lagoon.

1.5.6. Improving habitat for birds and small reptiles. The scarcity of wildlife recorded within the plantings suggests that it currently offers little valuable habitat. Nesting sites and food sources (e.g. insects, nectar, seeds) are both in short supply. While the site will increase in value as the trees mature, it may be possible to supplement this by planting understorey within the planting (as suggested above) or by planting suitable local shrubs on nearby grassy areas, which are of limited biodiversity value.

Addition of rocks and timber debris may improve the habitat value of the site for small reptiles, insects and fungi. This should be done in areas currently dominated by exotic species.

1.5.7. Removing tree-guards. Tree-guards remain on several of the plants within the planting. These could be removed to prevent future litter problems and to avoid constraining the growth of plants.

1.6. Fauna List for Flowerdale Lagoon

These records have been compiled from personal observation between 2010 and 2013 (Pers. obs.) and *Atlas of Living Australia* (ALA) records within 1 km of the target site.

1.6.1. Birds.

Common name	Scientific name	Record	NSW	Australia
Brown quail	*Coturnix ypsilophora*	Pers. obs.	Secure	Secure
Black swan	*Cygnus atratus*	Pers. obs. ALA	Secure	Secure
Australian wood duck	*Chenonetta jubata*	Pers. obs. ALA	Secure	Secure
Pink-eared duck	*Malacorhynchus membranaceus*	Pers. obs.	Secure	Secure
Chestnut teal	*Anas castanea*	ALA	Secure	Secure
Grey teal	*Anas gracilis*	Pers. obs. ALA	Secure	Secure
Pacific black duck	*Anas superciliosa*	Pers. obs. ALA	Secure	Secure
Australasian grebe	*Tachybaptus novaehollandiae*	Pers. obs. ALA	Secure	Secure
Rock dove	**Columba livia*	Pers. obs.	Introduced	
Crested pigeon	*Ocyphaps lophotes*	Pers. obs. ALA	Secure	Secure
Australasian darter	*Anhinga novaehollandiae*	Pers. obs. ALA	Secure	Secure
Little pied cormorant	*Microcarbo melanoleucos*	Pers. obs. ALA	Secure	Secure
Little black cormorant	*Phalacrocorax sulcirostris*	Pers. obs. ALA	Secure	Secure
Great cormorant	*Phalacrocorax carbo*	ALA	Secure	Secure
Australian pelican	*Pelecanus conspicillatus*	Pers. obs. ALA	Secure	Secure
White-necked heron	*Ardea pacifica*	Pers. obs.	Secure	Secure
Intermediate egret	*Ardea intermedia*	ALA	Secure	Secure
White-faced heron	*Egretta novaehollandiae*	Pers. obs. ALA	Secure	Secure
Eastern great egret	*Egretta modesta*	Pers. obs. ALA	Secure	Secure
Nankeen night-heron	*Nycticorax caledonicus*	Pers. obs.	Secure	Secure
Australian white ibis	*Threskiornis molucca*	Pers. obs.	Secure	Secure
Straw-necked ibis	*Threskiornis spinicollis*	Pers. obs.	Secure	Secure
Royal spoonbill	*Platalea regia*	Pers. obs.	Secure	Secure
Yellow-billed spoonbill	*Platalea flavipes*	Pers. obs. ALA	Secure	Secure
Australian hobby	*Falco longipennis*	Pers. obs.	Secure	Secure
Brown falcon	*Falco berigora*	Pers. obs.	Secure	Secure

Nankeen kestrel	*Falco cenchroides*	Pers. obs.	Secure	Secure
Whistling kite	*Haliastur sphenurus*	Pers. obs.	Secure	Secure
Black kite	*Milvus migrans*	Pers. obs.	Secure	Secure
Black-shouldered kite	*Elanus axillaris*	ALA	Secure	Secure
Collared sparrowhawk	*Accipiter cirrocephalus*	Pers. obs.	Secure	Secure
Purple swamphen	*Porphyrio porphyrio*	Pers. obs. ALA	Secure	Secure
Tasmanian native hen	*Tribonyx mortierii*	Pers. obs.	Secure	Secure
Dusky moorhen	*Gallinula tenebrosa*	Pers. obs. ALA	Secure	Secure
Eurasian coot	*Fulica atra*	Pers. obs. ALA	Secure	Secure
Masked lapwing	*Vanellus miles*	Pers. obs. ALA	Secure	Secure
Black-fronted dotterel	*Elseyornis melanops*	Pers. obs.	Secure	Secure
Red-kneed dotterel	*Erythrogonys cinctus*	Pers. obs.	Secure	Secure
Latham's snipe	*Gallinago hardwickii*	Pers. obs.	Secure	Secure
Sharp-tailed sandpiper	*Calidris acuminata*	Pers. obs.	Secure	Secure
Galah	*Eolophus roseicapillus*	Pers. obs. ALA	Secure	Secure
Long-billed corella	*Cacatua tenuirostris*	Pers. obs.	Secure	Secure
Sulphur-crested cockatoo	*Cacatua galerita*	Pers. obs. ALA	Secure	Secure
Cockatiel	*Nymphicus hollandicus*	ALA	Secure	Secure
Superb parrot	*Polytelis swainsonii*	Pers. obs. ALA	Vuln.	Vuln.
Yellow rosella	*Platycercus elegans flaveolus*	Pers. obs. ALA	Secure	Secure
Eastern rosella	*Platycercus eximius*	Pers. obs. ALA	Secure	Secure
Bluebonnet	*Northiella haematogaster*	Pers. obs.	Secure	Secure
Red-rumped parrot	*Psephotus haematonotus*	Pers. obs. ALA	Secure	Secure
Eastern barn owl	*Tyto javanica*	Pers. obs. ALA	Secure	Secure
Sacred kingfisher	*Todiramphus sanctus*	Pers. obs. ALA	Secure	Secure
Laughing kookaburra	*Dacelo novaeguineae*	Pers. obs. ALA	Secure	Secure
Brown treecreeper	*Climacteris picumnus picumnus*	ALA	Secure[1]	Secure
Superb fairy-wren	*Malurus cyaneus*	Pers. obs.	Secure	Secure
Yellow thornbill	*Acanthiza nana*	Pers. obs. ALA	Secure	Secure
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Pers. obs.	Secure	Secure
Striated pardalote	*Pardalotus striatus*	Pers. obs.	Secure	Secure
White-plumed honeyeater	*Lichenostomus penicillatus*	Pers. obs. ALA	Secure	Secure
Fuscous honeyeater	*Lichenostomus fuscus*	ALA	Secure	Secure
Blue-faced honeyeater	*Entomyzon cyanotus*	Pers. obs. ALA	Secure	Secure
Noisy miner	*Manorina melanocephala*	Pers. obs.	Secure	Secure

Red wattlebird	*Anthochaera carunculata*	Pers. obs. ALA	Secure	Secure
Noisy friarbird	*Philemon corniculatus*	Pers. obs. ALA	Secure	Secure
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	Pers. obs. ALA	Secure	Secure
Crested shrike-tit	*Falcunculus frontatus*	Pers. obs.	Secure	Secure[2]
Grey shrike-thrush	*Colluricincla harmonica*	Pers. obs. ALA	Secure	Secure
Black-faced woodswallow	*Artamus cinereus*	ALA	Secure	Secure
Dusky woodswallow	*Artamus cyanopterus*	ALA	Secure	Secure
Australian magpie	*Cracticus tibicen*	Pers. obs. ALA	Secure	Secure
Pied butcherbird	*Cracticus nigrogularis*	Pers. obs. ALA	Secure	Secure
Pied currawong	*Strepera graculina*	Pers. obs.	Secure	Secure
Willie wagtail	*Rhipidura leucophrys*	Pers. obs. ALA	Secure	Secure
Australian raven	*Corvus coronoides*	Pers. obs. ALA	Secure	Secure
Magpie-lark	*Grallina cyanoleuca*	Pers. obs.	Secure	Secure
White-winged chough	*Corcorax melanorhamphos*	Pers. obs.	Secure	Secure
Australian reed-warbler	*Acrocephalus australis*	Pers. obs.	Secure	Secure
Little grassbird	*Megalurus gramineus*	Pers. obs.	Secure	Secure
Rufous songlark	*Cincloramphus mathewsi*	Pers. obs. ALA	Secure	Secure
Welcome swallow	*Hirundo neoxena*	Pers. obs. ALA	Secure	Secure
Tree martin	*Petrochelidon nigricans*	Pers. obs.	Secure	Secure
Fairy martin	*Petrochelidon ariel*	Pers. obs.	Secure	Secure
Common blackbird	**Turdus merula*	Pers. obs. ALA	Introduced	
Common starling	**Sturnus vulgaris*	Pers. obs. ALA	Introduced	
Double-barred finch	*Taeniopygia bichenovii*	Pers. obs.	Secure	Secure
Red-browed finch	*Neochmia temporalis*	Pers. obs.	Secure	Secure
Diamond firetail	*Stagonopleura guttata*	Pers. obs.	Vuln.	Secure
House sparrow	**Passer domesticus*	Pers. obs.	Introduced	
European goldfinch	**Carduelis carduelis*	Pers. obs.	Introduced	

[1] *C. p. picumnus* is not threatened. *C. p. victoriae* is listed as vulnerable. Both occur in the Wagga area.

[2] Several subspecies of *F. frontatus* are threatened, but not the E. Australian form.

Native: 83. Introduced: 5.

1.6.2. Reptiles.

Common name	Scientific name	Record	NSW	Australia
Marbled gecko	*Christinus marmoratus*	Pers. obs.	Secure	Secure
Carnaby's wall skink	*Cryptoblepharus australis*	Pers. obs.	Secure	Secure
Robust ctenotus	*Ctenotus robustus*	Pers. obs.	Secure	Secure
Copper-tailed skink	*Ctenotus taeniolatus*	Pers. obs.	Secure	Secure
Southern rainbow-skink	*Carlia tetradactyla*	Pers. obs.	Secure	Secure
Pale-flecked garden sun-skink	*Lampropholis guichenoti*	Pers. obs.	Secure	Secure

Boulenger's snake-eyed skink	*Morethia boulengeri*	Pers. obs.	Secure	Secure
Eastern brown snake	*Pseudonaja textilis*	Pers. obs.	Secure	Secure

1.6.3. Mammals.

Common name	Scientific name	Record	NSW	Australia
Water rat	*Hydromys chrysogaster*	Pers. obs. ALA	Secure	Secure
Common brushtail possum	*Trichosurus vulpicula*	Pers. obs.	Secure	Secure
Platypus	*Ornithorhynchos anatinus*	ALA	Secure	Secure
Eastern grey kangaroo	*Macropus giganteus*	Pers. obs.	Secure	Secure

Pomingalarna Park

2014 Flora and Fauna Survey

2. Pomingalarna Park

2.1. Site Description

Pomingalarna Park is a 225-ha bushland reserve located west of the city of Wagga Wagga. The site is dominated by Wagga Wagga Hills Open Forest (DEC), an ecological community with a canopy of white box (*Eucalyptus albens*), Blakely's red gum (*Eucalyptus blakelyi*) and white cypress-pine (*Callitris glaucophylla*). Significant populations of drooping she-oak (*Allocasuarina verticillata*) are also present. Understorey on the upper slope is dominated by golden wattle (*Acacia pycnantha*), varnish wattle (*Acacia verniciflua*), showy parrot-pea (*Dillwynia sericea*), black-anther flax-lily (*Dianella revoluta*), hill raspwort (*Gonocarpus elatus*), sticky everlasting (*Xerochrysum viscosum*), common everlasting (*Chrysocephalum apiculatum*), rock fern (*Cheilanthes sieberi*) and native grasses. The lower slopes are dominated by sparse woodland and open grassland, consisting of a mixture of native and introduced grasses and forbs.

Access to Pomingalarna is limited. Gated entrances are located on Bagley Drive and the Sturt Highway. Some walking is required to access the bushland from either entrance.

2.2. Landcare Work

Pomingalarna Park has been the focus of several revegetation efforts beginning in 1998. Wagga Wagga Urban Landcare's involvement in these projects took the form of community tree-planting days. Two sites within the Park were selected for the purposes of this survey. These are designated **lower slope** and **upper slope** in this report. Work on the upper slope site was carried out by the Mountain Bike Club of Wagga Wagga. Site GPS coordinates are -35.115934, 147.297902 (lower slope, midpoint) and -35.113775, 147.301754 (upper slope, midpoint). For site details, including a map, see pg. 76.

2.2.1. Lower slope. Drooping she-oak (*Allocasuarina verticillata*) and wedge-leaf hop-bush (*Dodonaea viscosa* subsp. *cuneata*) were planted in an area of open grassland on the south-western side of Pomingalarna Park, parallel with the Sturt Hwy. The site is easily accessible from the main track. The primary purpose of this work was to encourage glossy black cockatoos (*Calyptorhynchus lathami*) to the area. She-oak cones are a primary food source for this species, which has been declared *vulnerable* in New South Wales.

This site was surveyed on March 20, 2014. Headcounts were taken and survivorship values calculated for each species (Table 2.1).

Table 2.1. Survivorship of plantings at Pomingalarna Park – Lower Slope

Common name	Scientific name	Height	Living	Dead	Survivorship
Drooping she-oak	*Allocasuarina verticillata*	1-4 m	44	3	91.5%
Wedge-leaf hop-bush	*Dodonaea viscosa* subsp. *cuneata*	1-2 m	4	-	100%

Survivorship values exceeded 90% for both species. This value is based on observation of living and dead material *in situ* and does not account for plants that have died but are no longer visible. Plants

were generally healthy. Most she-oaks were between 2 and 3 metres in height with diameters at breast height of less than 10 cm.

2.2.2. Upper slope. Extensive revegetation has been carried out on an exposed gravel patch at the summit of Pomingalarna Park. This consists of roughly 450 seedlings planted directly into poor soils around a series of contour banks and walking tracks. The site occurs alongside Scalds Track and is frequently trafficked by walkers, cyclists and horse riders. It also hosts a substantial population of eastern grey kangaroos (*Macropus giganteus*) and occasional swamp wallabies (*Wallabia bicolor*).

This site was surveyed on March 20, 2014. The site was divided into five subsections and headcounts taken for each. These were pooled to produce Table 2.2. Owing to the large number of unidentifiable dead seedlings, survivorship values have not been given for each species. An overall survivorship figure is given below. Several seedlings were too small to be correctly identified. These are given as UNKNOWN in the data.

Table 2.2. Headcount of plantings at Pomingalarna Park – Upper Slope

Common name	Scientific name	Height	Living	Dead
Deane's wattle	*Acacia deanei*	<0.5 m	39	2
Western silver wattle	*Acacia decora*	<0.5 m	48	1
Golden wattle	*Acacia pycnantha*	<0.5 m	12	1
Drooping she-oak	*Allocasuarina verticillata*	<0.5 m	3	1
Kurrajong	*Brachychiton populneus*	<0.5 m	6	1
Blackthorn	*Bursaria spinosa*	<0.2 m	22	12
White cypress-pine	*Callitris glaucophylla*	<0.5 m	5	1
Black-anther flax lily	*Dianella revoluta*	<0.5 m	47	15
Wedge-leaf hop-bush	*Dodonaea viscosa* subsp. *cuneata*	<0.5 m	6	0
Ruby saltbush	*?Enchylaena tomentosa*	0.5-1 m	12	4
Gum tree	*Eucalyptus* spp.	<0.5 m	18	0
Common eutaxia	*Eutaxia microphylla*	<0.2 m	4	0
Purple coral-pea	*Hardenbergia violacea*	<0.2 m	4	0
Silver cassia	*Senna artemisioides*	<0.2 m	7	0
UNKNOWN			14	184
TOTAL			247	222

Overall survivorship was 52.7%. Given that most of the included species occur naturally in the area around the planting, the high mortality rate is most likely due to poor soil quality and not to inappropriate selection of species. Significant deposits of topsoil were present in only a few areas; otherwise, plants were growing in coarse gravel. Few surviving plants exceeded 20 cm in height and many showed evidence of partial senescence.

Other factors implicated in the poor survival of these plants include trampling and grazing by horses and kangaroos. Horse and kangaroo tracks were very noticeable after rain.

2.3. Flora

The background flora varied significantly in both density and variety between the two sites. They are treated separately here. Noxious weeds are indicated in **bold**.

2.3.1. Lower slope. The lower slope planting is situated in the middle of open grassland dominated by **St. John's wort (**Hypericum perforatum*)**, wild oat (**Avena fatua*), brome grasses (**Bromus* spp.) and **Paterson's curse (**Echium plantagineum*)**. Many other common weeds were also represented, including flatweed (**Hypochaeris radicata*), skeleton weed (**Chondrilla juncea*) and narrow-leaf plantain (**Plantago lanceolata*). In summer, few native species were reported from this area: a small number of bluebells (*Wahlenbergia* spp.) occur in the densest grassland; fuzzweed (*Vittadinia cuneata*) and hill raspwort (*Gonocarpus elatus*) occur around the periphery of the site; and a small number of white cypress-pine plants (*Callitris glaucophylla*) extend into the planting. Above the planting, the grassland gives way to woodland, which is dominated by native species.

Re-surveying in April revealed large numbers of seasonal natives emerging in the grassland. These appeared to be bulbine lilies (*Bulbine bulbosa*) and chocolate lilies (*Dichopogon* sp.). It is possible that other seasonal species occur in this area.

2.2. Upper slope. Vegetation in this area was extremely sparse. A few small pockets of natural vegetation occurred within the planting. These consisted largely of *Eucalyptus* spp., *Callitris glaucophylla* and *Dianella revoluta*. Some natural regeneration of *Xerochrysum viscosum*, *Acacia pycnantha*, *Dillwynia sericea*, *Gonocarpus elatus*, *C. glaucophylla*, *Einadia nutans* and several native grasses was observed. These plants were generally small but healthy. Several wallaby grass (*Rytidosperma* sp.) and sticky everlasting plants were in flower at the time of the survey.

By and large, it appeared that weeds were unable to colonise the site. Only a small patch of stinkwort (**Dittrichia graveolens*) was reported in one corner of the planting. Stinkwort is known to colonise mine spoils and tolerate heavy metal contamination, and this may account for its survival in this site.

2.4. Fauna

Pomingalarna Park represents a significant remnant of woodland and open forest habitat within the boundaries of the City of Wagga Wagga. Roughly 100 native bird species, 17 reptiles, 8 mammals and six amphibians have been recorded within the park. This list, drawn from personal observation (2010-2013) and *Atlas of Living Australia* (ALA) data, is given in 2.6 below.

Significant species recorded from the site include the swift parrot (*Lathamus discolor*), which is nationally *endangered*, the superb parrot (*Polytelis swainsoni*), which is *vulnerable* nationwide, and the squirrel glider (*Petaurus norfolcensis*), which is *endangered* in the City of Wagga Wagga. Other species of note include the diamond firetail (*Stagonopleura guttata*), Gilbert's whistler (*Pachycephala inornata*), the varied sittella (*Daphoenositta chrysoptera*), and the black-chinned honeyeater (*Melithreptus gularis gularis*), all of which are *vulnerable* in New South Wales.

The habitat value of the Pomingalarna plantings is likely to be minimal as both plantings consist chiefly of immature plants. The current usage of these plantings by wildlife was assessed by means of bird surveys and incidental observations of other forms of animal life.

2.4.1. Birds. Two twenty-minute bird surveys were conducted at each of the two plantings. Birds were recorded if they could be detected (either visually or by call) from within the planting. Species were recorded as occurring *in* or *near* the planting and a rough count was taken. Where possible, location and behavioural details were noted. The first survey was conducted in the early morning (0700) and the second in the evening (1900). Results are given in Table 2.3 (lower slope) and Table 2.4 (upper slope).

Table 2.3. Results of bird surveys for Pomingalarna Park – lower slope

Common name	Scientific name	In	Near	A.M.	P.M.	Notes
Stubble quail	*Coturnix pectoralis*	Y	Y	4?	-	In grassy under-storey.
Brown falcon	*Falco berigora*	N	Y	1	-	Flying nearby.
Black-shouldered kite	*Elanus axillaris*	Y	Y	1	-	Hovering over grassland.
Eastern rosella	*Platycercus eximius*	Y	Y	2	2	In grassy under-storey.
Eastern barn owl	*Tyto javanica*	N	Y	-	1	Near roadside.
Laughing kookaburra	*Dacelo novaeguineae*	N	Y	1?	-	By call. Location not recorded.
Superb fairy-wren	*Malurus cyaneus*	Y	Y	6	6?	In grasses and *Callitris*.
Speckled warbler	*Cthonicola sagittata*	Y	Y	2	-	In *Callitris*.
Weebill	*Smicrornis brevirostris*	Y	Y	8	-	In *Callitris*.
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Y	Y	2	-	In grasses and *Callitris*.
Yellow thornbill	*Acanthiza nana*	Y	Y	6	-	In *Allocasuarina* and *Callitris*.
White-plumed honeyeater	*Lichenostomus penicillatus*	N	Y	3?	-	In nearby *Callitris*.
White-browed babbler	*Pomatostomus superciliosus*	N	Y	3?	-	In nearby *Callitris*.
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	N	Y	2	-	Flying nearby.
Australian magpie	*Cracticus tibicen*	Y	Y	3	-	In grasses.
Pied butcherbird	*Cracticus nigrogularis*	N	Y	1?	1?	By call. Location not recorded.
Pied currawong	*Strepera graculina*	N	Y	7	-	Flying nearby.
Grey fantail	*Rhipidura albiscapa*	Y	Y	2	2	In *Allocasuarina* and *Callitris*.
Australian raven	*Corvus coronoides*	N	Y	3	-	Flying nearby.
White-winged chough	*Corcorax melanorhamphos*	N	Y	6	-	In nearby *Callitris*.
Red-capped robin	*Petroica goodenovii*	N	Y	1	-	In nearby *Callitris*.
Rufous songlark	*Cincloramphus mathewsi*	Y	Y	2?	2?	In grasses.
Welcome swallow	*Hirundo neoxena*	Y	Y	10+	-	Flying nearby.
Common starling	**Sturnus vulgaris*	Y	Y	30+	30+	In grasses.
Double-barred finch	*Taeniopygia bichenovii*	Y	Y	8?	-	In *Callitris*

Native: 24. Introduced: 1.

Table 2.4. Results of bird surveys for Pomingalarna Park – upper slope

Common name	Scientific name	In	Near	A.M.	P.M.	Notes
Peaceful dove	*Geopelia striata*	N	Y	2	-	In nearby woodland.
Common bronzewing	*Phaps chalcoptera*	Y	Y	2	-	On ground and in *Callitris*.
Peregrine falcon	*Falco peregrinus*	N	Y	1	-	Flying nearby.
Collared sparrowhawk	*Accipiter cirrocephalus*	N	Y	1	1	In nearby *Eucalyptus*.
Wedge-tailed eagle	*Aquila audax*	N	Y	1	-	Flying nearby.
Sulphur-crested cockatoo	*Cacatua galerita*	N	Y	10+	-	Flying nearby.
Southern boobook	*Ninox novaeseelandiae*	N	Y	-	1	In nearby *Eucalyptus*.
Brown treecreeper	*Climacteris picumnus picumnus*	N	Y	2?	-	In nearby woodland.
White-throated treecreeper	*Cormobates leucophaea*	N	Y	1?	-	In nearby woodland.
Superb fairy-wren	*Malurus cyaneus*	Y	Y	6	-	On ground and in *Callitris*.
Speckled warbler	*Cthonicola sagittata*	N	Y	1	-	In nearby *Callitris*.
Weebill	*Smicrornis brevirostris*	Y	Y	8?	-	On ground and in *Eucalyptus*.
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	N	Y	2	-	In nearby *Callitris*.
Yellow thornbill	*Acanthiza nana*	N	Y	4?	-	In nearby *Callitris*.
Striated pardalote	*Pardalotus striatus*	N	Y	2	-	By call, from *Eucalyptus*.
Western gerygone	*Gerygone fusca*	N	Y	2	-	In nearby *Callitris*.
Fuscous honeyeater	*Lichenostomus fuscus*	N	Y	2	-	In nearby *Eucalyptus*.
White-plumed honeyeater	*Lichenostomus penicillatus*	N	Y	2	-	In nearby *Eucalyptus*.
Brown-headed honeyeater	*Melithreptus brevirostris*	Y	Y	10+	-	Flying between trees.
Varied sittella	*Daphoenositta chrysoptera*	N	Y	3	-	In nearby *Eucalyptus*.
Rufous whistler	*Pachycephala rufiventris*	N	Y	2?	-	By call. Location not recorded.
Grey shrike-thrush	*Colluricincla harmonica*	N	Y	1?	-	By call. Location not recorded.
Grey fantail	*Rhipidura albiscapa*	Y	Y	2	2	Flying between *Callitris* trees.
Willie wagtail	*Rhipidura leucophrys*	Y	Y	2	-	In *Eucalyptus* and on ground.
Red-capped robin	*Petroica goodenovii*	N	Y	1	-	In nearby *Callitris*.

Welcome swallow	*Hirundo neoxena*	N	Y	10+	-	Flying nearby.
Double-barred finch	*Taeniopygia bichenovii*	N	Y	6?	-	By call, location not recorded.
Native: 27. Introduced: 0.						

At both sites, diversity of small woodland birds was high. This is most notable in the densely wooded upper slope, whereas the grassy lower slope exhibited more variation in habitat use. Few birds made use of the plantings, however, preferring woodland or scattered remnant trees. In all, 43 bird species were recorded, of which 42 were native.

2.4.2. Mammals. Six mammal species were recorded during the surveys, four of them native.

Table 2.5. Mammal species recorded from Pomingalarna Park sites

Common name	Scientific name	Count	Notes
Common brushtail possum	*Trichosurus vulpecula*	2	In *Eucalyptus* – upper slope.
Common ringtail possum	*Pseudocheirus peregrinus*	2?	In *Eucalyptus* – mid slope.
Eastern grey kangaroo	*Macropus giganteus*	4	In gully – mid slope.
Swamp wallaby	*Wallabia bicolor*	1	In gully – mid slope.
Rabbit	**Oryctolagus cuniculus*	3	In grasses – lower slope.
Brown hare	**Lepus capensis*	1	In *Callitris* – lower slope.

2.4.3. Reptiles. Only two species of reptile were recorded from the sites, and both occurred in very low numbers. However, given the diversity of reptile species reported from Pomingalarna Park (see 2.6), this may be a reflection of the cooler conditions during the survey period and not evidence of a genuine scarcity.

Table 2.6. Reptile species recorded from Pomingalarna Park sites

Common name	Scientific name	Count	In	Near	Notes
Carnaby's wall skink	*Cryptoblepharus australis*	2	Y	N	Among stones – upper.
Boulenger's snake-eyed skink	*Morethia boulengeri*	1	Y	N	In grasses – lower.

2.4.4. Insects. No formal surveys were conducted at the site. Insects were generally scarce during the sample period, possibly owing to cooler conditions. The dense grasses of the lower slope support populations of locusts and crickets, and four species of butterfly (*Junonia villida*, *Heteronympha merope*, *Zizina labradus*, and *Vanessa kershawi*) were recorded.

2.5. Issues and Future Work

Plantings on the lower slope will take several years to reach maturity and to achieve their maximum value, while plantings on the upper slope may or may not survive to maturity, given the high mortality rate. Several issues and avenues for further work presented themselves during the survey, and these are discussed here.

2.5.1. Weed control: lower slope. The lower slope consists largely of open grassland. While this grassland is likely to have considerable biodiversity value during certain times of the year (i.e.

when *Bulbine bulbosa* and *Dichopogon* sp. are present), it retains a dense cover of weedy species at other times. The most conspicuous of these weeds is St. John's wort, which is declared noxious in Wagga Wagga. Controlling these weeds without damaging the native population may impractical or even impossible, but if achieved would greatly enhance the site. Late summer may be a possible window for control, as St. John's wort is still present while the native annuals are not. A wick applicator may allow for herbicide to be applied to the aerial shoots of St. John's wort while avoiding contact with native species, but this option would require expert consultation. Note that small populations of native perennials (e.g. *Wahlenbergia*) also occur in this grassland and may be at risk if herbicide were to be applied.

2.5.2. Weed control: upper slope. Weed cover is sparse on the upper slope. The few plants of *Dittrichia graveolens* present in the site could potentially be removed by hand, though care should be taken to avoid excessive contact, as *D. graveolens* is implicated in cases of dermatitis. The site should thereafter be monitored and any future infestations controlled.

2.5.3. Replanting: upper slope. It may be possible to replant the upper slope site with suitable local species in order to make up for the many losses from the last planting. Given the high mortality rate of the first planting, however, this may not be feasible. Any plants added to the site would require considerable aftercare – i.e. watering, addition of nutrients – and this may not be practical. It may be wise to instead encourage natural regeneration. If this approach were to be adopted, current plantings would be retained but no future plantings would be carried out (see 2.5.4).

2.5.4. Fencing: upper slope. If the decision is made to suspend future plantings at the site and instead focus on encouraging natural regeneration, it would be wise to fence the site off. The site is currently trafficked by walkers, cyclists, horse riders and kangaroos, and each represents a potential source of damage to emerging and immature vegetation. Evidence of trampling damage to sticky everlasting (*Xerochrysum viscosum*) plants by horses was observed during the survey. Fencing would ideally prevent access by kangaroos and horse riders while providing access for future surveyors. As the site is bisected by a cycle track (Scalds Track), it may be necessary to consult with mountain bikers before fencing is carried out.

2.5.5. Removal of tree guards: lower slope. Some plants of *Allocasuarina verticillata* still retain their tree guards and these could be removed. Additionally, many tree guards have dispersed into the surrounding grassland and present a litter problem. These could be collected in order to maintain the aesthetic qualities of the site.

2.6. Fauna List for Pomingalarna Reserve

These records have been compiled from personal observation between 2010 and 2013 (Pers. obs.) and *Atlas of Living Australia* (ALA) records within 1 km of the target site.

2.6.1. Birds.

Common name	Scientific name	Record	NSW	Australia
Brown quail	*Coturnix ypsilophora*	ALA	Secure	Secure
Stubble quail	*Coturnix pectoralis*	Pers. obs.	Secure	Secure

Australian wood duck	*Chenonetta jubata*	ALA Pers. obs.	Secure	Secure
Peaceful dove	*Geopelia striata*	ALA Pers. obs.	Secure	Secure
Common bronzewing	*Phaps chalcoptera*	ALA Pers. obs.	Secure	Secure
Crested pigeon	*Ocyphaps lophotes*	ALA Pers. obs.	Secure	Secure
Tawny frogmouth	*Podargus strigoides*	ALA	Secure	Secure
Little pied cormorant	*Microcarbo melanoleucos*	ALA	Secure	Secure
Australian pelican	*Pelecanus conspicillatus*	ALA	Secure	Secure
White-necked heron	*Ardea pacifica*	ALA	Secure	Secure
White-faced heron	*Egretta novaehollandiae*	ALA	Secure	Secure
Australian white ibis	*Threskiornis molucca*	ALA	Secure	Secure
Brown falcon	*Falco berigora*	ALA Pers. obs.	Secure	Secure
Nankeen kestrel	*Falco cenchroides*	ALA	Secure	Secure
Peregrine falcon	*Falco peregrinus*	Pers. obs.	Secure	Secure
Whistling kite	*Haliastur sphenurus*	ALA	Secure	Secure
Black-shouldered kite	*Elanus axillaris*	Pers. obs. ALA	Secure	Secure
Collared sparrowhawk	*Accipiter cirrocephalus*	Pers. obs. ALA	Secure	Secure
Wedge-tailed eagle	*Aquila audax*	Pers. obs. ALA	Secure	Secure
Little eagle	*Hieraaetus morphnoides*	ALA	Secure	Secure
Painted button-quail	*Turnix varius*	ALA	Secure	Secure
Galah	*Eolophus roseicapillus*	Pers. obs. ALA	Secure	Secure
Long-billed corella	*Cacatua tenuirostris*	ALA	Secure	Secure
Sulphur-crested cockatoo	*Cacatua galerita*	Pers. obs. ALA	Secure	Secure
Little lorikeet	*Glosopsitta pusilla*	ALA	Secure	Secure
Swift parrot	*Lathamus discolour*	ALA	E	E
Superb parrot	*Polytelis swainsonii*	Pers. obs. ALA	V	V
Crimson (yellow) rosella	*Platycercus elegans flaveolus*	Pers. obs. ALA	Secure	Secure
Eastern rosella	*Platycercus eximius*	Pers. obs. ALA	Secure	Secure
Red-rumped parrot	*Psephotus haematonotus*	Pers. obs. ALA	Secure	Secure
Fan-tailed cuckoo	*Cacomantis flabelliformis*	ALA	Secure	Secure
Horsfield's bronze-cuckoo	*Chryococcyx basalis*	ALA	Secure	Secure
Southern boobook	*Ninox novaeseelandiae*	Pers. obs.	Secure	Secure
Eastern barn owl	*Tyto javanica*	Pers. obs. ALA	Secure	Secure
Sacred kingfisher	*Todiramphus sanctus*	ALA	Secure	Secure
Laughing kookaburra	*Dacelo novaeguineae*	Pers. obs. ALA	Secure	Secure

Rainbow bee-eater	*Merops ornatus*	ALA	Secure	Secure
Brown treecreeper	*Climacteris picumnus picumnus*	Pers. obs. ALA	Secure[1]	Secure
White-throated treecreeper	*Cormobates leucophaea*	Pers. obs. ALA	Secure	Secure
Superb fairy-wren	*Malurus cyaneus*	Pers. obs. ALA	Secure	Secure
Speckled warbler	*Cthonicola sagittata*	Pers. obs. ALA	Secure	Secure
Weebill	*Smicrornis brevirostris*	Pers. obs. ALA	Secure	Secure
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Pers. obs. ALA	Secure	Secure
Yellow thornbill	*Acanthiza nana*	Pers. obs. ALA	Secure	Secure
Brown thornbill	*Acanthiza pusilla*	ALA	Secure	Secure
Buff-rumped thornbill	*Acanthiza reguloides*	Pers. obs. ALA	Secure	Secure
Chestnut-rumped thornbill	*Acanthiza uropygialis*	ALA	Secure	Secure
Spotted pardalote	*Pardalotus punctatus*	Pers. obs. ALA	Secure	Secure
Striated pardalote	*Pardalotus striatus*	Pers. obs. ALA	Secure	Secure
Western gerygone	*Gerygone fusca*	Pers. obs. ALA	Secure	Secure
Spiny-cheeked honeyeater	*Acanthagenys rufogularis*	ALA	Secure	Secure
Fuscous honeyeater	*Lichenostomus fuscus*	Pers. obs.	Secure	Secure
White-plumed honeyeater	*Lichenostomus penicillatus*	Pers. obs. ALA	Secure	Secure
Brown-headed honeyeater	*Melithreptus brevirostris*	Pers. obs.	Secure	Secure
Black-chinned honeyeater	*Melithreptus gularis gularis*	ALA	V	Secure
Noisy miner	*Manorina melanocephala*	Pers. obs. ALA	Secure	Secure
Red wattlebird	*Anthochaera carunculata*	Pers. obs. ALA	Secure	Secure
Little friarbird	*Philemon citreogularis*	ALA	Secure	Secure
Noisy friarbird	*Philemon corniculatus*	Pers. obs.	Secure	Secure
White-browed babbler	*Pomatostomus superciliosus*	Pers. obs. ALA	Secure	Secure
Varied sittella	*Daphoenositta chrysoptera*	Pers. obs. ALA	V	Secure
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	Pers. obs. ALA	Secure	Secure
White-bellied cuckoo-shrike	*Coracina papuensis*	ALA	Secure	Secure
White-winged triller	*Lalage sueurii*	Pers. obs. ALA	Secure	Secure
Crested shrike-tit	*Falcunculus frontatus*	Pers. obs. ALA	Secure	Secure[2]
Gilbert's whistler	*Pachycephala inornata*	ALA	V	Secure
Golden whistler	*Pachycephala pectoralis*	ALA	Secure	Secure
Rufous whistler	*Pachycephala rufiventris*	Pers. obs.	Secure	Secure

Grey shrike-thrush	*Colluricincla harmonica*	ALA Pers. obs. ALA	Secure	Secure
Olive-backed oriole	*Oriolus sagittatus*	ALA	Secure	Secure
Dusky woodswallow	*Artamus cyanopterus*	Pers. obs. ALA	Secure	Secure
Masked woodswallow	*Artamus personatus*	ALA	Secure	Secure
Australian magpie	*Cracticus tibicen*	Pers. obs. ALA	Secure	Secure
Pied butcherbird	*Cracticus nigrogularis*	Pers. obs. ALA	Secure	Secure
Grey butcherbird	*Cracticus torquatus*	ALA	Secure	Secure
Pied currawong	*Strepera graculina*	Pers. obs.	Secure	Secure
Grey fantail	*Rhipidura albiscapa*	Pers. obs. ALA	Secure	Secure
Willie wagtail	*Rhipidura leucophrys*	Pers. obs. ALA	Secure	Secure
Australian raven	*Corvus coronoides*	Pers. obs. ALA	Secure	Secure
Restless flycatcher	*Myiagra inquieta*	ALA	Secure	Secure
Magpie-lark	*Grallina cyanoleuca*	Pers. obs. ALA	Secure	Secure
White-winged chough	*Corcorax melanorhamphos*	Pers. obs. ALA	Secure	Secure
Jacky winter	*Microeca fascinans*	ALA	Secure	Secure
Eastern yellow robin	*Eopsaltria australis*	ALA	Secure	Secure
Scarlet robin	*Petroica boodang*	ALA	Secure	Secure
Red-capped robin	*Petroica goodenovii*	Pers. obs. ALA	Secure	Secure
Flame robin	*Petroica phoenicea*	ALA	Secure	Secure
Australasian pipit	*Anthus novaeseelandiae*	ALA	Secure	Secure
Brown songlark	*Cincloramphus cruralis*	Pers. obs. ALA	Secure	Secure
Rufous songlark	*Cincloramphus mathewsi*	Pers. obs. ALA	Secure	Secure
White-backed swallow	*Cheramoeca leucosterna*	ALA	Secure	Secure
Welcome swallow	*Hirundo neoxena*	Pers. obs. ALA	Secure	Secure
Fairy martin	*Petrochelidon ariel*	ALA	Secure	Secure
Tree martin	*Petrochelidon nigricans*	ALA	Secure	Secure
Common blackbird	**Turdus merula*	ALA	Introduced	
Common starling	**Sturnus vulgaris*	Pers. obs. ALA	Introduced	
Mistletoebird	*Dicaeum hirundinaceum*	ALA	Secure	Secure
Diamond firetail	*Stagonopleura guttata*	ALA	V	Secure
Double-barred finch	*Taeniopygia bichenovii*	Pers. obs. ALA	Secure	Secure
Zebra finch	*Taeniopygia guttata*	ALA	Secure	Secure
House sparrow	**Passer domesticus*	ALA	Introduced	
European goldfinch	**Carduelis carduelis*	Pers. obs. ALA	Introduced	

[1] *C. p. picumnus* is not threatened. *C. p. victoriae* is listed as vulnerable. Both occur in the Wagga area.

[2]Several subspecies of *F. frontatus* are threatened, but not the E. Australian form.

Native: 98. Introduced: 4.

2.6.2. Amphibians.

Common name	Scientific name	Record	NSW	Australia
Eastern sign-bearing froglet	*Crinia parinsignifera*	ALA	Secure	Secure
Eastern banjo frog	*Limnodynastes dumerilii*	ALA	Secure	Secure
Giant banjo frog	*Limnodynastes interioris*	ALA	Secure	Secure
Spotted grass frog	*Limnodynastes tasmaniensis*	ALA	Secure	Secure
Peron's tree frog	*Litoria peronii*	ALA	Secure	Secure
Sudell's frog	*Neobatrachus sudellae*	ALA	Secure	Secure

2.6.3. Reptiles.

Common name	Scientific name	Record	NSW	Australia
Marbled gecko	*Christinus marmoratus*	ALA	Secure	Secure
Patternless delma	*Delma inornata*	ALA	Secure	Secure
Southern rainbow-skink	*Carlia tetradactyla*	ALA	Secure	Secure
Carnaby's wall skink	*Cryptoblepharus australis*	ALA	Secure	Secure
Robust ctenotus	*Ctenotus robustus*	ALA	Secure	Secure
Copper-tailed skink	*Ctenotus taeniolatus*	ALA	Secure	Secure
Pale-flecked garden sun-skink	*Lampropholis guichenoti*	ALA	Secure	Secure
South-eastern slider	*Lerista bouganvillii*	ALA	Secure	Secure
Common dwarf skink	*Menetia greyii*	ALA	Secure	Secure
Boulenger's snake-eyed skink	*Morethia boulengeri*	ALA	Secure	Secure
Prong-snouted blind snake	*Ramphotyphlops bituberculatus*	ALA	Secure	Secure
Proximus blind snake	*Ramphotyphlops proximus*	ALA	Secure	Secure
Eastern blue-tongue	*Tiliqua scincoides*	ALA	Secure	Secure
Eastern bearded dragon	*Pogona barbata*	ALA	Secure	Secure
Lace monitor	*Varanus varius*	ALA	Secure	Secure
Diamond python	*Morelia spilota*	ALA	Secure	Secure
Eastern brown snake	*Pseudonaja textilis*	ALA	Secure	Secure
Curl snake	*Suta suta*	ALA	Secure	Secure

2.6.4. Mammals.

Common name	Scientific name	Record	NSW	Australia
Short-beaked echidna	*Tachyglossus aculeatus*	ALA	Secure	Secure
Little forest bat	*Vespadelus vulturnus*	ALA	Secure	Secure
Chocolate wattled bat	*Chalinolobus morio*	ALA	Secure	Secure
Squirrel glider[1]	*Petaurus norfolcensis*	ALA	V	Secure
Common ringtail possum	*Pseudocheirus peregrinus*	Pers. obs.	Secure	Secure
Common brushtail possum	*Trichosurus vulpicula*	Pers. obs. ALA	Secure	Secure
Eastern grey kangaroo	*Macropus giganteus*	Pers. obs. ALA	Secure	Secure
Swamp wallaby	*Wallabia bicolor*	Pers. obs. ALA	Secure	Secure
Cat	**Felis catus*	ALA	Introduced	
Fox	**Vulpes vulpes*	Pers. obs. ALA	Introduced	

Brown hare	**Lepus capensis*	Pers. obs. ALA	Introduced
Rabbit	**Oryctolagus cuniculus*	Pers. obs. ALA	Introduced

[1]Populations in the City of Wagga Wagga are listed as *endangered*.

Railway Viaduct

2014 Flora and Fauna Survey

3. Railway Viaduct

3.1. Site Description

The site designated "Railway Viaduct" consists of a section of riverfront in the north-east of Wagga Wagga, where the railway viaduct crosses the Murrumbidgee River. The natural vegetation is typical of watercourses in the area, consisting chiefly of river red gum (*Eucalyptus camaldulensis*) with an understorey of variable quality and density.

The site is bisected by the Wiradjuri Walking Track. It can be accessed by traversing the levee bank at Reddoch Dr. The replanting area is fenced but this does not impede access.

3.2. Landcare Work

Between 1999 and 2008, Wagga Wagga Urban Landcare members cleared sections of the riverfront of woody weeds and replanted native species at the railway viaduct.

The planting consists chiefly of river red gum (*Eucalyptus camaldulensis*) and river she-oak (*Casuarina cunninghamiana*), with a small number of additional native species. Notable populations of flax lily (*Dianella* sp.) and spiny mat-rush *(Lomandra longifolia*) were recorded within the site, but it was not clear whether these had been planted or had established from seed washed in from a second nearby planting, which also contained purple coral-pea (*Hardenbergia violacea*). This latter planting was not surveyed, but was considered to be in good condition. Site GPS coordinates are -35.116047, 147.381678 (site midpoint). For site details, including a map, see pg. 77.

Several plants of silver wattle (*Acacia dealbata*) and river bottlebrush (*Callistemon sieberi*) were reported nearby and were thought to be planted. The boundaries of this planting could not be established, however, and it was not surveyed.

The planting was surveyed on February 6, 2014, and a headcount taken (Table 3.1). From this headcount, survivorship values were calculated.

Table 3.1. Survivorship of plantings at Railway Viaduct

Common name	Scientific name	Height	DBH[1]	Living	Dead	Survivorship
River red gum	*Eucalyptus camaldulensis*	6 m	<40 cm	27	0	100%
River she-oak	*Casuarina cunninghamiana*	6 m	<10 cm	7	0	100%
She oak	*Allocasuarina* species	3 m	-	2	0	100%
Paperbark	*Melaleuca styphelioides*	3 m	-	1	0	100%
Flax lily	*Dianella* species	1 m	-	8	0	100%
Spiny mat-rush	*Lomandra longifolia*	1 m	-	7	0	100%

[1]Only species with a single central trunk were assessed for diameter at breast height (DBH).

Survivorship values of 100% were reported for all species. It should be noted that these values were calculated based on observations made during the survey and not on records of numbers planted. A significant caveat to this approach is that dead plants that are no longer standing or no longer visible will not be included in the headcount, and therefore survivorship figures may be misleading. This is

particular true in the case of sites in flood-prone areas such as this one, as floodwaters may have carried away dead material.

Significant regeneration of river red gums from seed has occurred within the site, most likely spurred by recent flooding. These seedlings ranged in height from <10 cm to approximately 1 m.

3.3. Flora

Understorey within the site consists chiefly of exotic grasses and herbaceous weeds. Dominant species include narrow-leaf plantain (**Plantago lanceolata*), soft brome (**Bromus molliformis*), prickly lettuce (**Lactuca serriola*) and purpletop vervain (**Verbena bonariensis*). Seedlings of river red gum provide the most significant native component of the understorey.

Minor weedy components of the understorey include canary grass (**Phalaris* sp.), wild oat (**Avena fatua*), wild mustard (**Sisymbrium* sp.), Scotch thistle (**Onopordum acanthicum*), St. Barnaby's thistle (**Centaurea solstitialis*), redflower mallow (**Modiola caroliniana*), umbrella sedge (**Cyperus eragrostis*), dock (**Rumex* sp.), spotted spurge (**Chamaesyce maculata*), flatweed (**Hypochaeris radicata*), clovers *(*Trifolium* spp.), fleabane (**Conyza bonariensis*), wireweed (**Polygonum aviculare*), and African peppercress (**Lepidium africanum*). Minor native components include windmill grass (*Chloris truncata*), spurge (*Chamaesyce drummondii*), Jersey cudweed (*Helichrysum luteoalbum*), tall bluebell (*Wahlenbergia stricta*) and fuzzweed (*Vittadinia cuneata*). Some areas of couch grass (*Cynodon dactylon*) were also noted.

Scotch thistle and St. Barnaby's thistle are both Class 4 noxious weeds in the Wagga Wagga area. A small population of lippia (**Phyla canescens*), also a Class 4 noxious weed, was recorded a short distance from the edge of the site. (DPI).

The condition of the site is relatively uniform. It is free of the dense grassy infestations (chiefly **Phalaris* sp.) of surrounding areas and no woody weeds were reported in the revegetation area. Three plants of small-leafed privet (**Ligustrum sinense*) were recorded within 100 m downstream of the viaduct. A small stand of black locust (**Robinia pseudoacacia*) occurs at the base of the viaduct.

3.4. Fauna

The Murrumbidgee River corridor provides significant habitat for birds, mammals, reptiles, amphibians, insects and molluscs. Lists of bird, mammal, reptile and mollusc species recorded from the site and its surrounds (either from personal observation or from *Atlas of Living Australia* data) are given in 3.6 below.

Significant species recorded for the site include the superb parrot (*Polytelis swainsonii*) and the squirrel glider (*Petaurus norfolcensis*). The superb parrot has been declared *vulnerable* nation-wide, while the squirrel glider is *vulnerable* in New South Wales (ENV). The squirrel glider population within the Wagga Wagga Local Government Area is listed as *endangered*. The site is also significant as the location of the last recorded sighting of the bilby (*Macrotis lagotis*) in the Wagga Wagga area (1914). The bilby is now extinct in New South Wales.

The revegetation area currently possesses relatively little habitat value. The canopy trees are too young to support nest-hollows and the shrub layer is sparse. Fauna surveys were conducted at the site to assess current usage of the site by native animals, which is expected to be minimal.

3.4.1. Birds. Two thirty-minute bird surveys were conducted at the site. Birds were recorded if they could be detected (either visually or by call) from within the planting. Species were recorded as occurring *in* or *near* the planting and a rough count was taken. Where possible, location and behavioural details were noted. The first survey was conducted in the early morning (0700) and the second in the evening (2000). Results are given in Table 3.2.

Table 3.2. Results of bird surveys for Railway Viaduct

Common name	Scientific name	In	Near	A.M.	P.M.	Notes
Australian wood duck	*Chenonetta jubata*	N	Y	1	1	Nearby reed-bed.
Crested pigeon	*Ocyphaps lophotes*	Y	Y	2	-	Feeding in understorey.
Galah	*Eolophus roseicapillus*	N	Y	6	6	Nearby river red gums.
Southern boobook	*Ninox novaeseelandiae*	N	Y	-	1	Nearby river red gums.
Laughing kookaburra	*Dacelo novaeguineae*	N	Y	2	1	Nearby river red gums.
Superb fairy-wren	*Malurus cyaneus*	N	Y	8	-	Nearby grasses.
Weebill	*Smicrornis brevirostris*	N	Y	12+	12+	Nearby river red gums.
Striated pardalote	*Pardalotus striatus*	N	Y	2	2	Nearby river red gums.
Noisy miner	*Manorina melanocephala*	N	Y	2	-	Nearby river red gums.
White-plumed honeyeater	*Lichenostomus penicillatus*	N	Y	12+	-	Nearby river red gums.
Australian magpie	*Cracticus tibicen*	Y	Y	4	4	Feeding in understorey.
Willie wagtail	*Rhipidura leucophrys*	Y	Y	2	-	Foraying for insects from shrubs/trees.
White-winged chough	*Corcorax melanorhamphos*	N	Y	8	-	On ground and among red gums.
Red-browed finch	*Neochmia temporalis*	N	Y	6	-	Nearby grasses.
Native: 14. Introduced: 0.						

In all, 14 bird species were recorded, all of which were native. Only three were recorded within the replanting area and none were recorded exclusively within the planting. Significantly, the bird fauna of the site and its surrounds was dominated by canopy- and ground-feeding species. Midstorey-feeding species were largely absent, though willie wagtails (*Rhipidura leucophrys*) were seen launching insect forays from planted shrubs.

3.4.2. Mammals. A single mammal species, the common brushtail possum (*Trichosurus vulpecula*), was reported during the survey period. Two individuals were observed moving between river red gums adjacent to the replanting site.

3.4.3. Reptiles. Two reptiles were recorded during the survey period (Table 3.3). No additional records of reptile species, either from personal observation or from *Atlas of Living Australia* data, are available.

Table 3.3. Reptile species recorded from Railway Viaduct site

Common name	Scientific name	Count	In	Near	Notes
Carnaby's wall skink	*Cryptoblepharus australis*	1	N	Y	On the trunk of a river red gum.
Copper-tailed skink	*Ctenotus taeniolatus*	1	Y	N	Leaf litter near river.

3.4.4. Insects. No formal insect surveys were undertaken at the site and few incidental observations were made. However, significant populations of the dainty swallowtail (*Papilio anactus*) were noted. These were feeding chiefly on purpletop vervain (**Verbena bonariensis*).

3.5. Issues and Future Work

River red gums take many decades to reach maturity, and the Railway Viaduct planting will not achieve its maximum value until this happens. Nevertheless, several activities could be undertaken to improve the condition of the planting in the shorter term and enhance the site more generally.

3.5.1. Woody weed removal. Though not by any means a significant infestation, some woody weeds have returned to the site. Three plants of small-leafed privet (**Ligustrum sinense*) and a single stand of black locust (**Robinia pseudoacacia*) were both reported near the planting site. These could be removed to prevent their spreading.

3.5.2. Understorey enhancement and weed removal. A small number of native species occur already in the understorey of the planting area, but the site is largely dominated by exotics. Controlling these weeds with herbicide may be impractical given the proximity of the site to the Murrumbidgee River. Planting of native herbs and small shrubs may be one way of enhancing the understorey without the risk of spray drift or water contamination. If weeds are to be removed, it would be necessary to plant nectar-producing native species in order to retain the site's insect fauna, including the dainty swallowtail (*Papilio anactus*), which was observed making extensive use of **Verbena bonariensis*. A list of potential species for replanting is given in section 5.5 below.

3.5.3. Litter removal. A small amount of litter occurs within the site, especially around nearby drainage channels. This is a minor issue.

3.5.4. Improving habitat for squirrel gliders. The locally endangered squirrel glider (*Petaurus norfolcensis*) has been reported within a kilometre of the planting site. The sighting was made in 2004 along Marshall's Creek, a small tributary of the Murrumbidgee River. It may be possible to expand and improve the habitat for this species by planting appropriate shrub species. Squirrel gliders are chiefly sap- and nectar-feeders. In situations, as here, where the canopy is dominated by a single *Eucalyptus* species, squirrel gliders appear to need additional sources of food (ENV). It is expected that they would benefit from planting of suitable local *Acacia* species (see 3.5.5 below).

3.5.5. Improving habitat for birds and small reptiles. The site currently offers little habitat value for native animal species and this is reflected in the scarcity of fauna reported in section 4 above. Habitat value is likely to increase as the planted species mature, but this will take many

decades. It may be possible to enhance the site's value in the near-future by way of supplementary plantings consisting chiefly of native shrubs and herbs. As it stands, the replanting is dominated by canopy species; adding a mid-layer and a native understorey would increase the complexity of the site and multiply the number of available habitat niches. Chosen with care, local *Acacia* species can provide year-round nectar suitable for squirrel gliders – for example, *A. pycnantha* provides abundant nectar in late winter and spring, while *A. deanei* can provide nectar in late summer and autumn. Small birds may benefit from habitat species such as kangaroo thorn (*Acacia paradoxa*) and sweet bursaria (*Bursaria spinosa*). Insects (and therefore reptiles and birds) may be attracted to the site by small shrubs and forbs. Suitable species include sticky everlasting (*Xerochrysum viscosum*), common everlasting (*Chrysocephalum apiculatum*), purple coral-pea (*Hardenbergia violacea*), and flax-lilies (*Dianella revoluta* and *Dianella longifolia*). Additional plantings of existing understorey species, chiefly fuzzweed (*Vittadinia cuneata*) and tall bluebell (*Wahlenbergia stricta*), may be beneficial. Native grasses such as kangaroo grass (*Themeda triandra*), meadow rice-grass (*Microlaena stipoides*), and wallaby grasses (*Rytidosperma* spp., formerly *Austrodanthonia* spp.) would provide additional habitat value. These forbs and grasses would require larger plantings than is usual for tree species; while the benefits of understorey establishment are considerable, the costs involved would need to be kept in mind.

3.6. Fauna List for Railway Viaduct

These records have been compiled from personal observation between 2010 and 2013 (Pers. obs.) and *Atlas of Living Australia* (ALA) records within 1 km of the target site.

3.6.1. Birds.

Common name	Scientific name	Record	NSW	Australia
Australian wood duck	*Chenonetta jubata*	Pers. obs. ALA	Secure	Secure
Pacific black duck	*Anas superciliosa*	Pers. obs. ALA	Secure	Secure
Rock dove	**Columba livia*	ALA	Introduced	
Common bronzewing	*Phaps chalcoptera*	ALA	Secure	Secure
Crested pigeon	*Ocyphaps lophotes*	Pers. obs. ALA	Secure	Secure
Little pied cormorant	*Microcarbo melanoleucos*	ALA	Secure	Secure
Australian pelican	*Pelecanus conspicillatus*	Pers. obs.	Secure	Secure
White-faced heron	*Egretta novaehollandiae*	ALA	Secure	Secure
Whistling kite	*Haliastur sphenurus*	Pers. obs.	Secure	Secure
Galah	*Eolophus roseicapillus*	Pers. obs. ALA	Secure	Secure
Long-billed corella	*Cacatua tenuirostris*	Pers. obs.	Secure	Secure
Sulphur-crested cockatoo	*Cacatua galerita*	Pers. obs. ALA	Secure	Secure
Superb parrot	*Polytelis swainsonii*	Pers. obs.	Vuln.	Vuln.
Crimson rosella	*Platycercus elegans elegans*	Pers. obs. ALA	Secure	Secure
Yellow rosella	*Platycercus elegans flaveolus*	Pers. obs.	Secure	Secure

Red-rumped parrot	*Psephotus haematonotus*	Pers. obs. ALA	Secure	Secure
Southern boobook	*Ninox novaeseelandiae*	Pers. obs.	Secure	Secure
Laughing kookaburra	*Dacelo novaeguineae*	Pers. obs. ALA	Secure	Secure
Dollarbird	*Eurystomus orientalis*	ALA	Secure	Secure
Superb fairy-wren	*Malurus cyaneus*	Pers. obs. ALA	Secure	Secure
Weebill	*Smicrornis brevirostris*	Pers. obs.	Secure	Secure
Western gerygone	*Gerygone fusca*	Pers. obs.	Secure	Secure
Yellow thornbill	*Acanthiza nana*	Pers. obs.	Secure	Secure
Spotted pardalote	*Pardalotus punctatus*	ALA	Secure	Secure
Striated pardalote	*Pardalotus striatus*	Pers. obs.	Secure	Secure
White-plumed honeyeater	*Lichenostomus penicillatus*	Pers. obs. ALA	Secure	Secure
Blue-faced honeyeater	*Entomyzon cyanotus*	Pers. obs.	Secure	Secure
Noisy miner	*Manorina melanocephala*	Pers. obs.	Secure	Secure
Red wattlebird	*Anthochaera carunculata*	ALA	Secure	Secure
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	Pers. obs. ALA	Secure	Secure
Crested shrike-tit	*Falcunculus frontatus*	Pers. obs.	Secure	Secure[2]
Rufous whistler	*Pachycephala rufiventris*	Pers. obs.	Secure	Secure
Grey shrike-thrush	*Colluricincla harmonica*	Pers. obs.	Secure	Secure
Masked woodswallow	*Artamus personatus*	ALA	Secure	Secure
White-browed woodswallow	*Artamus superciliosus*	ALA	Secure	Secure
Australian magpie	*Cracticus tibicen*	Pers. obs. ALA	Secure	Secure
Pied butcherbird	*Cracticus nigrogularis*	Pers. obs.	Secure	Secure
Pied currawong	*Strepera graculina*	Pers. obs. ALA	Secure	Secure
Grey fantail	*Rhipidura albiscapa*	Pers. obs.	Secure	Secure
Restless flycatcher	*Myiagra inquieta*	ALA	Secure	Secure
Willie wagtail	*Rhipidura leucophrys*	Pers. obs. ALA	Secure	Secure
Australian raven	*Corvus coronoides*	Pers. obs.	Secure	Secure
Magpie-lark	*Grallina cyanoleuca*	Pers. obs. ALA	Secure	Secure
White-winged chough	*Corcorax melanorhamphos*	Pers. obs.	Secure	Secure
Eastern yellow robin	*Eopsaltria australis*	Pers. obs.	Secure	Secure
Australian reed-warbler	*Acrocephalus australis*	Pers. obs.	Secure	Secure
Welcome swallow	*Hirundo neoxena*	Pers. obs.	Secure	Secure
Tree martin	*Petrochelidon nigricans*	Pers. obs.	Secure	Secure
Common blackbird	**Turdus merula*	Pers. obs. ALA	Introduced	
Common starling	**Sturnus vulgaris*	Pers. obs. ALA	Introduced	
Red-browed finch	*Neochmia temporalis*	Pers. obs.	Secure	Secure
House sparrow	**Passer domesticus*	Pers. obs. ALA	Introduced	
European goldfinch	**Carduelis carduelis*	ALA	Introduced	

[1]Several subspecies of *F. frontatus* are threatened, but not the E. Australian form.

Native: 48. Introduced: 5.

3.6.2. Reptiles.

Common name	Scientific name	Record	NSW	Australia
Carnaby's wall skink	*Cryptoblepharus australis*	Pers. obs.	Secure	Secure
Copper-tailed skink	*Ctenotus taeniolatus*	Pers. obs.	Secure	Secure

3.6.3. Mammals.

Common name	Scientific name	Record	NSW	Australia
Bilby[1]	*Macrotis lagotis*	ALA	Extinct	Vuln.
Squirrel glider	*Petaurus norfolcensis*	ALA	Vuln.	Secure
Common brushtail possum	*Trichosurus vulpecula*	Pers. obs.	Secure	Secure
Platypus	*Ornithorhynchos anatinus*	ALA	Secure	Secure
Common wombat	*Vombatus ursinus*	ALA	Secure	Secure
Swamp wallaby	*Wallabia bicolor*	Pers. obs.	Secure	Secure
Red fox	*Vulpes vulpes*	ALA	Introduced	

[1]This record dates from 1914.

3.6.4. Molluscs.

Common name	Scientific name	Record	NSW	Australia
None	*Alathyria condola*	ALA	Secure	Secure
None	*Alathyria jacksoni*	ALA	Secure	Secure
None	*Thiara balonnensis*	ALA	Secure	Secure
None	*Velesunio ambiguus*	ALA	Secure	Secure

Red Hill Road

2014 Flora and Fauna Survey

4. Red Hill Road

4.1. Site Description

Red Hill Rd. is located in the southern half of the City of Wagga Wagga, adjoining the Olympic Highway in the west and Plumpton Rd. and Kooringal Rd. in the east. It is south of the suburbs of Glenfield and Tolland and north of Lloyd.

The Wiradjuri Walking Track passes along the southern side of Red Hill Rd. for a distance of roughly 1.5 km, beginning at the eastern end of Jubilee Park and heading west. The track subsequently passes through Lloyd.

4.2. Landcare Work

Revegetation work was carried out at the Red Hill Rd. site on 30 July, 2006, as part of National Tree Planting Day. The work was carried out by Wagga Wagga Urban Landcare in collaboration with local schools and volunteers.

The revegetation site consists of a 1.2 km x roughly 10 m expanse of shrub and tree plantings on the southern (Lloyd) side of Red Hill Rd., a small area of shrub planting on the northern (Glenfield) side, and a line of white box (*Eucalyptus albens*) on either side of the road, extending approximately from Jubilee Park to Yentoo Dr. Site GPS coordinates are -35.145037, 147.328024 (start, Lloyd planting) to 35.136574, 147.320394 (end, Lloyd planting). For site details, including a map, see pg. 78.

The Red Hill Rd. site was surveyed on February 13-14, 2014. The Lloyd planting was divided into 40 sections of 30 m each and headcounts taken. These were compiled to give a single survivorship value for each species in the planting (Table 4.1). Results for each 30-m plot are given in 4.7 below. These give an indication of the relative density of the planting along its length; sparser areas within the planting may represent opportunities for future work.

Headcounts were also taken for the Glenfield shrub planting (Table 4.2) and the white box plantings (Table 4.3). Individual results for the Lloyd and Glenfield white box plantings are preserved in section 4.7.

The lack of available flowers and fruits and the inclusion of non-local and possibly cultivated species in the planting impeded identification. Uncertain species are indicated by '?'. One unidentifiable plant has been removed from the Glenfield data.

Table 4.1. Survivorship of plantings at Red Hill Rd. site (Lloyd)

Common name	Scientific name	Height	Living	Dead	Survivorship
Gold-dust wattle	*Acacia acinacea*	2m	13	-	100%
Box-leaf wattle	*Acacia buxifolia*	3m	93	-	100%
Western silver wattle	*Acacia decora*	3m	52	1	98%
Hakea wattle	*Acacia hakeoides*	3m	19	1	95%
Black wattle	*Acacia mearnsii*	4m	1	-	100%
Weeping boree	*Acacia vestita*	3m	29	-	100%

Silver banksia	*Banksia marginata*	4m	13	2	86.7%
Bottlebrushes	*Callistemon* spp.	2-3m	110	4	96.5%
She-oak	*Casuarina* species	4m	1	-	100%
Wedge-leaf hopbush	*Dodonaea viscosa* subsp. *cuneata*	1-3m	105	5	95.5%
Gum trees	*Eucalyptus* spp. *Corymbia* spp.	2-6m	137	5	96.5%
Sea-urchin hakea	*?Hakea petiolaris*	4m	9	1	90%
Red pokers	*?Hakea bucculenta*	2m	5	2	71.4%
Tick bush	*?Kunzea ambigua*	1.5m	20	-	100%
Paperbarks	*Melaleuca* spp.	2-3m	100	4	96.2%
Sweet pittosporum	*Pittosporum angustifolium*	1-2m	14	-	100%
Tea tree	*?Sannantha* sp.	1-2m	17	-	100%
UNKNOWN (DEAD)				25	

Table 4.2. Survivorship of plantings at Red Hill Rd. site (Glenfield)

Common name	Scientific name	Height	Living	Dead	Survivorship
Bottlebrushes	*Callistemon* spp.	2-3m	49	22	69%
Paperbarks	*Melaleuca* spp.	2-3m	44	4	91.7%

Table 4.3. Survivorship of white box plantings at Red Hill Rd. site

Common name	Scientific name	Height	Living	Dead	Survivorship
White box	*Eucalyptus albens*	6m	97	-	100%
She-oak	*Casuarina* species	6m	4	-	100%

Survivorship values for most species and species-groups were high, with only two falling below 80%: red pokers (*?Hakea bucculenta*) in the Lloyd planting (71.4%) and bottlebrushes (*Callistemon* spp.) in the Glenfield planting. Several silver banksias (*Banksia marginata*), paperbarks (*Melaleuca* spp.) and bottlebrushes within the Lloyd planting showed signs of extreme stress but were still living at the time of the survey. There was some evidence of mowing damage to a number of plants on both the Lloyd and Glenfield sides.

No evidence of standing dead material was noted in the white box planting. These plants were, with few exceptions, in very good condition.

It must be noted that these survivorship values are derived from observations of living and dead plants in the field, and do not account for dead individuals that cannot be seen or identified. These figures may therefore be misleading. Within the Lloyd planting, 25 unidentifiable dead plants were reported. Several large open areas were noted throughout the planting, suggesting that plants may have died at an early stage or that their remains may have been removed or destroyed.

Additionally, the tallies for several species include seedlings that have established subsequent to the plantings. *Acacia acinacea*, *Acacia decora*, *A. buxifolia*, eucalypts, and, in particular, *Dodonaea viscosa* subsp. *cuneata* have all produced significant numbers of seedlings, ranging from <10 cm to roughly 1 m. Several plants of *A. buxifolia* have escaped into an adjacent paddock at plot 24 of 40.

4.3. Flora

Understorey within the Lloyd planting is dense, and is dominated by exotic grasses and herbaceous weeds. The most common and noteworthy of these are brome grasses (**Bromus* spp.), wild oat (**Avena fatua*), cocksfoot (**Dactylis glomeratus*), skeleton weed (**Chondrilla juncea*), St. John's wort (**Hypericum perforatum*), prickly lettuce (**Lactuca serriola*), St. Barnaby's thistle (**), Scotch thistle (*Onopordum acanthicum*), prickly sowthistle (**Sonchus asper*), African peppercress (**Lepidium africanum*), clovers (**Trifolium* spp.), and flatweed (**Hypochaeris radicata*). Common wet-area weeds were reported in the drainage lines that occur at intervals along the planting, including umbrella sedge (**Cyperus eragrostis*), wireweed (**Polygonum aviculare*), barnyard grass (**Echinochloa crus-galli*) and paspalum (**Paspalum* sp.). Areas of paddy melon (**Cucumis* sp.) were also noted.

Common roadside weeds occur around the periphery of the site. These include fleabane (**Conyza bonariensis*), narrow-leaf plantain (**Plantago lanceolata*), caltrop (**Tribulus terrestris*), wild sage (**Salvia verbenaca*), khaki weed (**Alternanthera pungens*) and salad burnet (**Sanguisorba minor*). A single **Gazania* was recorded near the entrance to Lloyd.

St. John's wort, St. Barnaby's thistle and Scotch thistle are listed as Class 4 noxious weeds and should be controlled (DPI). Skeleton weed, khaki weed and caltrop, though not declared noxious, are significant weeds of crops and pastures.

A small number of escaped street and garden trees occurred within the Lloyd planting, including narrow-leafed ash (**Fraxinus angustifolia*; plot 33 of 40), a species of *Prunus* (plot 28 of 40), and a single plant of white cedar (*Melia azederach*; plot 27 of 40). White cedar is an Australian native but does not occur naturally in the Wagga area.

Very few native understorey species were reported within the Lloyd planting. Common 'weedy' species such as willowherb (*Epilobium* sp.) and couch (*Cynodon dactylon*) were observed in drainage lines and disturbed ground. The disturbance-tolerant grasses windmill grass (*Chloris truncata*) and red grass (*Bothriochloa macra*) were reported at intervals throughout the planting. Rushes (*Juncus* spp.) were recorded in drainage areas, as were several dock (*Rumex*) plants, but these could not be identified to species level. Both native and introduced *Rumex* species occur in the Wagga area. Likewise, *Panicum* plants recorded from the site could be native or introduced. Single patches of corkscrew grass (*Austrostipa scabra*) and wallaby grass (*Rytidosperma* sp.) were noted. A single plant of *Vittadinia cuneata* was recorded near a property entrance (plot 9 of 40).

Understorey within the Glenfield plantation consists chiefly of exotic grasses (namely *Bromus* spp. and *Avena fatua*). Understorey within the white-box plantings consists largely of well-maintained lawn grasses and associated weeds.

4.4. Fauna

The Red Hill Rd. planting exists within a highly disturbed landscape with very little surviving natural vegetation. It is bordered by pastoral land to the south and by suburban development to the north. The nearest reserves of note are Silvalite Reserve to the west and Willans Hill to the east. A small

area of native vegetation survives in the suburb of Bourkelands and nearby hilltops retain a small number of trees. Additional plantings of native species occur on the edge of Glenfield, near Silvalite and alongside Jubilee Park.

No prior observations – either personal or from the *Atlas of Living Australia* (ALA) – available for this site. A number of records are available from Silvalite Reserve and these are included in 4.6 below. The most significant of these are the swift parrot (*Lathamus discolor*), superb parrot (*Polytelis swainsoni*) and brown treecreeper (eastern subspecies; *Climacteris picumnus victoriae*). The swift parrot is nationally *endangered*, the superb parrot is nationally *vulnerable*, and the eastern form of the brown treecreeper is *vulnerable* in New South Wales. The relevance of these records is questionable, however, given the differences in habitat between the two sites.

The Red Hill Rd. planting represents a significant area of habitat in a degraded landscape. However, the scarcity of substantial reserves in the area and the close proximity of the site to suburban development and a major road may limit the site's usefulness to wildlife. To investigate this, bird surveys were conducted at the site and incidental observations of other forms of wildlife recorded.

4.4.1. Birds. Three thirty-minute bird surveys were conducted at the site. Birds were recorded if they could be detected (either visually or by call) from within the planting. Species were recorded as occurring *in* or *near* the planting and a rough count was taken. Where possible, location and behavioural details were noted. The first and second surveys were conducted in the early morning (0700) and the third in the evening (2000). Results are given in Table 4.4.

Table 4.4. Results of bird surveys for Red Hill Rd. site[1]

Common name	Scientific name	In	Near	A.M.	P.M.	Notes
Stubble quail	*Coturnix pectoralis*	Y	N	**L**. 2	-	**L**. In long grass.
Crested pigeon	*Ocyphaps lophotes*	Y	N	**L**. 2	**L**. 2	**L**. Roosting in gum.
Peaceful dove	*Geopelia striata*	Y	N	**L**. 2	-	**L**. In dense *A. decora*
Nankeen kestrel	*Falco cenchroides*	N	Y	**L**. 1	-	**L**. Adjacent paddock.
Brown falcon	*Falco berigora*	Y	N	**L**. 1	-	**L**. On fence; transient.
Yellow rosella	*Platycercus elegans flaveolus*	Y	Y	**G**. 4	**L**. 2	**L**. In grass. **G**. Open area nearby.
Southern boobook	*Ninox novaeseelandiae*	Y	Y	-	**W**. 1 **L**. 1	**W**. Perching. **L**. Flying overhead.
Superb fairy-wren	*Malurus cyaneus*	Y	Y	-	**L**. 5 **G**. 3	**L**. In hopbush, wattle. **G**. In bottlebrush.
Yellow thornbill	*Acanthiza nana*	Y	Y	**L**. 4	-	**L**. In denser shrubs.
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Y	Y	**L**. 2 **G**. 6	-	**L**. In denser shrubs. **G**. Open area nearby.
White-plumed honeyeater	*Lichenostomus penicillatus*	Y	N	**L**. 2 **W**. 2	-	**L**. In eucalypts, wattles. **W**. Foraying from trees.
Noisy miner	*Manorina melanocephala*	N	Y	**G**. 4	-	**G**. Open area nearby.
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	N	Y	**L**. 2	-	**L.** Adjacent paddock.
Australian magpie	*Cracticus tibicen*	Y	N	**L**. 2 **G**. 4	-	**L**. In long grass. **G**. Open area nearby.
Willie wagtail	*Rhipidura leucophrys*	Y	Y	**L**. 2	-	**L**. Perching in shrubs.

				G. 2		**G**. Foraying from shrub.
Australian raven	*Corvus coronoides*	N	Y	**L**. 4	-	**L**. Adjacent paddock.
Magpie-lark	*Grallina cyanoleuca*	Y	Y	**L**. 2 **G**. 2	-	**L**. In grasses. **G**. Open area nearby.
Common blackbird	**Turdus merula*	Y	N	**L**. 1	**L**. 1 **G.** 2	**L**. In *Dodonaea*. **G.** In *Melaleuca*.
Common starling	**Sturnus vulgaris*	N	Y	**L**. 20	**L**. 6	**L**. Adjacent paddock.

[1]L=Lloyd (southern) side. G=Glenfield (northern) side. W=white box.

Native: 17. Introduced: 2.

In all, 19 bird species were recorded, of which 17 were native. Most species recorded were common birds of suburban areas (e.g. Australian magpie, crested pigeon), birds of open areas (e.g. Australian raven, brown falcon), and insectivorous woodland birds with less stringent habitat requirements (e.g. thornbills).

The presence of peaceful doves within the planting is unexpected. Peaceful doves occur in woodlands around Wagga (including Willans Hill) but are generally sedentary and are rarely found in small areas of vegetation. They may be using Red Hill Rd. as a corridor between sites.

Stubble quails are also noteworthy as they tend not to persist after suburban development. They require open grassland – the two individuals recorded during the survey were seen in dense stands of the exotic grasses, **Avena fatua* and **Bromus catharticus*.

4.4.2. Mammals. A single mammal species, the introduced red fox (**Vulpes vulpes*), was recorded during the survey. It was sighted in nearby pasture, and not within the plantings.

4.4.3. Reptiles. Four reptile species were recorded during the survey (Table 4.5), all on the Lloyd side of Red Hill Rd..

Table 4.5. Reptile species recorded from Red Hill Rd. site

Common name	Scientific name	Count	In	Near	Notes
Carnaby's wall skink	*Cryptoblepharus australis*	4	Y	N	In long grass.
Copper-tailed skink	*Ctenotus taeniolatus*	1	Y	N	At base of white box.
Southern rainbow-skink	*Carlia tetradactyla*	1	Y	N	Under dense shrubs.
Eastern brown snake	*Pseudonaja textilis*	1	N	Y	In adjacent paddock.

4.4.4. Insects. No formal insect surveys were conducted and few incidental observations were made. The butterfly fauna was scarce, presumably owing to the lack of available nectar, and most recorded butterflies were common grass-blues (*Zizina labradus*), a very small species. The open grassy areas of the site were home to significant grasshopper and katydid populations.

4.5. Issues and Future Work

Most species planted within the Red Hill Rd. site have now attained or are close to attaining their maximum size. Additional regeneration from seed notwithstanding, the site is essentially 'complete' – i.e. its habitat value will not increase significantly from this point onward. There is an opportunity,

therefore, to assess the site and determine what it is lacking and what can be reasonably done to improve it. Some options are considered here.

4.5.1. Litter removal. The planting occurs along a well-trafficked road, and consequently there is a build-up of litter along the margins of the site. Additionally, some larger items (including a chair, some piping, and a bag of concrete) have been dumped within the planting. Most of the site remains relatively free of waste – the small amount that is there could be profitably removed.

4.5.2. Restore and enhance Glenfield planting. Survivorship in the Glenfield planting was noticeably lower than in the Lloyd planting. The reasons for this are not immediately clear, though some mower damage was observed. The planting is very close to the road, and it is possible that some damage has been done by passing vehicles. Additionally, soil and water conditions may not be favourable so close to the road.

While simply replanting where plants have died is unlikely to have much success, it may be possible to expand the planting towards Glenfield and away from the road. Behind the planting is open space, currently dominated by exotic grasses and forbs. This space is bisected by a cycle track, but is otherwise apparently unused. Building a second corridor on this side of the road would greatly enhance the value of the Red Hill Rd. site.

4.5.3. Weed removal and replanting along and around drainage lines. Several drainage lines and culverts occur within or alongside the planting area. Many of these show significant infestations of weeds and may act as reservoirs of weed seeds, bolstering infestations in other parts of the city. Removal would have to be by hand and care would need to be taken to ensure only introduced species are removed. This would entail careful identification of *Rumex* species in these areas.

Replanting along drainage lines may help to suppress weeds. Care would be needed in the process of selecting species, lest they become weedy themselves. *Carex appressa* and several species of *Juncus* are available from native nurseries and may be suitable. *Carex appressa*, in particular, would enhance the aesthetic properties of these drainage lines.

4.5.4. Weed suppression by revegetation within the planting. The Lloyd planting is densely infested with exotic grasses and herbaceous weeds, including several species declared noxious in the Wagga area. Sections of the planting only sparsely populated with planted shrubs are currently mowed, and this may suppress (but not eliminate) the weeds. The most recent mowing, however, occurred after the bulk of the weeds had already shed seed. If mowing cannot be scheduled to occur prior to seed production, an alternative means of weed control will be needed. Additionally, the densest sections of planting cannot be reached by mower and appear to act as year-round reservoirs of weed seed.

While it will not be possible to eliminate weeds altogether, it may be possible to reduce the weed burden by planting additional native species – chiefly grasses, forbs and small shrubs – to compete with the exotics. In areas currently accessible by mower, these should be grasses (e.g. *Themeda*

triandra, *Rytidosperma* (*Austrodanthonia*) spp., *Austrostipa scabra*, *Austrostipa densiflora*, *Poa sieberiana*, and *Elymus scaber*). This would allow the current control regime to continue and, at the same time, enhance habitat for ground-dwelling animals such as the stubble quail and lizards. In less accessible areas – for example, plots 13-17 – forbs and small shrubs could be planted to enhance the biodiversity value of the site and reduce weeds. Suitable species could include sticky everlasting (*Xerochrysum viscosum*), common everlasting (*Chrysocephalum apiculatum*), clustered everlasting (*Chrysocephalum semipapposum*), bulbine lilies (*Bulbine bulbosa*), chocolate lilies (*Dichopogon strictus*), flax lilies (*Dianella revoluta* and *D. longifolia*), tall bluebells (*Wahlenbergia stricta*), showy parrot-pea (*Dillwynia sericea*) and bush pea (*Pultenaea foliolosa*). These species would also encourage insect- and bird-life. Note, however, that many of these species are very small and would need to be assessed for cost-effectiveness.

4.6. Fauna List for Red Hill Road

These records have been compiled from personal observations of Red Hill Rd. during the survey period (Pers. obs.) and *Atlas of Living Australia* (ALA) data for the nearby Silvalite Reserve.

4.6.1. Birds.

Common name	Scientific name	Record	NSW	Australia
Stubble quail	*Coturnix pectoralis*	Pers. obs.	Secure	Secure
Australasian grebe	*Tachybaptus novaehollandiae*	ALA	Secure	Secure
Peaceful dove	*Geopelia striata*	Pers. obs.	Secure	Secure
Crested pigeon	*Ocyphaps lophotes*	Pers. obs. ALA	Secure	Secure
Common bronzewing	*Phaps chalcoptera*	ALA	Secure	Secure
Little pied cormorant	*Microcarbo melanoleucos*	ALA	Secure	Secure
Straw-necked ibis	*Threskiornis spinicollis*	Pers. obs.	Secure	Secure
Brown falcon	*Falco berigora*	Pers. obs.	Secure	Secure
Nankeen kestrel	*Falco cenchroides*	Pers. obs.	Secure	Secure
Black-shouldered kite	*Elanus axillaris*	ALA	Secure	Secure
Galah	*Eolophus roseicapillus*	Pers. obs. ALA	Secure	Secure
Sulphur-crested cockatoo	*Cacatua galerita*	Pers. obs.	Secure	Secure
Swift parrot	*Lathamus discolor*	ALA	End.	End.
Superb parrot	*Polytelis swainsonii*	Pers. obs. ALA	Vuln.	Vuln.
Crimson rosella	*Platycercus elegans*	ALA	Secure	Secure
Yellow rosella	*Platycercus elegans flaveolus*	Pers. obs.	Secure	Secure
Red-rumped parrot	*Psephotus haematonotus*	Pers. obs.	Secure	Secure
Laughing kookaburra	*Dacelo novaeguineae*	Pers. obs.	Secure	Secure
Brown treecreeper	*Climacteris picumnus victoriae*	ALA	Vuln.	Secure
Superb fairy-wren	*Malurus cyaneus*	Pers. obs.	Secure	Secure
Western gerygone	*Gerygone fusca*	Pers. obs.	Secure	Secure
Yellow thornbill	*Acanthiza nana*	Pers. obs. ALA	Secure	Secure
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Pers. obs. ALA	Secure	Secure
Weebill	*Smicrornis brevirostris*	Pers. obs.	Secure	Secure
Spotted pardalote	*Pardalotus punctatus*	ALA	Secure	Secure

Striated pardalote	*Pardalotus striatus*	Pers. obs.	Secure	Secure
Fuscous honeyeater	*Lichenostomus fuscus*	ALA	Secure	Secure
Yellow-tufted honeyeater	*Lichenostomus melanops*	ALA	Secure	Secure
White-plumed honeyeater	*Lichenostomus penicillatus*	Pers. obs. ALA	Secure	Secure
Blue-faced honeyeater	*Entomyzon cyanotus*	Pers. obs.	Secure	Secure
Noisy miner	*Manorina melanocephala*	Pers. obs. ALA	Secure	Secure
Red wattlebird	*Anthochaera carunculata*	Pers. obs. ALA	Secure	Secure
Little friarbird	*Philemon citreogularis*	ALA	Secure	Secure
Noisy friarbird	*Philemon corniculatus*	Pers. obs.	Secure	Secure
White-browed babbler	*Pomatostomus superciliosus*	ALA	Secure	Secure
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	Pers. obs.	Secure	Secure
Rufous whistler	*Pachycephala rufiventris*	Pers. obs.	Secure	Secure
Grey shrike-thrush	*Colluricincla harmonica*	Pers. obs. ALA	Secure	Secure
Dusky woodswallow	*Artamus cyanopterus*	ALA	Secure	Secure
Australian magpie	*Cracticus tibicen*	Pers. obs. ALA	Secure	Secure
Pied currawong	*Strepera graculina*	Pers. obs. ALA	Secure	Secure
Restless flycatcher	*Myiagra inquieta*	ALA	Secure	Secure
Grey fantail	*Rhipidura albiscapa*	Pers. obs. ALA	Secure	Secure
Willie wagtail	*Rhipidura leucophrys*	Pers. obs.	Secure	Secure
Australian raven	*Corvus coronoides*	Pers. obs. ALA	Secure	Secure
Magpie-lark	*Grallina cyanoleuca*	Pers. obs.	Secure	Secure
Red-capped robin	*Petroica goodenovii*	Pers. obs.	Secure	Secure
Rufous songlark	*Cincloramphus mathewsi*	Pers. obs.	Secure	Secure
Silvereye	*Zosterops lateralis*	ALA	Secure	Secure
Common blackbird	**Turdus merula*	Pers. obs. ALA	Introduced	
Common starling	**Sturnus vulgaris*	Pers. obs.	Introduced	
House sparrow	**Passer domesticus*	Pers. obs.	Introduced	
Native: 49. Introduced: 3.				

4.6.2. Reptiles.

Common name	Scientific name	Record	NSW	Australia
Carnaby's wall skink	*Cryptoblepharus australis*	Pers. obs.	Secure	Secure
Copper-tailed skink	*Ctenotus taeniolatus*	Pers. obs.	Secure	Secure
Southern rainbow-skink	*Carlia tetradactyla*	Pers. obs.	Secure	Secure
Eastern brown snake	*Pseudonaja textilis*	Pers. obs.	Secure	Secure

4.6.3. Mammals.

Common name	Scientific name	Record	NSW	Australia
Red fox	**Vulpes vulpes*	Pers. obs. ALA	Introduced	

4.7. Raw Data for Headcounts and Survivorship

As described above, the Lloyd planting was subdivided into 40 plots of 30 metres in length, in order to simplify the process of conducting headcounts. Results for each 30-m plot were compiled to give the overall values presented in Table 4.1 above, but are presented individually here, as they may provide additional information about plant densities at particular points. For example, plots 7 to 10 currently contain very few plants and may be usable in future plantings. NOTE: plots run from east to west – that is, plot 1 is the easternmost point of the planting (near the quarry entrance) and plot 40 is the westernmost point (roughly opposite Yentoo Dr.).

Raw data from the Glenfield and white box plantings are given here also.

4.7a. Survivorship of plantings at Red Hill Rd. (Lloyd)

Name	Plot 1			Plot 2			Plot 3		
	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.
AAC	1	-	100%	1	-	100%	1	-	100%
ABU	1	-	100%	-	-	-	-	-	-
ADE	3	-	100%	3	-	100%	5	-	100%
AHA	1	-	100%	3	-	100%	1	-	100%
AME	-	-	-	-	-	-	-	-	-
AVE	-	-	-	-	-	-	-	-	-
BAN	-	-	-	-	1	0%	1	-	100%
CALL	1	-	100%	-	-	-	5	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	1	-	100%	2	-	100%	2	-	100%
EUCS	2	-	100%	4	-	100%	5	-	100%
HA1	-	-	-	-	-	-	-	-	-
HA2	-	-	-	-	-	-	-	-	-
KAM	-	-	-	-	-	-	-	-	-
MEL	8	-	100%	4	-	100%	1	-	100%
PIT	-	-	-	-	-	-	-	-	-
SAN	-	-	-	-	-	-	-	-	-
?	-	4	-	-	1	-	-	1	-

Name	Plot 4			Plot 5			Plot 6		
	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.
AAC	-	-	-	-	-	-	-	-	-
ABU	4	-	100%	4	-	100%	-	-	-
ADE	3	-	100%	-	-	-	1	-	100%
AHA	1	-	100%	-	-	-	-	-	-
AME	-	-	-	-	-	-	-	-	-
AVE	-	-	-	-	-	-	-	-	-
BAN	-	-	-	-	-	-	-	-	-
CALL	8	-	100%	1	-	100%	1	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	2	-	100%	2	-	100%	2	1	66.7%
EUCS	5	-	100%	1	-	100%	4	-	100%
HA1	-	-	-	-	-	-	-	-	-
HA2	-	-	-	-	-	-	-	-	-
KAM	2	-	100%	2	-	100%	1	-	100%
MEL	2	-	100%	3	-	100%	2	1	66.7%

PIT	-	-	-	-	-	-	1	-	100%
SAN	-	-	-	4	-	100%	1	-	100%
?	-	-	-	-	-	-	-	-	-

Name	Plot 7[1]			Plot 8			Plot 9[2]		
	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.
AAC	1	-	100%	-	-	-	-	-	-
ABU	-	-	-	-	-	-	-	-	-
ADE	-	-	-	-	-	-	-	-	-
AHA	-	-	-	-	-	-	-	-	-
AME	-	-	-	-	-	-	-	-	-
AVE	-	-	-	-	-	-	-	-	-
BAN	-	-	-	-	-	-	-	-	-
CALL	1	-	100%	-	-	-	1	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	2	-	100%	-	-	-	-	-	-
EUCS	1	-	100%	-	-	-	-	1	0%
HA1	-	1	0%	-	-	-	-	-	-
HA2	-	-	-	-	-	-	-	-	-
KAM	-	-	-	-	-	-	-	-	-
MEL	2	-	100%	-	-	-	-	-	-
PIT	-	-	-	-	-	-	-	-	-
SAN	-	-	-	1	-	100%	-	-	-
?	-	1	-	-	-	-	-	-	-

Name	Plot 10[3]			Plot 11			Plot 12		
	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.
AAC	-	-	-	1	-	100%	-	-	-
ABU	-	-	-	1	-	100%	-	-	-
ADE	1	-	100%	-	-	-	-	-	-
AHA	-	-	-	-	-	-	-	-	-
AME	-	-	-	-	-	-	-	-	-
AVE	-	-	-	-	-	-	1	-	100%
BAN	-	-	-	-	-	-	3	-	100%
CALL	-	-	-	-	-	-	2	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	1	-	100%	8	1	88.9%	4	1	80%
EUCS	-	-	-	5	1	83.3%	3	-	100%
HA1	-	-	-	-	-	-	2	-	100%
HA2	-	-	-	-	-	-	-	-	-
KAM	2	-	100%	2	-	100%	1	-	100%
MEL	-	-	-	-	-	-	-	-	-
PIT	-	-	-	-	-	-	-	-	-
SAN	2	-	100%	-	-	-	-	-	-
?	-	-	-	-	-	-	-	-	-

Name	Plot 13			Plot 14			Plot 15		
	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.
AAC	1	-	100%	1	-	100%	2	-	100%
ABU	6	-	100%	9	-	100%	7	-	100%
ADE	3	-	100%	5	-	100%	7	-	100%
AHA	-	-	-	-	-	-	-	-	-
AME	-	-	-	1	-	100%	-	-	-
AVE	-	-	-	-	-	-	-	-	-

BAN	3	-	100%	1	1	50%	1	-	100%
CALL	4	-	100%	3	1	75%	4	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	29	1	96.7%	16	-	100%	15	-	100%
EUCS	3	-	100%	7	-	100%	6	-	100%
HA1	1	-	100%	-	-	-	-	-	-
HA2	-	-	-	-	-	-	-	-	-
KAM	2	-	100%	7	-	100%	-	-	-
MEL	2	-	100%	3	-	100%	4	-	100%
PIT	-	-	-	1	-	100%	1	-	100%
SAN	-	-	-	1	-	100%	1	-	100%
?	-	1	-	-	-	-	-	-	-

Name	**Plot 16**			**Plot 17**			**Plot 18**		
	LIVE	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**
AAC	2	-	100%	1	-	100%	-	-	-
ABU	5	-	100%	4	-	100%	-	-	-
ADE	5	-	100%	3	-	100%	1	-	100%
AHA	-	-	-	-	-	-	-	-	-
AME	-	-	-	-	-	-	-	-	-
AVE	-	-	-	-	-	-	-	-	-
BAN	-	-	-	-	-	-	-	-	-
CALL	5	-	100%	3	2	60%	4	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	12	-	100%	2	-	100%	4	-	100%
EUCS	6	-	100%	6	1	85.7%	2	-	100%
HA1	-	-	-	2	-	100%	-	-	-
HA2	-	-	-	-	-	-	-	-	-
KAM	1	-	100%	-	-	-	-	-	-
MEL	-	-	-	1	-	100%	1	-	100%
PIT	1	-	100%	1	-	100%	4	-	100%
SAN	1	-	100%	2	-	100%	3	-	100%
?	-	-	-	-	1	-	-	5	-

Name	**Plot 19[3]**			**Plot 20**			**Plot 21**		
	LIVE	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**
AAC	-	-	-	-	-	-	-	-	-
ABU	2	-	100%	-	-	-	-	-	-
ADE	-	-	-	-	-	-	2	1	66.7%
AHA	-	-	-	1	-	100%	1	-	100%
AME	-	-	-	-	-	-	-	-	-
AVE	1	-	100%	-	-	-	-	-	-
BAN	-	-	-	-	-	-	-	-	-
CALL	4	-	100%	1	-	100%	4	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	-	-	-	-	-	-	-	-	-
EUCS	5	-	100%	2	-	100%	8	-	100%
HA1	-	-	-	-	-	-	1	-	100%
HA2	-	-	-	-	-	-	-	-	-
KAM	-	-	-	-	-	-	-	-	-
MEL	2	-	100%	-	-	-	4	-	100%
PIT	3	-	100%	-	-	-	-	-	-
SAN	1	-	100%	-	-	-	-	-	-

?	-	1	-	-	-	-	-	2	-
Name	**Plot 22**			**Plot 23[1,2]**			**Plot 24**		
	LIVE	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**
AAC	1	-	100%	-	-	-	-	-	-
ABU	10	-	100%	17	-	100%	-	-	-
ADE	3	-	100%	-	-	-	-	-	-
AHA	-	-	-	-	-	-	-	-	-
AME	-	-	-	-	-	-	-	-	-
AVE	2	-	100%	-	-	-	-	-	-
BAN	1	-	100%	-	-	-	-	-	-
CALL	4	1	80%	2	-	100%	1	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	1	-	100%	-	-	-	-	-	-
EUCS	9	-	100%	11	-	100%	-	-	-
HA1	2	-	100%	-	-	-	-	-	-
HA2	-	-	-	-	-	-	-	-	-
KAM	-	-	-	-	-	-	-	-	-
MEL	4	-	100%	2	-	100%	-	-	-
PIT	2	-	100%	-	-	-	-	-	-
SAN	-	-	-	-	-	-	-	-	-
?	-	1	-	-	-	-	-	-	-
Name	**Plot 25**			**Plot 26**			**Plot 27**		
	LIVE	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**
AAC	-	-	-	-	-	-	-	-	-
ABU	9	-	100%	3	-	100%	10	-	100%
ADE	-	-	-	4	-	100%	-	-	-
AHA	-	-	-	3	1	75%	1	-	100%
AME	-	-	-	-	-	-	-	-	-
AVE	5	-	100%	2	-	100%	4	-	100%
BAN	-	-	-	1	-	100%	-	-	-
CALL	10	-	100%	7	-	100%	9	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	-	-	-	-	-	-	-	-	-
EUCS	10	-	100%	12	-	100%	7	1	87.5%
HA1	-	-	-	-	-	-	-	-	-
HA2	-	-	-	1	-	100%	1	-	100%
KAM	-	-	-	-	-	-	-	-	-
MEL	1	-	100%	5	-	100%	4	2	66.7%
PIT	-	-	-	-	-	-	-	-	-
SAN	-	-	-	-	-	-	-	-	-
?	-	1	-	-	3	-	-	-	-
Name	**Plot 28**			**Plot 29[4]**			**Plot 30[4]**		
	LIVE	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**
AAC	-	-	-	-	-	-	-	-	-
ABU	-	-	-	-	-	-	-	-	-
ADE	1	-	100%	-	-	-	-	-	-
AHA	1	-	100%	5	-	100%	-	-	-
AME	-	-	-	-	-	-	-	-	-
AVE	5	-	100%	1	-	100%	-	-	-
BAN	-	-	-	-	-	-	-	-	-
CALL	5	-	100%	5	-	100%	-	-	-

CAS	1	-	100%	-	-	-	-	-	-
DOD	-	-	-	-	-	-	-	-	-
EUCS	-	-	-	1	-	100%	-	-	-
HA1	-	-	-	-	-	-	-	-	-
HA2	-	-	-	-	-	-	-	-	-
KAM	-	-	-	-	-	-	-	-	-
MEL	9	1	90%	3	-	100%	-	-	-
PIT	-	-	-	-	-	-	-	-	-
SAN	-	-	-	-	-	-	-	-	-
?	-	1	-	-	-	-	-	-	-
Name	**Plot 31**			**Plot 32**			**Plot 33**		
	LIVE	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**
AAC	-	-	-	-	-	-	-	-	-
ABU	-	-	-	-	-	-	-	-	-
ADE	1	-	100%	1	-	100%	-	-	-
AHA	-	-	-	1	-	100%	-	-	-
AME	-	-	-	-	-	-	-	-	-
AVE	1	-	100%	3	-	100%	1	-	100%
BAN	1	-	100%	-	-	-	-	-	-
CALL	7	-	100%	3	-	100%	-	-	-
CAS	-	-	-	-	-	-	-	-	-
DOD	-	-	-	-	-	-	-	-	-
EUCS	-	-	-	3	-	100%	2	-	100%
HA1	-	-	-	-	-	-	-	-	-
HA2	-	-	-	-	-	-	-	-	-
KAM	-	-	-	-	-	-	-	-	-
MEL	3	-	100%	11	-	100%	1	-	100%
PIT	-	-	-	-	-	-	-	-	-
SAN	-	-	-	-	-	-	-	-	-
?	-	1	-	-	1	-	-	-	-
Name	**Plot 34[3]**			**Plot 35**			**Plot 36**		
	LIVE	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**	**LIVE**	**DEAD**	**SURV.**
AAC	-	-	-	-	-	-	-	-	-
ABU	-	-	-	-	-	-	1	-	100%
ADE	-	-	-	-	-	-	-	-	-
AHA	-	-	-	-	-	-	-	-	-
AME	-	-	-	-	-	-	-	-	-
AVE	-	-	-	-	-	-	1	-	100%
BAN	-	-	-	-	-	-	1	-	100%
CALL	-	-	-	3	-	100%	-	-	-
CAS	-	-	-	-	-	-	-	-	-
DOD	-	-	-	1	-	0%	-	-	-
EUCS	-	-	-	-	-	-	5	1	83.3%
HA1	-	-	-	-	-	-	1	-	100%
HA2	-	-	-	-	1	100%	-	-	-
KAM	-	-	-	-	-	-	-	-	-
MEL	-	-	-	7	-	100%	4	-	100%
PIT	-	-	-	-	-	-	-	-	-
SAN	-	-	-	-	-	-	-	-	-
?	-	-	-	-	-	-	-	-	-
Name	**Plot 37**			**Plot 38**			**Plot 39[1]**		

	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.	LIVE	DEAD	SURV.
AAC	-	-	-	-	-	-	-	-	-
ABU	-	-	-	-	-	-	-	-	-
ADE	-	-	-	-	-	-	-	-	-
AHA	-	-	-	-	-	-	-	-	-
AME	-	-	-	-	-	-	-	-	-
AVE	-	-	-	-	-	-	2	-	100%
BAN	-	-	-	-	-	-	-	-	-
CALL	-	-	-	-	-	-	1	-	100%
CAS	-	-	-	-	-	-	-	-	-
DOD	-	-	-	-	-	-	-	-	-
EUCS	1	-	100%	1	-	100%	-	-	-
HA1	-	-	-	-	-	-	-	-	-
HA2	-	-	-	-	-	-	1	1	50%
KAM	-	-	-	-	-	-	-	-	-
MEL	-	-	-	4	-	100%	3	-	100%
PIT	-	-	-	-	-	-	-	-	-
SAN	-	-	-	-	-	-	-	-	-
?	-	-	-	-	-	-	-	-	-

Name	Plot 40		
	LIVE	DEAD	SURV.
AAC	-	-	-
ABU	-	-	-
ADE	-	-	-
AHA	-	-	-
AME	-	-	-
AVE	-	-	-
BAN	-	-	-
CALL	1	-	100%
CAS	-	-	-
DOD	-	-	-
EUCS	-	-	-
HA1	-	-	-
HA2	1	1	50%
KAM	-	-	-
MEL	-	-	-
PIT	-	-	-
SAN	-	-	-
?	-	-	-

ABBREVIATIONS

AAC=Gold-dust wattle (*Acacia acinacea*).
ABU=Box-leaf wattle (*Acacia buxifolia*).
ADE=Western silver wattle (*Acacia decora*).
AHA=Hakea wattle (*Acacia hakeoides*).
AME.=Black wattle (*Acacia mearnsii*).
AVE=Weeping boree (*Acacia vestita*).
BAN=Banksia (*Banksia* sp.).
CALL=Bottlebrushes (*Callistemon* spp.).
CAS=Belah (?C*asuarina cristata*).
EUCS=Gum trees (*Eucalyptus* spp. and *Corymbia* spp.).
DOD=Wedge-leaf hopbush (*Dodonaea viscosa* subsp. *cuneata*).
HA1=Sea-urchin hakea (*?Hakea petiolaris*).
HA2=Red pokers (*?Hakea bucculenta*).
KAM=Tick bush (*?Kunzea ambigua*).
MEL=Paperbarks (*Melaleuca* spp.).
PIT=Narrow-leaf pittosporum (*Pittosporum angustifolia*).
SAN=Tea tree (*?Sannantha* sp.).
?=Unknown.

[1]culvert. [2]property road. [3]drainage line. [4]Lloyd entrance.

4.7b. Survivorship of plantings at Red Hill Rd. (Glenfield)

Common name	Scientific name	LIVE	DEAD	SURV.
Bottlebrush	*Callistemon* spp.	49	22	69%
Paperbarks	*Melaleuca* spp.	44	4	91.7%
?		1	0	100%

4.7c. Survivorship of tree plantings at Red Hill Rd. (Lloyd)

Common name	Scientific name	LIVE	DEAD	SURV.

White box	*Eucalyptus albens*	44	0	100%

4.7d. Survivorship of tree plantings at Red Hill Rd. (Glenfield)

Common name	**Scientific name**	**LIVE**	**DEAD**	**SURV.**
White box	*Eucalyptus albens*	53	0	100%
She-oak	*Allocasuarina* sp.	4	0	100%

Wilks Park

2014 Flora and Fauna Survey

5. Wilks Park

5. 1. Site Description

Wilks Park, situated on the eastern bank of the Murrumbidgee River in the north of Wagga Wagga, is an area of roughly 39 ha (NGH) of river red gum woodland. The site represents a significant area of habitat within the City of Wagga Wagga itself. This site was the focus of the present survey.

Access to Wilks Park is through the caravan park on Hampden Avenue. A number of formal and informal walking/cycling tracks occur in the site. The Wiradjuri Walking Track passes on the opposite bank of the river, through Wiradjuri Reserve, and does not approach Wilks Park.

5. 2. Landcare Work

Revegetation work at the Wilks Park site was carried out by Wagga Wagga Urban Landcare in 2002 and 2003, in conjunction with local schools, TAFE, Wagga Wagga City Council and the Roads and Traffic Authority (now the Roads and Maritime Service). The project involved the planting of more than 2000 shrubs and trees, the installation of nest boxes and the planting, by WWCC employees, of an area of native grass. Site GPS coordinates are -35.096176, 147.369495 (site midpoint). A map is given in For site details, including a map, see pg. 79.

Revegetation of the site was carried out with an aim to enhancing habitat for squirrel gliders (*Petaurus norfolcensis*), which are locally endangered. Species were selected to supply sources of nectar for gliders, as well as habitat for local bird species. These species include silver wattle (*Acacia dealbata*), northern silver wattle (*Acacia leucoclada*), river she oak (*Casuarina cunninghamiana*), and river bottle brush (*Callistemon sieberi*). Site descriptions (NGH) indicate that golden wattle (*Acacia pycnantha*) was also planted at the site, but this could not be located. Several additional *Acacia* species were noted in the planting area, including black wattle (*A. mearnsii*) and Deane's wattle (*A. deanei*).

Plantings along the main walking track were surveyed on February 11-12, 2014. Headcounts were taken and survivorship values calculated (Table 5.1). Plantings of *Acacia* spp. were not surveyed, as extensive regeneration of these species from seed made this impractical. Furthermore, seedlings of these species were found more than 100 m afield of the original planting, likely due to movement of seeds during flooding; it would be impossible to locate and count all seedlings. Further, if these seedlings were to be included in the tally, it is very likely that the current population for several species would equal or exceed the number planted (i.e. "survivorship" would be ≥ 100%). It should be noted, however, that several large, open areas were recorded in the planting, perhaps resulting from early deaths of seedlings.

No evidence of native grasses was reported from the planting site. The area designated for these plantings was dominated by exotic annual grasses and herbaceous weeds. Surveys in autumn or winter may reveal more.

Table 5.1. Survivorship of river she-oak and bottlebrush plantings at Wilks Park site

Common name	Scientific name	Height	DBH[1]	Living	Dead	Survivorship
River she-oak	*Casuarina cunninghamiana*	1.5-6 m	<10 cm	40	11	78.4%
River bottlebrush	*Callistemon sieberi*	2 m	-	8	-	100%

[1]Species with >1 trunk were not measured for diameter at breast height (DBH).

No standing dead material of river bottlebrush (*Callistemon sieberi*) was noted during the survey and survivorship was therefore calculated as 100%. It should be noted that this value does not account for dead material that is no longer visible (e.g. carried away by floodwaters) and may therefore be misleading. These plants were healthy and yellow thornbills (*Acanthiza nana*) were recorded in one.

Survivorship was significantly lower for river she-oak (*Casuarina cunninghamiana*), especially in the northern half of the site. Some of these casualties can be attributed to a small fire that burnt a section of the planting (see map, pg. 79), but many occurred outside the burnt area. These were generally smaller plants, roughly 1.5-2 metres in height. The survivorship value given (78.4%) is likely to decline still further, as many living plants showed signs of extreme stress. Several bird species were recorded using larger she-oaks.

5.3. Flora

A dense understorey of exotic grasses and herbaceous weeds exists on the eastern side of the main walking track (see map, pg. 79). Dominant and otherwise significant weed species in these areas include chicory (**Cichorium intybus*), purpletop verbena (**Verbena bonariensis*), thistles (including scotch thistle, **Onopordum acanthicum*), wild oat (**Avena fatua*), brome grasses (**Bromus* spp.), prickly lettuce (**Lactuca serriola*), cleavers (**Galium aparine*), Paterson's curse (**Echium vulgare*), and hedge mustard (**Sisymbrium* sp.). Small populations of small-leafed privet (**Ligustrum sinense*), broad-leafed privet (**Ligustrum lucidum*) and sweet briar (**Rosa rubiginosa*) were also recorded. A single plant of bridal creeper (**Asparagus asparagoides*) was recorded, but could not be located during a later survey.

Minor weedy components of the understorey include flatweed (**Hypochaeris radicata*), fleabane (**Conyza bonariensis*), prickly sow-thistle (**Sonchus asper*), onion grass (**Romulea rosea*), African peppercress (**Lepidium africanum*), umbrella sedge (**Cyperus eragrostis*), red-flower mallow (**Modiola caroliniana*), and blackberry nightshade (**Solanum nigrum*). Cathead (**Tribulus terrestris*), wireweed (**Polygonum aviculare*) and khaki weed (**Alternanthera pungens*) occurred along the walking track and in disturbed ground. Two oak trees (**Quercus* sp.) were also recorded.

Scotch thistle, Paterson's curse, sweet briar and bridal creeper are all Class 4 noxious weeds in the Wagga Wagga area (DPI). Broad-leafed and small-leafed privet are noxious weeds in several surrounding districts, but not in Wagga itself. Bridal creeper is a declared Weed of National Significance.

Aside from river red gum (*Eucalyptus camaldulensis*), native plants are sparse at the site and are generally "weedy" species capable of withstanding disturbance. These include pigweed (*Portulaca oleracea*), spurge (*Chamaesyce drummondii*), and, most notably, couch (*Cynodon dactylon*). Couch

dominated several sections of the site, often to the exclusion of all other species. Some rushes (*Juncus* spp.) were also noted.

5.4. Fauna

In common with other riverfront areas, Wilks Park offers a suite of habitat types to suit a diverse bird, mammal, amphibian, reptile and insect fauna. More than 90 native bird species and a range of reptiles, amphibians and mammals have been recorded from the site. This list, drawn from personal observation (2010-2013) and *Atlas of Living Australia* (ALA) data, is given in 5.6 below.

A number of these species are of conservation significance. The blue-billed duck (*Oxyura australis*), brown treecreeper (eastern subspecies; *Climacteris picumnus victoriae*), flame robin (*Petroica phoenicea*), varied sittella (*Daphoenositta chrysoptera*), superb parrot (*Polytelis swainsoni*) and large-footed myotis (*Myotis macropus*) are all declared *vulnerable* in New South Wales. The Wagga Wagga population of the squirrel glider (*Petaurus norfolcensis*) is a declared *endangered population*.

The addition of shrub species to a site dominated by canopy and groundcover species may act to enhance the diversity of habitats and, consequently, the diversity of animal life in a site. Bird surveys were carried out at the Wilks Pk. site to investigate this. Incidental observations of other animal species were also recorded.

5.4.1. Birds. Two thirty-minute bird surveys were conducted at the site. Birds were recorded if they could be detected (either visually or by call) from within the planting. A rough count was taken. No attempt was made to record species as either *in* or *near* the planting, as the boundaries of the planting were not clear. Where possible, location and behavioural details were noted. The first survey was conducted in the early morning (0700) and the second in the evening (2030). Results are given in Table 5.2.

Table 5.2. Results of bird surveys for Wilks Park site

Common name	**Scientific name**	A.M.	P.M.	Notes
Brown quail	*Coturnix ypsilophora*	2	-	In grasses and mustard.
Australian wood duck	*Chenonetta jubata*	2	-	In riverbank vegetation.
Pacific black duck	*Anas superciliosa*	2	-	In riverbank vegetation.
Rock dove	**Columba livia*	3	1	Under and near bridge.
Crested pigeon	*Ocyphaps lophotes*	2	2	In couch and mustard.
Australian pelican	*Pelecanus conspicillatus*	1	-	Flying overhead.
White-faced heron	*Egretta novaehollandiae*	1	-	In river shallows.
Straw-necked ibis	*Threskiornis spinicollis*	2	-	In exotic grasses.
Collared sparrowhawk	*Accipiter cirrocephalus*	1	-	In river she-oak.
Purple swamphen	*Porphyrio porphyrio*	2	-	In reed bed north of site.
Masked lapwing	*Vanellus miles*	3	3	Near caravan park.
Galah	*Eolophus roseicapillus*	10	10	In red gums and grasses.
Sulphur-crested cockatoo	*Cacatua galerita*	12+	12+	In red gums and grasses.
Long-billed corella	*Cacatua tenuirostris*	2	2	With cockatoos.
Crimson rosella	*Platycercus elegans*	5	-	In red gums and grasses.
Yellow rosella	*Platycercus elegans flaveolus*	2	-	In red gums and grasses.
Eastern rosella	*Platycercus eximius*	6	-	In thistles and long grass.

Red-rumped parrot	*Psephotus haematonotus*	2	3	In exotic grasses.
Southern boobook	*Ninox novaeseelandiae*	-	1	In river red gum.
Laughing kookaburra	*Dacelo novaeguineae*	2	-	In gums near river.
Brown treecreeper (?western subsp.)	*?Climacteris picumnus picumnus*	2	-	On trunks of river red gum.
Superb fairy-wren	*Malurus cyaneus*	8	4	In riverbank vegetation.
Western gerygone	*Gerygone fusca*	2	-	Call only. Probably in red gums.
Yellow thornbill	*Acanthiza nana*	4	-	In grasses, she oak and bottlebrush.
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	2	-	In she oak.
Striated pardalote	*Pardalotus striatus*	?2	?2	Call only. Probably in red gum canopy.
Weebill	*Smicrornis brevirostris*	8	?8	Red gum canopy.
White-plumed honeyeater	*Lichenostomus penicillatus*	4	2	In red gums and she oak.
Noisy miner	*Manorina melanocephala*	4	-	In treed area with weedy understorey.
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	2	-	Flying overhead.
Varied sittella	*Daphoenositta chrysoptera*	4	-	On trunks of river red gum.
Rufous whistler	*Pachycephala rufiventris*	1	-	In river she oak.
Grey shrike-thrush	*Colluricincla harmonica*	1	-	In gums, she oak and foraging on ground.
Australian magpie	*Cracticus tibicen*	4	-	Disturbed area near caravan park.
Grey fantail	*Rhipidura albiscapa*	2	1	Foraying from red gums.
Willie wagtail	*Rhipidura leucophrys*	2	2	Gums near caravan park.
Australian raven	*Corvus coronoides*	3	-	Flying overhead.
Magpie-lark	*Grallina cyanoleuca*	3	-	Disturbed area near caravan park.
White-winged chough	*Corcorax melanorhamphos*	8	-	In grasses under gums.
Rufous songlark	*Cincloramphus mathewsi*	?1	-	Call only. Possibly in grass.
Welcome swallow	*Hirundo neoxena*	6	-	Circling overhead. Possibly in gums.
Common blackbird	**Turdus merula*	2	-	Disturbed area near caravan park.
Common starling	**Sturnus vulgaris*	6	-	Gums near caravan park.
Red-browed finch	*Neochmia temporalis*	4	-	On thistles and in grasses.
House sparrow	**Passer domesticus*	4	-	In long grass near caravan park.
Native: 41. Introduced: 4.				

In all, 45 bird species were recorded, of which 41 were native. The site is notable for the large number of insectivorous woodland species (e.g. western gerygone, yellow and yellow-rumped thornbills, weebill, striated pardalote, grey fantail, grey shrike-thrush and varied sittella) present. This may be partly due to the size of the site, as many woodland birds require substantial habitats for feeding and reproduction. The diversity of habitat types may also have an effect.

The sighting of a small population of the varied sittella is significant, as that species is uncommon in the Wagga area and has been declared vulnerable state-wide. The sittella is sedentary and nests in high canopies such as those provided by river red gum, suggesting that it may be a permanent resident at the Wilks Pk. site.

5.4.2. Mammals. Two mammal species were recorded from the site (Table 5.3). A possible sighting of the locally endangered squirrel glider (*Petaurus norfolcensis*) was made but could not be confirmed.

Table 5.3. Mammal species recorded from Wilks Park site

Common name	Scientific name	Count	Notes
Swamp wallaby	*Wallabia bicolor*	2	In long grass and wild mustard.
Common brushtail possum	*Trichosurus vulpecular*	1	In river red gum. Possibly others nearby.

5.4.3. Reptiles. Three reptile species were recorded from the site (Table 5.4). In addition, several small reptiles were observed that could not be identified. The relatively large numbers of *C. australis* and *C. taeniolatus* recorded here suggest an abundance of suitable habitat for small reptiles. Further surveying may reveal a greater diversity of species.

Table 5.4. Reptile species recorded from Wilks Park site

Common name	Scientific name	Count	Notes
Carnaby's wall skink	*Cryptoblepharus australis*	8	Multiple sightings on river red gums.
Robust ctenotus	*Ctenotus robustus*	1	In leaf litter and wild oat.
Copper-tailed skink	*Ctenotus taeniolatus*	4	Two sightings of two individuals, in mustard and leaf litter.

5.4.4. Insects. No formal insect surveys were carried out and few observations were made. Several dainty swallowtails (*Papilio anactus*) were observed feeding on purpletop verbena (**Verbena bonariensis*). Three species of dragonfly – *Diplacodes bipunctata*, *Hemicordulia tau* and *Orthetrum caledonicum* – were observed in grassy areas. These are a significant food source for insectivorous birds.

5.5. Issues and Future Work

The site may gain in habitat value as the large number of *Acacia* seedlings present mature, but it is apparent from the fauna surveys and from past records that the site is already highly significant. Future work should focus on replanting river she-oak, clearing litter, resurveying for native grasses (and replanting these if necessary), and, most pressingly, weed control.

5.5.1. Replanting failed river she-oak plantings. While many river she-oaks persist in the site, a number have died and it is likely that more will die in the coming months. The reasons for this failure are not clear: some plants have obviously been killed by fire, but others show no obvious signs of physical damage. Poor conditions during planting and damage by floodwaters may be implicated. Replanting of river she-oaks, particularly in the northern section of the site, would help

to fill gaps in the forest canopy and improve habitat values in the site. This would need to be carried out in suitable conditions to avoid a repeat of the current situation.

5.5.2. Removal of litter. Patches of paper and plastic litter were noted at the site, as well as a few larger household items. These could be removed to improve the aesthetic values of the site. Given the proximity of the site to the city and a caravan park, litter is likely to be an ongoing issue.

5.5.3. Resurveying for native grasses. The section of the site dedicated to native grass species was overrun by exotics and no trace of the planting could be identified. Many of these exotics are annuals (e.g. wild oat, brome grass) and will die back in the colder months. Resurveying the site at this time may reveal signs of the initial planting and allow a more thorough assessment of its success. It is possible, however, that the planting failed and no native grasses now survive. If so, it may be possible to replant at this site or at a more suitable site nearby (see 5.5.4).

5.5.4. Replanting native grasses, if necessary. If resurveying reveals no sign of native grasses, replanting is an option. Given the density of weeds at the current site, a new location may be more suitable. Planting at the periphery of the site, where there is less competition, is one option. This should increase survivorship while still developing a reservoir of native grass seed. These seeds may then find their way into the site proper and establish opportunistically there.

5.5.5. Removing woody weeds. Minor infestations of several woody weeds (chiefly privet and sweet briar) occur within the Wilks Park site. These could be removed with relatively little difficulty, as the populations are still small.

5.5.6. Suppressing weed infestations and enhancing biodiversity values. Exotic species dominate the understorey of Wilks Park. While these provide significant habitat value (e.g. grass seed for parrots and quails, habitat for small ground insects and reptiles, nectar for butterflies), they also exclude native forb and grass species. While weed infestations will never be wholly controlled, it may be possible to reduce their severity. Slashing and spraying with herbicide are two options for weed control in the short-term, but a more enduring approach will ultimately be needed. This would involve additional plantings of native species in weedy areas (after slashing or spraying) to out-compete exotics. Native species suitable for this task could include additional *Acacia* species, small shrubs, wetland species such as *Juncus* and *Carex appressa*, forbs, and native grasses. Large grassy areas will be needed to retain habitat for quails. Additionally, flowering herbs and shrubs will be needed if the current butterfly population is to be maintained. These could include (*Acacia paradoxa*), sweet bursaria (*Bursaria spinosa*), sticky everlasting (*Xerochrysum viscosum*), common everlasting (*Chrysocephalum apiculatum*), purple coral-pea (*Hardenbergia violacea*), flax-lilies (*Dianella revoluta* and *Dianella longifolia*), fuzzweed (*Vittadinia cuneata*) and tall bluebell (*Wahlenbergia stricta*). Given the small stature of many of these plants and the consequent effort involved in planting, consideration should be given to the costs and benefits of this approach.

5.5. Fauna List for Wilks Park

These records have been compiled from personal observation between 2010 and 2013 (Pers. obs.) and *Atlas of Living Australia* (ALA) records within 1 km of the central point of Wilks Park.

5.6.1. Birds.

Common name	Scientific name	Record	NSW	Australia
Brown quail	*Coturnix ypsilophora*	Pers. obs.	Secure	Secure
Black swan	*Cygnus atratus*	ALA	Secure	Secure
Hardhead	*Aythya australis*	ALA	Secure	Secure
Australian wood duck	*Chenonetta jubata*	Pers. obs. ALA	Secure	Secure
Grey teal	*Anas gracilis*	ALA	Secure	Secure
Pacific black duck	*Anas superciliosa*	Pers. obs. ALA	Secure	Secure
Blue-billed duck	*Oxyura australis*	ALA	Vuln.	Secure
Australasian grebe	*Tachybaptus novaehollandiae*	Pers. obs. ALA	Secure	Secure
Rock dove	**Columba livia*	Pers. obs.	Introduced	
Bar-shouldered dove	*Geopelia humeralis*	ALA	Secure	Secure
Peaceful dove	*Geopelia striata*	ALA	Secure	Secure
Crested pigeon	*Ocyphaps lophotes*	Pers. obs. ALA	Secure	Secure
Tawny frogmouth	*Podargus strigoides*	ALA	Secure	Secure
Australasian darter	*Anhinga novaehollandiae*	ALA	Secure	Secure
Little pied cormorant	*Microcarbo melanoleucos*	ALA	Secure	Secure
Great cormorant	*Phalacrocorax carbo*	ALA	Secure	Secure
Little black cormorant	*Phalacrocorax sulcirostris*	ALA	Secure	Secure
Pied cormorant	*Phalacrocorax varius*	ALA	Secure	Secure
Australian pelican	*Pelecanus conspicillatus*	ALA	Secure	Secure
Eastern great egret	*Ardea modesta*	ALA	Secure	Secure
White-necked heron	*Ardea pacifica*	ALA	Secure	Secure
White-faced heron	*Egretta novaehollandiae*	Pers. obs. ALA	Secure	Secure
Nankeen night-heron	*Nycticorax caledonicus*	ALA	Secure	Secure
Australian white ibis	*Threskiornis molucca*	ALA	Secure	Secure
Straw-necked ibis	*Threskiornis spinicollis*	Pers. obs. ALA	Secure	Secure
Yellow-billed spoonbill	*Platalea flavipes*	ALA	Secure	Secure
Brown falcon	*Falco berigora*	ALA	Secure	Secure
Nankeen kestrel	*Falco cenchroides*	Pers. obs.	Secure	Secure
Whistling kite	*Haliastur sphenurus*	ALA	Secure	Secure
Black-shouldered kite	*Elanus axillaris*	ALA	Secure	Secure
Collared sparrowhawk	*Accipiter cirrocephalus*	Pers. obs.	Secure	Secure
Purple swamphen	*Porphyrio porphyrio*	Pers. obs. ALA	Secure	Secure
Dusky moorhen	*Gallinula tenebrosa*	ALA	Secure	Secure
Eurasian coot	*Fulica atra*	Pers. obs. ALA	Secure	Secure
Black-winged stilt	*Himantopus himantopus*	ALA	Secure	Secure
Masked lapwing	*Vanellus miles*	Pers. obs.	Secure	Secure

		ALA		
Black-fronted dotterel	*Elseyornis melanops*	ALA	Secure	Secure
Sharp-tailed sandpiper	*Calidris acuminata*	Pers. obs.	Secure	Secure
Silver gull	*Chroicocephalus novaehollandiae*	ALA	Secure	Secure
Galah	*Eolophus roseicapillus*	Pers. obs.	Secure	Secure
		ALA		
Sulphur-crested cockatoo	*Cacatua galerita*	Pers. obs.	Secure	Secure
		ALA		
Little corella	*Cacatua sanguinea*	ALA	Secure	Secure
Long-billed corella	*Cacatua tenuirostris*	Pers. obs.	Secure	Secure
Rainbow lorikeet	*Trichoglossus haematodus*	ALA	Secure	Secure
Superb parrot	*Polytelis swainsoni*	Pers. obs.	Vuln.	Secure
Crimson rosella	*Platycercus elegans*	Pers. obs.	Secure	Secure
		ALA		
Yellow rosella	*Platycercus elegans flaveolus*	Pers. obs.	Secure	Secure
Eastern rosella	*Platycercus eximius*	Pers. obs.	Secure	Secure
		ALA		
Red-rumped parrot	*Psephotus haematonotus*	Pers. obs.	Secure	Secure
		ALA		
Southern boobook	*Ninox novaeseelandiae*	Pers. obs.	Secure	Secure
		ALA		
Sacred kingfisher	*Todiramphus sanctus*	ALA	Secure	Secure
Laughing kookaburra	*Dacelo novaeguineae*	Pers. obs.	Secure	Secure
		ALA		
Rainbow bee-eater	*Merops ornatus*	ALA	Secure	Secure
Dollarbird	*Eurystomus orientalis*	ALA	Secure	Secure
Brown treecreeper (west)	*Climacteris picumnus picumnus*	Pers. obs.	Secure	Secure
		ALA		
Brown treecreeper (east)	*Climacteris picumnus victoriae*	ALA	Vuln.	Secure
Superb fairy-wren	*Malurus cyaneus*	Pers. obs.	Secure	Secure
		ALA		
White-browed scrubwren	*Sericornis frontalis*	ALA	Secure	Secure
Western gerygone	*Gerygone fusca*	Pers. obs.	Secure	Secure
Yellow thornbill	*Acanthiza nana*	Pers. obs.	Secure	Secure
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Pers. obs.	Secure	Secure
		ALA		
Spotted pardalote	*Pardalotus punctatus*	ALA	Secure	Secure
Striated pardalote	*Pardalotus striatus*	Pers. obs.	Secure	Secure
		ALA		
Weebill	*Smicrornis brevirostris*	Pers. obs.	Secure	Secure
White-plumed honeyeater	*Lichenostomus penicillatus*	Pers. obs.	Secure	Secure
		ALA		
Blue-faced honeyeater	*Entomyzon cyanotus*	Pers. obs.	Secure	Secure
		ALA		
Noisy miner	*Manorina melanocephala*	Pers. obs.	Secure	Secure
		ALA		
Red wattlebird	*Anthochaera carunculata*	ALA	Secure	Secure
Little friarbird	*Philemon citreogularis*	ALA	Secure	Secure
Noisy friarbird	*Philemon corniculatus*	Pers. obs.	Secure	Secure
		ALA		
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	Pers. obs.	Secure	Secure

Varied sittella	*Daphoenositta chrysoptera*	Pers. obs. ALA	Vuln.	Secure
White-winged triller	*Lalage sueurii*	ALA	Secure	Secure
Crested shrike-tit	*Falcunculus frontatus*	Pers. obs. ALA	Secure	Secure[1]
Golden whistler	*Pachycephala pectoralis*	ALA	Secure	Secure
Rufous whistler	*Pachycephala rufiventris*	Pers. obs. ALA	Secure	Secure
Grey shrike-thrush	*Colluricincla harmonica*	Pers. obs. ALA	Secure	Secure
Australian magpie	*Cracticus tibicen*	Pers. obs. ALA	Secure	Secure
Pied butcherbird	*Cracticus nigrogularis*	Pers. obs.	Secure	Secure
Pied currawong	*Strepera graculina*	Pers. obs. ALA	Secure	Secure
Grey fantail	*Rhipidura albiscapa*	Pers. obs. ALA	Secure	Secure
Willie wagtail	*Rhipidura leucophrys*	Pers. obs. ALA	Secure	Secure
Australian raven	*Corvus coronoides*	Pers. obs. ALA	Secure	Secure
Restless flycatcher	*Myiagra inquieta*	ALA	Secure	Secure
Magpie-lark	*Grallina cyanoleuca*	Pers. obs. ALA	Secure	Secure
White-winged chough	*Corcorax melanorhamphos*	Pers. obs. ALA	Secure	Secure
Flame robin	*Petroica phoenicea*	ALA	Vuln.	Secure
Eastern yellow robin	*Eopsaltria australis*	Pers. ops.	Secure	Secure
Golden-headed cisticola	*Cisticola exilis*	Pers. obs.	Secure	Secure
Australian reed-warbler	*Acrocephalus australis*	Pers. obs.	Secure	Secure
Little grassbird	*Megalurus gramineus*	Pers. obs.	Secure	Secure
Rufous songlark	*Cincloramphus mathewsi*	Pers. obs. ALA	Secure	Secure
Welcome swallow	*Hirundo neoxena*	Pers. obs. ALA	Secure	Secure
Tree martin	*Petrochelidon nigricans*	Pers. obs.	Secure	Secure
Common blackbird	**Turdus merula*	Pers. obs. ALA	Introduced	
Common starling	**Sturnus vulgaris*	Pers. obs. ALA	Introduced	
Red-browed finch	*Neochmia temporalis*	Pers. obs.	Secure	Secure
House sparrow	**Passer domesticus*	Pers. obs. ALA	Introduced	
European goldfinch	**Carduelis carduelis*	Pers. obs.	Introduced	

[1]Several subspecies of *F. frontatus* are threatened, but not the E. Australian form.

Native: 93. Introduced: 5.

5.6.2. Reptiles.

Common name	Scientific name	Record	NSW	Australia
Marbled gecko	*Christinus marmoratus*	Pers. obs.	Secure	Secure

Carnaby's wall skink	*Cryptoblepharus australis*	Pers. obs.	Secure	Secure
Robust ctenotus	*Ctenotus robustus*	Pers. obs.	Secure	Secure
Copper-tailed skink	*Ctenotus taeniolatus*	Pers. obs.	Secure	Secure
Bandy-bandy	*Vermicella annulata*	ALA	Secure	Secure

5.6.3. Amphibians.

Common name	Scientific name	Record	NSW	Australia
Eastern sign-bearing froglet	*Crinia parinsignifera*	ALA	Secure	Secure
Common eastern froglet	*Crinia signifera*	ALA	Secure	Secure
Spotted grass frog	*Limnodynastes tasmaniensis*	ALA	Secure	Secure
Peron's tree frog	*Litora peronii*	ALA	Secure	Secure

5.6.4. Mammals.

Common name	Scientific name	Record	NSW	Australia
Common ringtail possum	*Pseudocheirus peregrinus*	ALA	Secure	Secure
Common brushtail possum	*Trichosurus vulpicula*	Pers. obs. ALA	Secure	Secure
Squirrel glider	*Petaurus norfolcensis*	ALA	Vuln.[1]	Secure
Platypus	*Ornithorhynchos anatinus*	ALA	Secure	Secure
Swamp wallaby	*Wallabia bicolor*	Pers. obs.	Secure	Secure
Large-footed myotis	*Myotis macropus*	ALA	Vuln.	Secure

[1] the Wagga Wagga population of *P. norfolcensis* is listed as endangered.

Willans Hill

2014 Flora and Fauna Survey

6. Willans Hill

6.1. Site Description

Willans Hill is a significant woodland reserve totalling 249 hectares, located in the centre of Wagga Wagga. The site is dominated by Wagga Wagga Hills Open Forest (DEC), an ecological community with a canopy of white box (*Eucalyptus albens*), Blakely's red gum (*Eucalyptus blakelyi*) and white cypress-pine (*Callitris glaucophylla*). Understorey is of variable quality, but several well-preserved remnants remain. These are dominated by golden wattle (*Acacia pycnantha*), showy parrot-pea (*Dillwynia sericea*), small-leaf bush-pea (*Pultenaea foliolosa*), black-anther flax-lily (*Dianella revoluta*), hill raspwort (*Gonocarpus elatus*), sticky everlasting (*Xerochrysum viscosum*), rock fern (*Cheilanthes sieberi*) and native grasses. Many additional native forbs, include several orchids, occur on Willans Hill. Only 15% of the estimated pre-1750 extent of the Wagga Wagga Hills Open Forest community remains.

Access to Willans Hill is available at several points. Major roads crossing the hill include Lord Baden Powell Dr., Redhill Rd. and Stanley St./Leavenworth Dr. The Wiradjuri Walking Track bisects the hill from roughly north to south.

6.2. Landcare Work

Willans Hill has been the site of frequent and extensive revegetation work beginning in the 1950s. Replanting by Wagga Wagga Urban Landcare in collaboration with Willans Hill Primary School and South Wagga Rotary began in 1997 and continued for two years. Multiple sites were used in these plantings, but many could not be located. The site selected for the purposes of this survey was the largest continuous area of replanting.

The survey site is located between Leavenworth Dr. and Redhill Rd. Revegetation work was carried out on both sides of the Wiradjuri Walking Track. The site extends for roughly 600 m, beginning near Leavenworth Dr. and Kunming Grove. Site GPS coordinates are -35.145475, 147.363920 (site midpoint). For site details, including a map, see pg. 80.

When seedlings were included in the headcount, roughly 1400 surviving plants were reported from the site. These were a mixture of local and non-local natives, chiefly *Acacia* spp. Several non-local *Acacia* species could not be satisfactorily identified and are grouped under "unknown wattles" in the headcount. Headcounts were further complicated by the tendency of many of these species to "sucker" – that is, to produce new stems vegetatively rather than by seed. The distinction between suckering stems and plants is not readily apparent *in situ*, and it was therefore necessary to estimate the total number of plants.

The site was surveyed on April 1 and 4, 2014 after first being divided into five sections. Headcounts were taken for each. These headcounts were then pooled to produce Table 6.1.

Table 6.1. Survivorship of plantings at Willans Hill

Common name	Scientific name	Height	Living	Dead	Survivorship
Cootamundra wattle	*Acacia baileyana*	1-4 m	58	-	100%
Box-leaf wattle	*Acacia buxifolia*	2-3 m	36	4	90%
Heart-leaf wattle	*Acacia cardiophylla*	2-3 m	122	2	98.4%
Silver wattle	*Acacia dealbata*	3-4 m	17	1	94.4%
Deane's wattle	*Acacia deanei*	0.5-3 m	615	23	96.4%
Western silver wattle	*Acacia decora*	1-2 m	36	-	100%
Currawang	*?Acacia doratoxylon*	3-4 m	3	-	100%
Early wattle	*Acacia genistifolia*	1.5-2 m	10	-	100%
Hakea wattle	*Acacia hakeoides*	2-3 m	14	-	100%
Hickory wattle	*Acacia implexa*	4-5 m	8	-	100%
Kangaroo thorn	*Acacia paradoxa*	1-3 m	37	2	94.9%
Golden wattle	*Acacia pycnantha*	0.5-3 m	29	1	96.7%
Varnish wattle	*Acacia verniciflua*	2-4 m	77	1	98.7%
Unknown wattles	*Acacia* spp.	Variable	226	3	98.7%
She-oaks	*Allocasuarina* spp. *Casuarina* spp.	1-6 m	36	6	85.7%
Blackthorn	*Bursaria spinosa*	2-4 m	26	-	100%
Bottlebrushes	*Callistemon* spp.	1-3 m	7	-	100%
Wedge-leaf hop-bush	*Dodonaea viscosa* subsp. *cuneata*	1-2 m	82	4	95.3%
Gum trees	*Eucalyptus* spp.	3-4 m	21	-	100%
Purple coral-pea	*Hardenbergia violacea*	<0.5 m	4	-	100%
Leafless indigo	*Indigofera adesmiifolia*	1 m	1	-	100%
Paperbarks	*Melaleuca* spp.	3 m	6	-	100%
UNKNOWN (DEAD)				44	-

Survivorship values exceeded 80% for all identifiable species. It should be noted, however, that these survivorship values are derived from observations of living and dead plants in the field, and do not account for dead individuals that cannot be seen or identified. The figures given may therefore be misleading. A total of 44 unidentifiable dead plants were reported from the site. Several of these had evidently been cut down, including some still in tree-guards, though the reason for their removal was not clear. It was not always possible to distinguish between replanting and the natural background vegetation. This is particularly true for *Acacia deanei*, *A. decora* and *Eucalyptus* spp.

Plantings in the north-western section of the site were extremely sparse, suggesting that large numbers of seedling died in this area. An area of burnt vegetation occurs in the south-western part of the site: 11 dead plants of *A. deanei* were recorded here.

Most species had attained their maximum sizes. Exceptions include *?Acacia doratoxylon*, *Casuarina* and *Allocasuarina* spp., and seedlings of *Acacia* spp. and *Dodonaea viscosa* subsp. *cuneata*. Surviving plants were in good condition, with a small number showing signs of localised senescence.

6.3. Flora

The background flora of the site varied significantly along its length. While some effort has been made to document this variation, a complete flora survey was impractical. General impressions and

significant species are recorded here. The site is divided here into five subsections. These have been mapped (pg. 80).

Several noxious weeds were reported from the site. These are indicated in **bold**.

6.4.1. North-east. No revegetation. This area is dominated by natural vegetation, with a canopy of *Eucalyptus* spp. (chiefly white box, *Eucalyptus albens*) and a herbaceous understorey featuring sticky everlasting (*Xerochrysum viscosum*), rock fern (*Cheilanthes sieberi*), hill raspwort (*Gonocarpus elatus*), wallaby grasses (*Rytiosperma* [formerly *Austrodanthonia*] spp.), and brush speargrass (*Austrostipa densiflora*). Many other native forbs and grasses occur in this area.

6.4.2. North-west. Sparse revegetation. This area is dominated by a grassy understorey with a significant herbaceous component, including both native and introduced species. Native species include common components of Wagga Wagga Hills Open Forest – namely wallaby grasses, brush speargrass, rock fern, sticky everlasting, and hill raspwort – and disturbance-tolerant species such as red grass (*Bothriochloa macra*), umbrella grass (*Digitaria* sp.), blue storkbill (*Erodium crinitum*), pigweed (*Portulaca oleracea*), hairy panic (*Panicum effusum*), and couch (*Cynodon dactylon*). Significant populations of the yellow rush-lily (*Tricoryne elatior*) occurred here, particularly on the lower slope.

Exotic species recorded here included **Paterson's curse (**Echium plantagineum*)**, flatweed (**Hypochaeris radicata*), quaking grass (**Briza maxima*), wild oat (**Avena fatua*), bromegrasses (**Bromus* spp.), prickly sowthistle (**Sonchus asper*), **broomrape (**Orobanche minor*)**, **Johnson grass (**Sorghum halepense*)**, mallow (**Malva* sp.), common heliotrope (**Heliotropium europaeum*), goose grass (**Eleusine tristachya*), fleabane (**Conyza bonariensis*) and skeleton weed (**Chondrilla juncea*). A large area of caltrop (**Tribulus terrestris*) occurs at the top of the slope.

6.4.3. East. Extensive revegetation, particularly on the steeper slopes. Native vegetation is sparse. Understorey is densely grassy, consisting largely of exotic species such as wild oat (**Avena fatua*) and bromegrasses (**Bromus* spp.). Also reported here were populations of **African boxthorn (**Lycium ferocissimum*)**, privet (**Ligustrum sinense* and **Ligustrum lucidum*), **sweet briar (**Rosa rubiginosa*)**, **St. John's wort (**Hypericum perforatum*)**, narrow-leaf plantain (**Plantago lanceolata*), khaki weed (**Alternanthera pungens*), cotoneaster (**Cotoneaster glaucophylla*), and firethorn (**Pyracantha* sp.). Further south, native canopy trees (*Eucalyptus* spp.) become more common, however the understorey remains highly degraded. Areas of horehound (**Marrubium vulgare*) occur in the south-eastern section.

6.4.4. West. Sparse revegetation. Areas of St. John's wort, privet, Johnson grass, blackberry nightshade (**Solanum nigrum*), narrow-leaf ash (**Fraxinus angustifolia*) and olive (**Olea europaea*) occur in the north, but native vegetation cover increases in the south. This includes canopy species (*Eucalyptus* spp. and white cypress-pine, *Callitris glaucophylla*) and the common forbs and grasses identified above, as well as scattered plants of the native bush-pea *Pultenaea foliolosa*. Further south, native species dominate.

6.4.5. South. Extensive revegetation. The understorey is grassy, with areas of African boxthorn and privet. Some native forbs occur here, including rock fern and hill raspwort, but these are sparse. A canopy of *Eucalyptus* spp. and white cypress-pine occurs in places.

6.4. Fauna

Willans Hill represents a significant remnant of woodland and open forest habitat in the centre of the City of Wagga Wagga. More than 100 native bird species and a range of reptiles and mammals have been recorded from the site. This list, drawn from personal observation (2010-2013) and *Atlas of Living Australia* (ALA) data, is given in 6.6 below.

Significant species recorded from the site include the diamond firetail (*Stagonopleura guttata*) and barking owl (*Ninox connivens*), both of which are declared *vulnerable* in New South Wales, and the superb parrot (*Polytelis swainsoni*), which is *vulnerable* nationwide.

Revegetation work on Willans Hill has provided a range of shrub and small tree habitats for wildlife. These plants have reached maturity and their habitat value will not increase. The current value of these plantings was assessed by means of bird surveys and incidental observations of other forms of animal life.

6.4.1. Birds. Two thirty-minute bird surveys were conducted at the site. Birds were recorded if they could be detected (either visually or by call) from within the planting. Species were recorded as occurring *in* or *near* the planting and a rough count was taken. Where possible, location and behavioural details were noted. The first survey was conducted in the early morning (0700) and the second in the evening (1900). Results are given in Table 6.2.

Table 6.2. Results of bird surveys for Willans Hill site

Common name	Scientific name	In	Near	A.M.	P.M.	Notes
Peaceful dove	*Geopelia striata*	N	Y	2?	-	By call, location unknown.
Common bronzewing	*Phaps chalcoptera*	N	Y	1	-	Near Leavenworth Dr.
Crested pigeon	*Ocyphaps lophotes*	Y	N	4	4	In NW grasses/forbs.
Nankeen kestrel	*Falco cenchroides*	Y	N	1	-	Flying overhead.
Collared sparrowhawk	*Accipiter cirrocephalus*	Y	N	-	1	In *Eucalyptus*.
Galah	*Eolophus roseicapillus*	Y	Y	20+	20+	Flying overhead.
Crimson (yellow) rosella	*Platycercus elegans flaveolus*	Y	Y	2	-	In NW grasses/forbs.
Eastern rosella	*Platycercus eximius*	Y	N	-	2	In SE grasses.
Southern boobook	*Ninox novaeseelandiae*	Y	N	-	5	In *Eucalyptus*. With young.
Superb fairy-wren	*Malurus cyaneus*	Y	N	6	2	In *Acacia paradoxa*.
Speckled warbler	*Cthonicola sagittata*	Y	N	2	-	In *Callitris glaucophylla*.
Weebill	*Smicrornis brevirostris*	Y	N	8?	-	In *A. deanei*, *Eucalyptus*, *C. glaucophylla*.
Yellow thornbill	*Acanthiza nana*	Y	N	6	6	In *A. deanei*.
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Y	N	3	-	In *A. deanei*.

Striated pardalote	*Pardalotus striatus*	N	Y	2?	-	By call, location unknown.
Western gerygone	*Gerygone fusca*	N	Y	1	-	Nearby *Callitris*.
Fuscous honeyeater	*Lichenostomus fuscus*	N	Y	3?	-	Nearby *Eucalyptus*.
White-plumed honeyeater	*Lichenostomus penicillatus*	Y	Y	2	2	*A. pycnantha* and nearby *Eucalyptus*.
Blue-faced honeyeater	*Entomyzon cyanotus*	N	Y	3	-	Nearby garden.
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	Y	Y	2	-	Flying overhead.
Rufous whistler	*Pachycephala rufiventris*	N	Y	2	-	By call, location unknown.
Grey shrike-thrush	*Colluricincla harmonica*	N	Y	2	-	By call, location unknown.
Australian magpie	*Cracticus tibicen*	Y	Y	6	8	In NW and SE grasses, and nearby gardens.
Pied butcherbird	*Cracticus nigrogularis*	N	Y	1	1	By call. Nearby *Eucalyptus*.
Pied currawong	*Strepera graculina*	Y	Y	12	3?	Flying overhead, roosting in *Eucalyptus*.
Grey fantail	*Rhipidura albiscapa*	Y	N	6	6	In *A. deanei*, *A. paradoxa*, *Eucalyptus*, *Callitris*.
Willie wagtail	*Rhipidura leucophrys*	Y	N	2	-	In *A. deanei*, *Eucalyptus*.
Australian raven	*Corvus coronoides*	N	Y	6	-	Flying nearby.
Magpie-lark	*Grallina cyanoleuca*	Y	N	2	-	In *Eucalyptus* and SE grasses.
Red-capped robin	*Petroica goodenovii*	N	Y	2	2	Near Leavenworth Dr.
Silvereye	*Zosterops lateralis*	Y	Y	6?	-	In *Eucalyptus*, gardens.
Welcome swallow	*Hirundo neoxena*	Y	Y	8?	-	Flying overhead.
Common blackbird	**Turdus merula*	Y	Y	6	6	In SE grasses, gardens.
Common starling	**Sturnus vulgaris*	N	Y	-	20+	Flying nearby.
Double-barred finch	*Taeniopygia bichenovii*	Y	N	8	8?	In *Callitris*, *A. deanei*. By call at night.
European goldfinch	**Carduelis carduelis*	N	Y	3	-	Flying nearby.
Native: 36. Introduced: 3.						

In all, 39 bird species were recorded, of which 36 were native.

The presence of small, insectivorous woodland birds – e.g. the double-barred finch, speckled warbler, red-capped robin and fuscous honeyeater – suggests that this site has high habitat value. Few birds made exclusive use of the revegetation works, however: most moved between planted and natural vegetation.

6.4.2. Mammals. Three mammal species were identified during the survey, of which two were introduced. A small flock of bats was observed but these could not be identified.

Table 6.3. Mammal species recorded from Willans Hill site

Common name	Scientific name	Count	Notes
Common brushtail possum	*Trichosurus vulpecula*	2	In nearby white box.
Rabbit	**Oryctolagus cuniculus*	3	In dense grasses (southeast).
Brown hare	**Lepus capensis*	1	In dense grasses (south).

The dense, weedy grasses on the southern and south-eastern sides of the site provide ample habitat for introduced herbivores such as the rabbit and hare. Abundant evidence of rabbit activity – in the form of diggings and scats – was noted.

6.4.3. Reptiles. Two reptile species were reported during the survey. Note that surveys were conducted during cooler weather when reptiles may be less active. The dense grasses and leaf litter, and the large insect population, offer valuable habitat for small reptiles.

Table 6.4. Reptile species recorded from Willans Hill site

Common name	Scientific name	Count	In	Near	Notes
Carnaby's wall skink	*Cryptoblepharus australis*	6	Y	Y	In grasses, leaf litter and on *Eucalyptus*.
Pale-flecked garden sun-skink	*Lampropholis guichenoti*	3	Y	Y	In grasses and leaf litter.

6.4.4. Insects. No formal insect surveys were conducted at the site. Six species of butterfly (*Junonia villida*, *Heteronympha merope*, *Papilio anactus*, *Zizina labradus*, *Vanessa itea*, and *Ocybadistes walkeri*), three species of dragonfly (*Diplacodes bipunctata*, *Hemicordulia tau* and *Orthetrum caledonicum*), and large populations of locusts, crickets and katydids were reported from the site. The diversity and density of these populations reflects the diversity of ecological niches within the site.

6.5. Issues and Future Work

Plantings within the site are now roughly 15-17 years old and have reached maturity. Additional regeneration from seed notwithstanding, the site is now "complete" – its habitat value will not increase significantly from this point onward. There is an opportunity, therefore, to assess the site and determine what it is lacking and what can be reasonably done to improve it. Some options are considered here.

6.5.1. Removal of tree-guards. Tree guards remain on many plants in the revegetation area and others are now loose. These could be removed to prevent the accumulation of litter. Litter is otherwise a minor problem within the site.

6.5.2. Removal of woody weeds. Significant populations of narrow-leaf privet, broad-leaf privet, African boxthorn and sweet briar occur in the site, as do scattered plants of olive, cotoneaster and firethorn. These could be profitably removed. Sweet briar and African boxthorn are noxious weeds in the Wagga area and should, where possible, be suppressed. Cootamundra wattle also occurs throughout the planting and is commonly regarded as an environmental weed.

6.5.3. Control of grass and herbaceous weeds. Large areas of the site are dominated by exotic grass and forb species and these could profitably be eradicated. In some cases control may be impractical or unwise. On the lower slope in the north-west of the site, for instance, native and exotic species exist in roughly equal proportions; thus, removal of weeds from this area may be at

the cost of natives. Large areas of caltrop can be found on the upper slope. The tough, spiny seeds of this species make it a significant pest. Spraying this species with herbicide and replanting with native shrubs, forbs or grasses (see 5.4) would significantly improve the site.

On the eastern slope, the understorey is dominated by dense swathes of exotic grass. Controlling these would likely require a combination of slashing, spraying and replanting. The steep angle of the slope may be an impediment.

6.5.4. Replanting in open spaces. While most of the site is dominated either by revegetation or by natural woodland, some open spaces remain. These are most noticeable on the north-western edge of the site, near Kunming Grove. The lower slope retains a relatively diverse array of native species and would ideally be left intact. The upper slope, however, is suitable for replanting (see site diagram, pg. 80). This would not only aid in the removal of weeds (see 6.5.3), it would enhance the biodiversity value of the site. Suitable species for this task include the trees *Eucalyptus albens*, *Callitris glaucophylla* and *Eucalyptus blakelyi*; the wattles *Acacia deanei*, *Acacia decora* and *Acacia pycnantha*; the shrubs *Dillwynia sericea*, *Pultenaea foliolosa* and *Dodonaea viscosa* subsp. *cuneata*; the forbs *Xerochrysum viscosum*, *Dianella revoluta* and *Hardenbergia violacea*; and the grasses *Austrostipa densiflora* and *Rytidospermum erianthum*. Additional species appropriate to the site could be determined by surveying nearby patches of remnant vegetation.

6.6. Fauna List for Willans Hill

These records have been compiled from personal observation between 2010 and 2013 (Pers. obs.) and *Atlas of Living Australia* (ALA) records within 1 km of the target site.

6.6.1. Birds.

Common name	Scientific name	Record	NSW	Australia
Brown quail	*Coturnix ypsilophora*	Pers. obs.	Secure	Secure
Stubble quail	*Coturnix pectoralis*	ALA	Secure	Secure
Australian wood duck	*Chenonetta jubata*	Pers. obs. ALA	Secure	Secure
Pacific black duck	*Anas superciliosa*	Pers. obs. ALA	Secure	Secure
Australian shelduck	*Tadorna tadornoides*	ALA	Secure	Secure
Rock dove	**Columba livia*	Pers. obs.	Introduced	
Peaceful dove	*Geopelia striata*	Pers. obs. ALA	Secure	Secure
Common bronzewing	*Phaps chalcoptera*	Pers. obs. ALA	Secure	Secure
Crested pigeon	*Ocyphaps lophotes*	Pers. obs. ALA	Secure	Secure
Tawny frogmouth	*Podargus strigoides*	ALA	Secure	Secure
White-faced heron	*Egretta novaehollandiae*	Pers. obs.	Secure	Secure
Australian white ibis	*Threskiornis molucca*	ALA	Secure	Secure
Brown falcon	*Falco berigora*	Pers. obs.	Secure	Secure
Nankeen kestrel	*Falco cenchroides*	Pers. obs. ALA	Secure	Secure
Peregrine falcon	*Falco peregrinus*	Pers. obs.	Secure	Secure

		ALA		
Black falcon	*Falco subniger*	ALA	Secure	Secure
Black kite	*Milvus migrans*	Pers. obs.	Secure	Secure
Whistling kite	*Haliastur sphenurus*	Pers. obs.	Secure	Secure
Black-shouldered kite	*Elanus axillaris*	Pers. obs.	Secure	Secure
Collared sparrowhawk	*Accipiter cirrocephalus*	Pers. obs. ALA	Secure	Secure
Brown goshawk	*Accipiter fasciatus*	ALA	Secure	Secure
Little eagle	*Hieraaetus morphnoides*	ALA	Secure	Secure
Painted button-quail	*Turnix varius*	Pers. obs.	Secure	Secure
Silver gull	*Chroicocephalus novaehollandiae*	ALA	Secure	Secure
Galah	*Eolophus roseicapillus*	Pers. obs. ALA	Secure	Secure
Long-billed corella	*Cacatua tenuirostris*	Pers. obs.	Secure	Secure
Sulphur-crested cockatoo	*Cacatua galerita*	Pers. obs. ALA	Secure	Secure
Cockatiel	*Nymphicus hollandicus*	Pers. obs. ALA	Secure	Secure
Rainbow lorikeet	*Trichoglossus haematodus*	Pers. obs. ALA	Secure	Secure
Superb parrot	*Polytelis swainsonii*	Pers. obs. ALA	V	V
Crimson (yellow) rosella	*Platycercus elegans flaveolus*	Pers. obs. ALA	Secure	Secure
Eastern rosella	*Platycercus eximius*	Pers. obs. ALA	Secure	Secure
Red-rumped parrot	*Psephotus haematonotus*	Pers. obs. ALA	Secure	Secure
Fan-tailed cuckoo	*Cacomantis flabelliformis*	Pers. obs. ALA	Secure	Secure
Pallid cuckoo	*Cacomantis pallidus*	Pers. obs.	Secure	Secure
Eastern koel	*Eudynamys orientalis*	ALA	Secure	Secure
Barking owl	*Ninox connivens*	ALA	V	Secure
Southern boobook	*Ninox novaeseelandiae*	Pers. obs.	Secure	Secure
Eastern barn owl	*Tyto javanica*	Pers. obs.	Secure	Secure
Sacred kingfisher	*Todiramphus sanctus*	Pers. obs. ALA	Secure	Secure
Rainbow bee-eater	*Merops ornatus*	ALA	Secure	Secure
Dollarbird	*Eurystomus orientalis*	ALA	Secure	Secure
Laughing kookaburra	*Dacelo novaeguineae*	Pers. obs. ALA	Secure	Secure
Brown treecreeper	*Climacteris picumnus picumnus*	Pers. obs. ALA	Secure[1]	Secure
White-throated treecreeper	*Cormobates leucophaea*	ALA	Secure	Secure
Superb fairy-wren	*Malurus cyaneus*	Pers. obs. ALA	Secure	Secure
White-browed scrubwren	*Sericornis frontalis*	Pers. obs.	Secure	Secure
Speckled warbler	*Cthonicola sagittata*	Pers. obs. ALA	Secure	Secure
Weebill	*Smicrornis brevirostris*	Pers. obs. ALA	Secure	Secure

Buff-rumped thornbill	*Acanthiza reguloides*	Pers. obs.	Secure	Secure
Inland thornbill	*Acanthiza apicalis*	ALA	Secure	Secure
Yellow thornbill	*Acanthiza nana*	Pers. obs. ALA	Secure	Secure
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Pers. obs. ALA	Secure	Secure
Spotted pardalote	*Pardalotus punctatus*	Pers. obs. ALA	Secure	Secure
Striated pardalote	*Pardalotus striatus*	Pers. obs. ALA	Secure	Secure
White-throated gerygone	*Gerygone olivacea*	ALA	Secure	Secure
Western gerygone	*Gerygone fusca*	Pers. obs. ALA	Secure	Secure
Yellow-faced honeyeater	*Lichenostomus chrysops*	Pers. obs.	Secure	Secure
Fuscous honeyeater	*Lichenostomus fuscus*	Pers. obs.	Secure	Secure
Yellow-tufted honeyeater	*Lichenostomus melanops*	ALA	Secure	Secure
Yellow-plumed honeyeater	*Lichenostomus ornatus*	ALA	Secure	Secure
White-plumed honeyeater	*Lichenostomus penicillatus*	Pers. obs. ALA	Secure	Secure
Brown-headed honeyeater	*Melithreptus brevirostris*	Pers. obs.	Secure	Secure
Blue-faced honeyeater	*Entomyzon cyanotus*	Pers. obs. ALA	Secure	Secure
Black-chinned honeyeater	*Melithreptus gularis*	ALA	Secure	Secure
Noisy miner	*Manorina melanocephala*	Pers. obs. ALA	Secure	Secure
Red wattlebird	*Anthochaera carunculata*	Pers. obs. ALA	Secure	Secure
Little friarbird	*Philemon citreogularis*	Pers. obs. ALA	Secure	Secure
Noisy friarbird	*Philemon corniculatus*	Pers. obs. ALA	Secure	Secure
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	Pers. obs. ALA	Secure	Secure
White-bellied cuckoo-shrike	*Coracina papuensis*	ALA	Secure	Secure
White-winged triller	*Lalage sueurii*	Pers. obs.	Secure	Secure
Crested shrike-tit	*Falcunculus frontatus*	Pers. obs. ALA	Secure	Secure[2]
Golden whistler	*Pachycephala pectoralis*	Pers. obs.	Secure	Secure
Rufous whistler	*Pachycephala rufiventris*	Pers. obs. ALA	Secure	Secure
Grey shrike-thrush	*Colluricincla harmonica*	Pers. obs. ALA	Secure	Secure
Olive-backed oriole	*Oriolus sagittatus*	ALA	Secure	Secure
Dusky woodswallow	*Artamus cyanopterus*	Pers. obs.	Secure	Secure
Australian magpie	*Cracticus tibicen*	Pers. obs. ALA	Secure	Secure
Pied butcherbird	*Cracticus nigrogularis*	Pers. obs. ALA	Secure	Secure
Grey butcherbird	*Cracticus torquatus*	ALA	Secure	Secure
Pied currawong	*Strepera graculina*	Pers. obs. ALA	Secure	Secure

Grey fantail	*Rhipidura albiscapa*	Pers. obs. ALA	Secure	Secure
Willie wagtail	*Rhipidura leucophrys*	Pers. obs. ALA	Secure	Secure
Australian raven	*Corvus coronoides*	Pers. obs. ALA	Secure	Secure
Restless flycatcher	*Myiagra inquieta*	ALA	Secure	Secure
Magpie-lark	*Grallina cyanoleuca*	Pers. obs. ALA	Secure	Secure
Jacky winter	*Microeca fascinans*	ALA	Secure	Secure
Eastern yellow robin	*Eopsaltria australis*	Pers. obs. ALA	Secure	Secure
Scarlet robin	*Petroica boodang*	Pers. obs. ALA	Secure	Secure
Red-capped robin	*Petroica goodenovii*	Pers. obs. ALA	Secure	Secure
Flame robin	*Petroica phoenicea*	ALA	Secure	Secure
Brown songlark	*Cincloramphus cruralis*	ALA	Secure	Secure
Rufous songlark	*Cincloramphus mathewsi*	Pers. obs. ALA	Secure	Secure
Silvereye	*Zosterops lateralis*	Pers. obs. ALA	Secure	Secure
White-backed swallow	*Cheramoeca leucosterna*	ALA	Secure	Secure
Welcome swallow	*Hirundo neoxena*	Pers. obs. ALA	Secure	Secure
Tree martin	*Petrochelidon nigricans*	ALA	Secure	Secure
Common blackbird	**Turdus merula*	Pers. obs. ALA	Introduced	
Common myna	**Sturnus tristis*	ALA	Introduced	
Common starling	**Sturnus vulgaris*	Pers. obs. ALA	Introduced	
Mistletoebird	*Dicaeum hirundinaceum*	ALA	Secure	Secure
Diamond firetail	*Stagonopleura guttata*	ALA	V	Secure
Double-barred finch	*Taeniopygia bichenovii*	Pers. obs. ALA	Secure	Secure
Zebra finch	*Taeniopygia guttata*	ALA	Secure	Secure
Red-browed finch	*Neochmia temporalis*	Pers. obs.	Secure	Secure
House sparrow	**Passer domesticus*	Pers. obs. ALA	Introduced	
Eurasian tree sparrow	**Passer montanus*	ALA	Introduced	
European goldfinch	**Carduelis carduelis*	Pers. obs. ALA	Introduced	

[1] *C. p. picumnus* is not threatened. *C. p. victoriae* is listed as vulnerable. Both occur in the Wagga area.
[2] Several subspecies of *F. frontatus* are threatened, but not the E. Australian form.

Native: 102. Introduced: 7.

6.6.2. Reptiles.

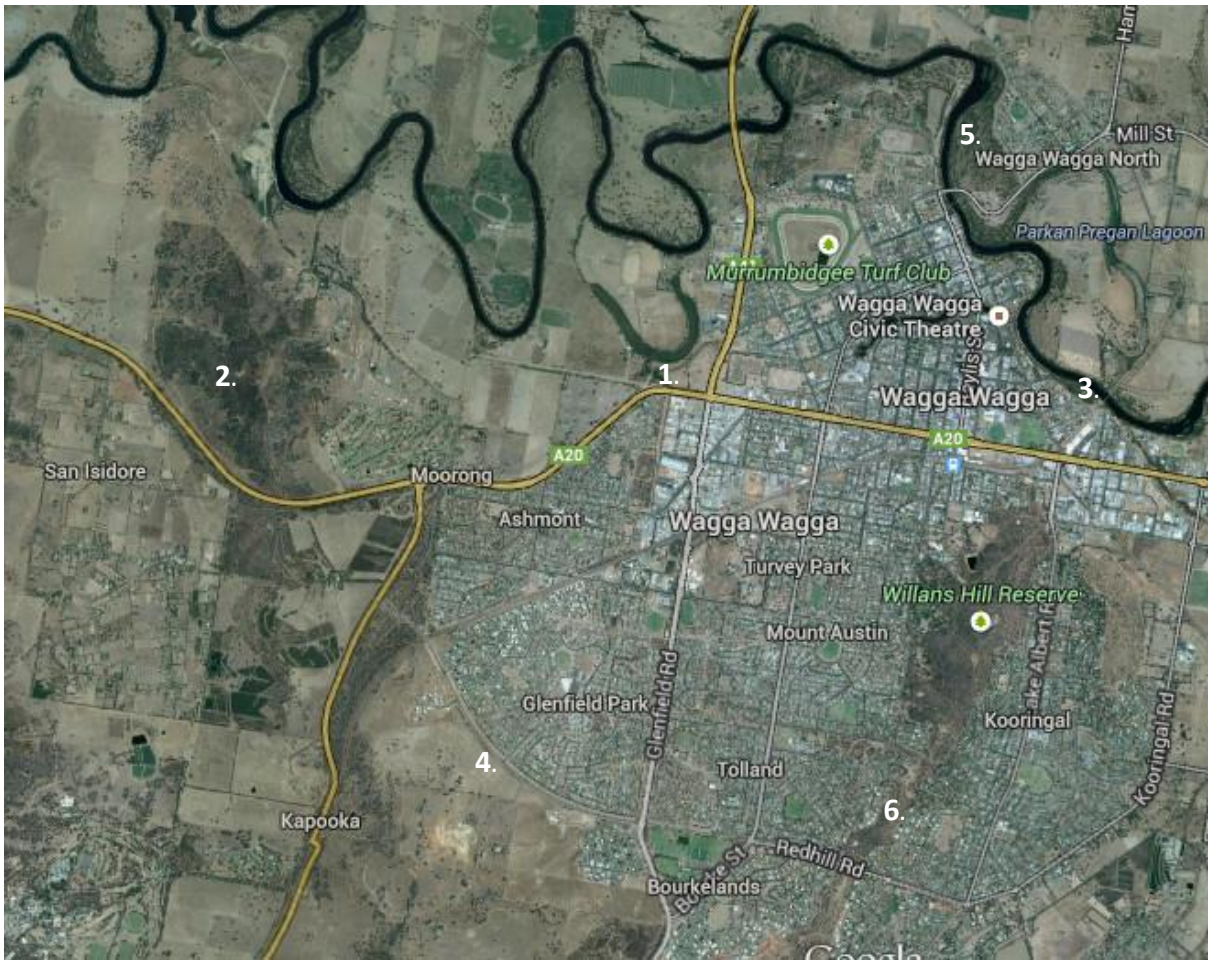
Common name	Scientific name	Record	NSW	Australia
Marbled gecko	*Christinus marmoratus*	Pers. obs.	Secure	Secure
Southern rainbow-skink	*Carlia tetradactyla*	Pers. obs. ALA	Secure	Secure

Carnaby's wall skink	*Cryptoblepharus australis*	Pers. obs.	Secure	Secure
Copper-tailed skink	*Ctenotus taeniolatus*	Pers. obs.	Secure	Secure
Pale-flecked garden sun-skink	*Lampropholis guichenoti*	Pers. obs.	Secure	Secure
Boulenger's snake-eyed skink	*Morethia boulengeri*	Pers. obs. ALA	Secure	Secure
Diamond python	*Morelia spilota*	ALA	Secure	Secure
Eastern brown snake	*Pseudonaja textilis*	Pers. obs.	Secure	Secure

6.6.3. Mammals.

Common name	Scientific name	Record	NSW	Australia
Common ringtail possum	*Pseudocheirus peregrinus*	ALA	Secure	Secure
Common brushtail possum	*Trichosurus vulpicula*	Pers. obs. ALA	Secure	Secure
Platypus	*Ornithorhynchos anatinus*	ALA	Secure	Secure
Eastern grey kangaroo	*Macropus giganteus*	Pers. obs. ALA	Secure	Secure
White-striped freetail bat	*Tadarida australis*	ALA	Secure	Secure
Cat	**Felis cattus*	Pers. obs. ALA	Introduced	
Fox	**Vulpes vulpes*	Pers. obs. ALA	Introduced	
Rabbit	**Oryctolagus cuniculus*	Pers. obs.	Introduced	
Brown hare	**Lepus capensis*	Pers. obs. ALA	Introduced	
House mouse	**Mus musculus*	Pers. obs. ALA	Introduced	

Site Maps and Overviews



Map of the Wagga Wagga area. Numbered areas correspond to survey sites (see below). (Map data ©Google).

The six sites included in this survey span the Wagga Wagga area and reflect the diversity of habitat types in the area. The relative position of these sites can be seen on the map above.

KEY

1. Flowerdale Lagoon. 2. Pomingalarna Reserve. 3. Railway Viaduct. 4. Red Hill Road. 5. Wilks Park. 6. Willans Hill.

Detailed maps and site overviews for each survey site are given in the following pages.

1. Flowerdale Lagoon

Flowerdale Lagoon is located in the north-west of Wagga Wagga. It is accessible via Edward St. West, which connects to the Olympic Hwy.

Map of Flowerdale Lagoon. Area highlighted in green is the revegetation area. The area with the greatest density of weedy species is marked in red. (Map data ©Google).

2. Pomingalarna Reserve

The two revegetation sites in Pomingalarna Park can be accessed via the main entrance on the Sturt Hwy. The main path bisects the lower slope planting, while Scalds Track bisects the upper slope planting.

Map of Pomingalarna Park sites. Highlighted areas are upper and lower slope sites. Road visible along on the base of the image is the Sturt Hwy. (Map data ©Google).

Map of Pomingalarna Park sites. Highlighted area is upper slope site. Areas marked with black hatching area are contour banks. (Map data ©Google).

The upper slope site consists of a series of plantings around contour banks built into exposed gravel. This is visible on a satellite image as an exposed patch. An approximate site diagram is given here.

3. Railway Viaduct

Railway Viaduct is located on the bank of the Murrumbidgee River next to the railway crossing. It can be accessed via the levee bank on Reddoch Dr., which connects via Day St. and Higgins Ave. to Tarcutta St.

Map of Railway Viaduct. Area highlighted in green is revegetation site. Areas marked with hatching show highest densities of seedling regeneration. (Map data ©Google).

4. Red Hill Road

Red Hill Rd. is a major thoroughfare through the southern half of Wagga Wagga. It can be accessed at many points, including the Olympic Highway and Kooringal Rd. The revegetation site extends roughly from the western point of Jubilee Park to Yentoo Dr. Shrub plantings begin at the quarry entrance (Lloyd side) and end roughly opposite Yentoo Dr. (visible in the upper left corner of the map image).

Map of Red Hill Rd. Areas highlighted in green are Lloyd planting (large) and Glenfield planting (small). White box planting can be seen as a widely spaced row of points on either side of Red Hill Rd. Areas marked in black are drainage lines. (Map data ©Google).

5. Wilks Park

Wilks Park is located on the banks of the Murrumbidgee River in North Wagga. It can be accessed via Hampden Ave. An unlocked gate connects the revegetation site to the caravan park.

Owing to seedling regeneration and transfer of seeds via flooding, the boundaries of the site are no longer contiguous and may not reflect the initial planting. Additionally, the areas marked on this map may not represent the full extent of re-vegetation as seedlings were reported some distance from the original site.

Note that while the native grass planting is marked on this map, no grasses were reported from the site and it is possible that no grasses persist there now.

Map of Wilks Park. Areas highlighted in green are patches of revegetation. Area in green with black hatching (southernmost point) is native grass planting. Areas in red are dominated by weeds. Area marked with black and white hatching is a burnt patch. (Map data ©Google).

6. Willans Hill

The Willans Hill revegetation site is most easily accessed from Leavenworth Dr. It occurs on both sides of the Wiradjuri Walking Track, but is most noticeable on the eastern slope of the hill.

Map of Willans Hill site. Outlined areas are those surveyed. Labels correspond to descriptions given in section 4. (Map data ©Google).

The outlined areas correspond to the descriptions given in section 4. A floristic survey for each area is given in sections 4.1 to 4.5. A general over-view is given here:

- NW. Revegetation is sparse. Understorey dominated by native and exotic grasses and forbs.
- NE. Remnant stand of Wagga Wagga Hills Open Forest. No revegetation.
- W. Mixed revegetation and remnant. Understorey largely native, especially at the southern limit.
- E. Dense revegetation. Understorey is dominated by exotic grasses. Several noxious weeds occur throughout.
- S. Dense revegetation. Understorey is dominated by exotic grasses with some natives. Several noxious weeds occur throughout.

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