



Wagga Wagga City Council
Wagga Wagga and North Wagga Wagga Murrumbidgee
River Levee Upgrades
Ecological assessment

23 November 2012

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Table of contents

1.	Introduction	1
1.1	The proposal	1
1.2	Purpose of this report	4
1.3	Assumptions.....	4
1.4	Subject site and study area	4
1.5	Existing environment	5
1.6	Legislative requirements.....	5
2.	Methods.....	8
2.1	Desktop review.....	8
2.2	Field survey.....	9
2.3	Assessment of the likelihood of occurrence	13
2.4	Likelihood of occurrence assessment criteria.....	14
3.	Results.....	16
3.1	Landscape context	16
3.2	Desktop review results	17
3.3	Flora	17
3.4	Vegetation communities	18
3.5	Fauna.....	21
3.6	Terrestrial fauna habitats.....	28
3.7	Aquatic fauna habitat.....	29
4.	Species, populations and communities of conservation concern	30
4.1	Matters of national environmental significance.....	30
4.2	State-listed species, communities and populations	30
5.	Potential impacts.....	32
5.1	Potential direct impacts	32
5.2	Indirect impacts	35
5.3	Cumulative impacts.....	36
5.4	Significance of potential impacts.....	36
6.	Safeguards and mitigation measures.....	39
7.	Conclusion	42
8.	References	43

Table index

Table 1: Proposed average and maximum increases in levee height.	1
Table 2: Zonings for the levee bank and borrow pits in the subject site under the Wagga Wagga LEP 2010	7

Table 3: Literature and database review.....	8
Table 4: Ecological survey effort for the proposal.....	10
Table 5: Confidence ratings applied to calls.....	13
Table 6: Assessment of the landscape value of vegetation in the study area	16
Table 7: Species known to occur in the study area and their listing under NSW (TSC Act and FM Act) and National (EPBC Act) legislation.....	17
Table 8: Noxious weeds in the study area	20
Table 9: Summary of Anabat analysis for each unit for each night deployed	22
Table 11: Threatened and migratory species and ecological communities that have the potential to be impacted by the proposal.....	30
Table 12: Tree categories and numbers to be removed	33
Table 13: Tree species and numbers to be removed	33
Table 10: Hollow bearing trees in the subject site to be removed	34
Table 14: Safeguards and mitigation measures to be implemented for the proposal	40

Figure index

Figure 1: The subject site and study area with the three proposed borrow pits.....	3
Figure 2: Flora and fauna surveys and threatened species records.....	15
Figure 3: River Red Gum forest in the subject site - along Marshall's Creek looking north-west	19
Figure 4: North Wagga Wagga borrow pit site showing remnant River Red Gum trees	19
Figure 5: Copland Street borrow pit site.....	20
Figure 6: Tasman Road borrow pit site	21
Figure 7: Vegetation proposed to be removed and hollow-bearing trees	23

Appendices

Appendix A Flora list
Appendix B Fauna list
Appendix C Hollow-bearing trees in the study area
Appendix D Habitat assessment table
Appendix E Significance assessments
Appendix F Database searches
Appendix G Habitat pruning techniques

Terms and acronyms

The following definitions are utilised throughout this report and should be referred to when interpreting the results in this document:

direct impacts – are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat (DEC 2004).

indirect impacts – occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas (DEC 2004).

life cycle – Is the series or stages of reproduction, growth, development and aging and death of an organism (DEC 2004).

likely – taken to be a real chance or possibility (DEC 2004).

locality – means the area within a 10 kilometre radius of the subject site.

local population – the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions.

- The *local population* of a threatened *plant* species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
- The *local population* of *resident fauna* species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
- The *local population* of *migratory or nomadic fauna* species comprises those individuals that are likely to occur in the study area from time to time.

In cases where multiple populations occur in the study area, each population should be assessed separately.

proposal – the action proposed to be undertaken. In this case the proposed upgrade of the Main City Levee, North Wagga Wagga Levee and East Street (Bank Two) Levee, including borrowing activities from the North Wagga Wagga borrow pit, Copland Street borrow pit and Tasman Road borrow pit.

region – means a biogeographical region that has been recognised and documented such as the Interim Biogeographical Regions of Australia (IBRA). The study area is located within the South West Slopes bioregion.

subject site – the area to be directly affected by the proposal (DEC 2004), in this case it encompasses the levee design, including the Main City Levee, North Wagga Wagga Levee and East Street (Bank Two) Levee. It also includes the construction footprint, stockpile areas and any areas that would be disturbed, including the North Wagga Wagga, Copland Street and Tasman Road borrow pit sites. This is an area of 47 hectares of which 31.3 hectares is in the three borrow pit sites

study area – means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account (DEC 2004). The study area incorporates the land within a 500 metre radius of the subject site.

threatened biota – those threatened species, populations or ecological communities listed under the TSC Act or the EPBC Act which are known or likely to occur in the study area.

threatened species – a species specified in Schedule 1 Part 1 (endangered species), Part 4 (presumed extinct) and Schedule 2 (vulnerable species) of the TSC Act or listed under the EPBC Act.

viable – the capacity to successfully complete each stage of the life cycle under normal conditions

1. Introduction

Wagga Wagga City Council proposes to upgrade the Wagga Wagga and North Wagga Wagga levees along the Murrumbidgee River. These levees include the Main City Levee, North Wagga Wagga Levee and East Street (Bank Two) Levee (Figure 1).

The proposal is required to increase the level of flood protection for residents and businesses of Wagga Wagga.

The proposal would raise the Main City Levee to provide flood protection for up to a 100 year average recurrence interval (ARI) flood event, and would raise the North Wagga Wagga Levee and East Street (Bank Two) Levee to provide flood protection for up to a 20 year ARI flood event.

The proposal is located adjacent to the Murrumbidgee River in Wagga Wagga, East Wagga Wagga and Koorinal (hereafter referred to in this ecological assessment as Central Wagga Wagga) and North Wagga Wagga.

1.1 The proposal

Key features of the proposed upgrade to the Wagga Wagga and North Wagga Wagga levees along the Murrumbidgee River include:

- Constructing the following levee types, with average increases in height of 66 centimetres to 83 centimetres:
 - Embankment levees
 - Sheet pile levees
 - Concrete wall levees
 - Hybrid levees (embankment/sheet pile, embankment/gabion wall and embankment/box culvert)
- Constructing spillways to enable large floods (higher than the proposed level of flood protection) to enter the protected areas in a controlled manner
- Upgrading levee crossings that are lower than the design flood protection level or that require structural improvement. These would include crossings for the Great Southern Railway, several major roads, and a number of minor roads and access roads.

The proposed average and maximum increases in height for each levee are provided in Table 1.

Table 1: Proposed average and maximum increases in levee height.

Levee	Average height increase (m)	Maximum height increase (m)
Main City Levee	0.76	3.03
North Wagga Wagga Levee	0.66	1.60
East Street (Bank Two) Levee	0.83	1.04

For earth embankment levees, increases in height would require levee widening. Generally, an increased height of 76 centimetres, with an upstream batter grade of four horizontal to one vertical and a downstream batter grade of two horizontal to one vertical, would require total widening to 4.5 metres. The amount of widening required for non-embankment levees and hybrid levees would be less.

Construction of the proposal would commence in 2014. Assuming no funding constraints, the proposal would be constructed sequentially over a period of about five years. Construction funding availability is uncertain however, and this may affect the timetable for delivery of the proposal.

It is anticipated that works would commence at the eastern end of the Main City Levee (chainage 9111) and progress to the western end of the levee (chainage 0). Works would commence on the North Wagga Wagga levee and East Street (Bank Two) Levee after completion of the Main City Levee.

Works would mostly involve earthworks to raise and extend the existing embankment levees, including:

- Increasing the height of the levees
- Flattening batters
- Improving compaction where necessary.

Other construction processes would include:

- Sheet pile installation
- Erection of gabion walls
- Raising and extending concrete retaining walls
- Placement of box culverts on Main City Levee (chainage 4930-4990)
- Construction of rockfill mattress lined spillways
- Raising road crossings
- Construction of flood gate support walls, footings, flood gate assemblies (commissioning stage) and storage shed.

On-site concrete works would be required for levee options requiring concrete structures (eg concrete retaining walls).

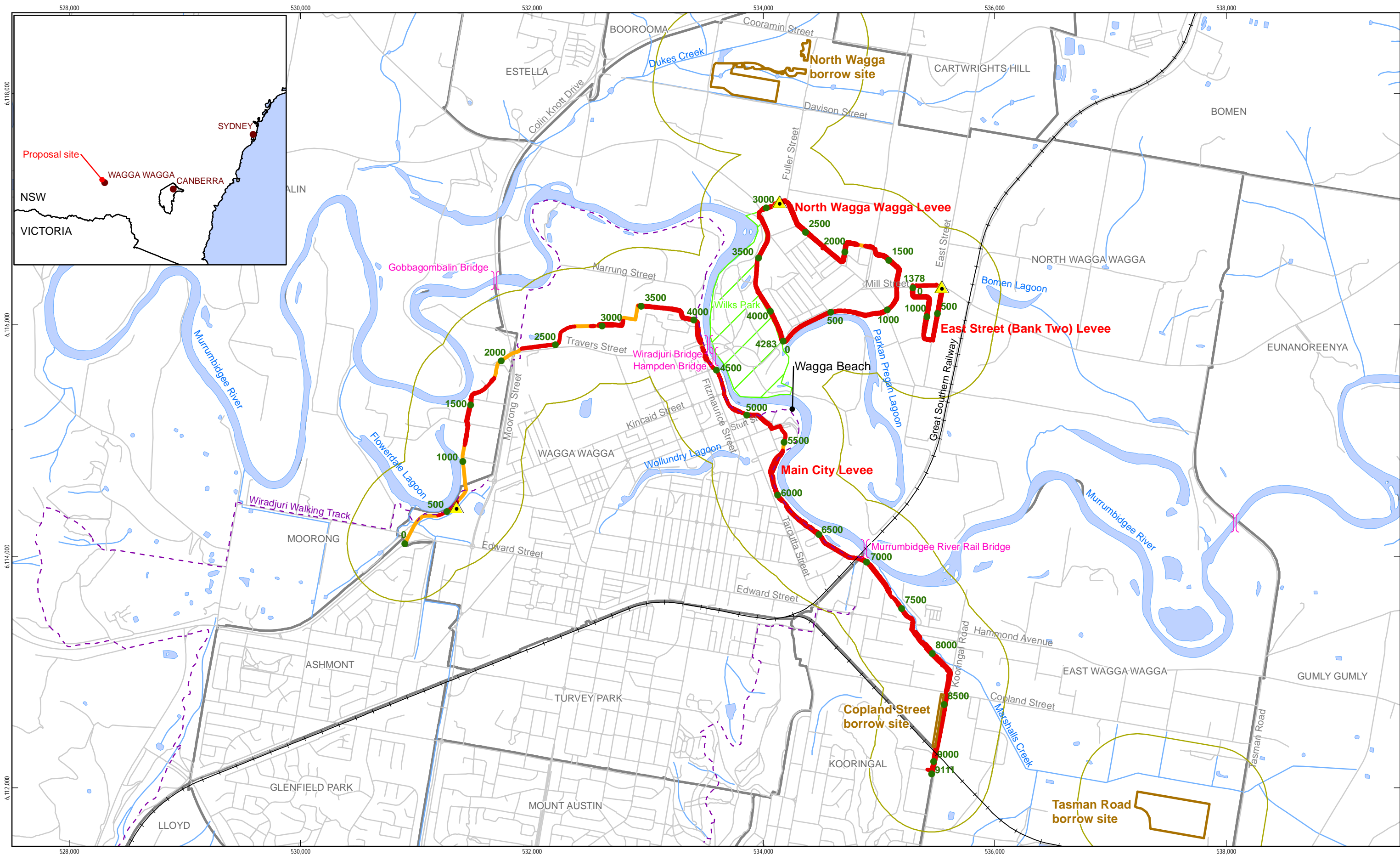
Wherever possible, native vegetation would be retained. The existing levees are generally free of trees and shrubs. The proposal would involve removal of trees, shrubs, groundcover and topsoil from the existing levees at various locations, and from adjacent land where the levees would be widened.

Earthworks would occur primarily where embankment levees would be upgraded. Excavation would involve stripping topsoil from the levees, and excavating the existing levee banks and foundations. Placement of fill would include placing and compacting fill for levee embankments, and placing and trimming random fill and topsoil.

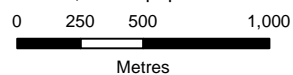
Earthworks would also be required for preparing the levee foundations before placing material. Topsoil stripped from the levees would be stockpiled and later used for rehabilitation and revegetation of the levee banks.

Materials required for the proposal would be sourced from three borrow sites (Figure 1), all owned by Council, including:

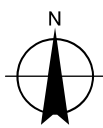
- North Wagga borrow site
- Copland Street borrow site
- Tasman Road borrow site.



1:30,000 @ paper size A3



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



LEGEND

- | | | | |
|---------------------------|-------------------------------|------------------------|--------------|
| ● Levee chainage (metres) | - - - Wiradjuri Walking Track | Proposed levee upgrade | □ Study area |
| ▲ Proposed spillway | — Drainage line | — Proposed works | □ Waterbody |
| ⌋ Bridge | — Railway line | — No works | ▨ Wilks Park |
| | — Road | ▭ Proposed borrow site | □ Suburb |



Wagga Wagga City Council
Wagga Wagga levee upgrade ecological assessment

Wagga Wagga and North Wagga Wagga levees subject site and study area

Job Number 23-14536
Revision 0
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Figure 1

1.2 Purpose of this report

GHD has been engaged by Council to undertake an ecological assessment for the proposal addressing relevant legislation (see section 1.6), including:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- NSW *Environmental Planning and Assessment Act 1979* (EP&A Act)
- NSW *Threatened Species Conservation Act 1995* (TSC Act)
- NSW *Fisheries Management Act 1994* (FM Act).

The primary objectives of the ecological assessment are to:

- Identify potential ecological constraints and opportunities, including in particular the known or likely presence of species, populations and ecological communities and their habitats listed under the Commonwealth EPBC Act, NSW TSC Act and NSW FM Act
- Identify the potential relevance of any matters of National Environmental Significance (NES) listed under the EPBC Act
- Identify the potential impacts of the proposal on threatened species, populations and ecological communities and their habitats
- Describe and map ecological communities present within the study area, including threatened ecological communities
- Assess the significance of impacts on threatened biota and matters of NES and identify whether further approvals under the EP&A Act and EPBC Act are required
- Consider the OEH policy of avoid, minimise and mitigate in considering the impacts of the proposal and development of mitigation measures
- Advise on potential development design options and specific mitigation and environmental management actions to avoid or minimise impacts on threatened biota and biodiversity values.

1.3 Assumptions

The services undertaken by GHD in connection with preparing this ecological assessment:

- Were limited to those specifically detailed in section 1.2 of this report
- Did not include preparation of a Species Impact Statement or Commonwealth Referral.

1.4 Subject site and study area

The subject site is 47 hectares (15.7 at the levee banks and 31.3 hectares at the three borrow pits) and is the area in which the upgrade of the levee banks would take place, including the three borrow pits.

The subject site of the Main City Levee generally follows a west to east direction from Chainage 0 in the west to Chainage 9111 in the east. The North Wagga Wagga residential area is enclosed by the subject site of the North Wagga Wagga Levee, from Chainage 0 to Chainage 4283, while the eastern residential area of North Wagga Wagga is enclosed by the subject site of the East Street (Bank Two) Levee, from Chainage 0 to Chainage 1378 (Figure 1). The levee totals 14.8 kilometres in length; 9.1, 4.3 and 1.4 kilometres, respectively.

The study area is defined as the area within 500 metres of the subject site as described above. The study area is located on the northern side of Wagga Wagga in southern NSW.

The terrain of the study area is flat throughout due to its location on the floodplain of the Murrumbidgee River. The Murrumbidgee River is the only major permanent water course in the study area. Marshall's Creek in the east of the study area is a permanent watercourse with most of the permanent water coming from the Koorinal Sewage Treatment plant after it has been treated and discharged to the creek. Two lagoons occur within the study area; Flowerdale Lagoon in the west and Parkan Pregon Lagoon in the east, which are currently near capacity due to flooding in March 2012.

1.5 Existing environment

The study area comprises a mix of residential and commercial premises, with agricultural land located to the north, east and west of the subject site. Areas zoned for public recreation, environmental conservation and primary production border the residential areas of North Wagga Wagga.

Native vegetation within the study area exists mostly as a thin riparian vegetation strip along the Murrumbidgee River corridor. Wilks Park is a reserve of about 59 hectares in the study area bound by the Murrumbidgee River to the west and North Wagga levee to the east. It is an important remnant patch of riparian vegetation, particularly for the conservation of threatened species. Vegetation throughout the study area and locality is patchily connected to the Murrumbidgee River riparian corridor.

1.6 Legislative requirements

This ecological assessment is required to aid in fulfilling the requirements of Part 5 of the NSW EP&A Act. The following legislation and State Environmental Planning Policies have been consulted and are relevant to the proposal:

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

In NSW, assessment of proposed development is prescribed by the EP&A Act and the EP&A Regulation. The proposal would be determined under Part 5 of the EP&A Act. Council is the determining authority.

The EP&A Act includes in Section 5A an assessment of significance, which uses seven factors to assist in determining if the proposed development or activity *'is likely to have a significant effect on threatened species, populations or ecological communities, or their habitats'*. These seven factors must be taken into account by a consent or determining authority when considering a development proposal or development application. This enables a decision to be made as to whether there is likely to be a significant effect on the species, population or ecological community, and hence if a Species Impact Statement (SIS) is required.

1.6.2 NSW Threatened Species Conservation Act 1995 (TSC Act)

The TSC Act lists a number of threatened species, populations or ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. If a species of flora or fauna listed in Schedule 1 or 2 of the TSC Act is identified, a review must be undertaken of the factors set out to establish if there is likely to be a significant effect on that species, population, ecological community or habitat. If any of these could be impacted by the proposal, an assessment of significance that addresses the requirements of section 5A of the EP&A Act must be completed to determine the significance of the impact. If a significant impact on a threatened species, population or ecological community is likely, a SIS must be completed and consultation with the NSW Office of Environment and Heritage (OEH) is required.

1.6.3 NSW Fisheries Management Act 1994 (FM Act)

The FM Act aims to conserve, develop and share the fishery resources of the State for the benefit of present and future generations including conserving fish stocks and fish habitat and promoting ecologically sustainable development.

The FM Act requires an assessment of whether threatened species of fish and marine vegetation, populations or ecological communities listed under the Act are likely to be affected by the proposal. If a significant impact on a threatened species, population or ecological community is likely, a SIS must be completed and consultation with NSW Department of Primary Industries (Fisheries and Aquaculture) is required.

1.6.4 State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas (*Phascolarctos cinereus*). SEPP 44 also aims to ensure a permanent free-living population of Koalas over their present range, and reverse the current trend of Koala population decline by:

- Requiring the preparation of plans of management before development consent can be granted in relation to areas of core Koala habitat
- Encouraging the identification of areas of core Koala habitat
- Encouraging the inclusion of areas of core Koala habitat in environment protection zones.

While SEPP 44 does not apply under Part 5 of the EP&A Act, this REF considers the intent of the SEPP.

SEPP 44 applies to each local government area (LGA) listed in Schedule 1, which includes the Wagga Wagga LGA. Schedule 2 of SEPP 44 lists preferred feed tree species of the Koala, including River Red Gum (*Eucalyptus camaldulensis*).

River Red Gum constitutes at least 15 per cent of the total number of trees in the upper or lower strata of the tree component within the study area. As a result the habitat in the study area comprises potential Koala habitat as defined under SEPP 44.

The habitat assessment (see Appendix D) found that the Koala is unlikely to inhabit the study area due to a lack of recent local records. The species has not been reliably recorded in the Wagga Wagga LGA since the mid 1960's.

The study area is therefore unlikely to contain core Koala habitat, defined by SEPP 44 as '*an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.*'

1.6.5 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act provides a mechanism for assessing the environmental impact of activities and developments, where matters of national environmental significance (NES) may be affected by the proposed activities.

If the proposal is likely to have a significant impact on a matter of NES it must be referred to the Commonwealth Minister for the Environment. After the Referral is completed and assessed, the Commonwealth Minister may determine that no further assessment is required, accredit the assessment of the proposal in accordance with the NSW Planning system under the bilateral agreement, or require additional assessment and approval under the EPBC Act.

Matters of NES relevant to this ecological assessment include:

- Migratory species protected under international agreements
- Ramsar wetlands of international importance
- Listed threatened species and communities.

Under the EPBC Act a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of NES or the environment of Commonwealth land.

1.6.6 Wagga Wagga Local Environment Plan 2010 (Wagga Wagga LEP 2010)

Under the Wagga Wagga LEP 2010, the levee bank and three borrow pits sites have a number of different zonings (Table 2).

Table 2: Zonings for the levee bank and borrow pits in the subject site under the Wagga Wagga LEP 2010

Location	Location	Area (ha)
Main City Levee	B3 – Commercial Core	0.05
	IN1 – General Industrial	1.98
	IN2 – Light Industrial	0.47
	R1 - General Residential	0.05
	R3 – Medium Density Residential	0.35
	RE1 – Public Recreation	2.53
	RE2 – Private Recreation	0.002
	RU1 – Primary Production	0.93
	SP1 – Special Activities	0.25
	SP2 – infrastructure	2.19
	North Wagga Wagga Levee	RE1 – Public Recreation
RU1 – Primary Production		2.74
RU5 – Village		1.7
East Street (Bank Two) Levee	RU1 – Primary Production	2.25
	RU5 – Village	0.01
North Wagga Wagga borrow pit	RU1 – Primary Production	13.67
Copland Street borrow pit	IN1 – General Industrial	1.01
Tasman Road borrow pit	RE1 – Public Recreation	6.40
	IN2 – Light Industrial	10.22

2. Methods

2.1 Desktop review

2.1.1 Database review

A search of relevant databases was conducted to obtain records of threatened and migratory species, populations and ecological communities within the locality. The search included all species, populations and ecological communities listed under the NSW TSC Act, FM Act and Commonwealth EPBC Act with the potential to occur in the locality (Table 3).

Table 3: Literature and database review

Literature / database	Reference	Search date	Search radius
NSW OEH Wildlife Database Atlas – licensed data for Wagga Wagga LGA	NSW National Parks and Wildlife Service	21 September 2012	10 km
EPBC Act Protected Matters Search Tool	Department of Sustainability, Environment, Water, Population and Communities	20 September 2012	10 km
BioBanking Credit Calculator search for species and communities known or predicted to occur in locality	NSW Office of Environment and Heritage	25 September 2012	N/A
Fishing and Aquaculture Records viewer	NSW Department of Primary Industries – Fishing and aquaculture	19 October 2012	LGA
Threatened species, populations and ecological communities of NSW	NSW Office of Environment and Heritage	N/A	N/A
Species profile and threats database	Department of Sustainability, Environment, Water, Population and Communities	N/A	N/A
Noxious Weed Declarations – Wagga Wagga Control Area	NSW Department of Primary Industries	25 September 2012	N/A

A database search assists in overcoming some of the limitations associated with a short survey period, survey timing and the types of survey methods employed. A more comprehensive level of data can be obtained with the assistance of a database search. Other recent reports reviewed included:

- Paterson Britton and Partners (2004). Wagga Wagga riverbank protection stage 1 emergency works. Unpublished report prepared for Wagga Wagga City Council.
- GHD (2010). Murrumbidgee River rock protection works. Review of Environmental Factors. Unpublished report prepared for Wagga Wagga City Council.

- David Read – Wagga Wagga City Council, Biodiversity Officer. Personal communications regarding previous locations of threatened species records.

2.2 Field survey

2.2.1 Survey effort

Flora and fauna field surveys were conducted by two ecologists from 3 September to 4 September 2012, with Anabat detector surveys conducted between 24 September and 26 September 2012. Where appropriate, field surveys were conducted with reference to *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (DEC 2004).

The primary objectives of the field surveys were to:

- Determine the extent of vegetation removal resulting from the proposed works;
- Determine the presence and/or potential for threatened flora and fauna species, populations and ecological communities, listed under the NSW TSC Act and Commonwealth EPBC Act, and their habitats to occur in the study area;
- Determine the value of the habitat in the study area for flora and fauna species, particularly for threatened species and species of conservation significance, and describe potential impacts that would result from the proposed works; and
- Describe the flora and fauna species, habitat, populations and ecological communities in the study area in relation to their occurrence and quality in the locality. This included reference to aerial photographs and vegetation mapping.

[Survey effort for the proposal is summarised in](#)

Table 4 and Figure 2.

2.2.2 Flora

Flora surveys were conducted within the subject site and study area using a random meandering transect and quadrat surveys. For the transect survey, the random meander technique (Cropper 1993) was conducted throughout the subject site and study area to search likely habitat for flora. As rare plants often exist in discrete populations in specific areas, a random search can increase the probability of finding rare plant populations. A random search effort also encompasses a greater portion of the landscape, as the search is not limited to specific areas (only the stratification unit), and is useful in surveying difficult terrain and irregular shaped search areas.

Three quadrats of dimensions 50 metres by 20 metres were surveyed in the study area. Within each plot the vegetation and habitat characteristics, and land tenure were recorded. The following information was recorded:

- Description of native vegetation
- Dominant canopy vegetation
- Dominant understorey vegetation
- Age structure
- Groundcover species and abundance
- Any signs of previous disturbance and grazing.

Table 4: Ecological survey effort for the proposal

Method	Effort
Flora	
Random meander transect – recording incidental species in the subject site and study area	<ul style="list-style-type: none"> The entire subject site was walked, including areas of potential vegetation clearing and adjacent study area. Approximately 15 person-hours
Floristic quadrats	<ul style="list-style-type: none"> Three 20 m x 50 m quadrats
GPS location records for all hollow-bearing trees within the subject site and within 10 metres of the subject site in the study area	All trees with the potential to be removed or on the edge of the subject site were surveyed, including identification of tree species, diameter at breast height and number and size of hollows.
Fauna	
Habitat assessment	Potential fauna habitat identified within areas of potential vegetation clearing and adjacent areas.
Diurnal birds	<ul style="list-style-type: none"> Five x 30-minute two hectare transects. Approximately 2.5 person-hours. Incidental observations.
Microchiropteran bats	<ul style="list-style-type: none"> Echolocation survey – all night echolocation detection using two Anabat detectors for two nights in four locations. Approximately 40 hours of remote detection.
Arboreal mammals and nocturnal birds	<ul style="list-style-type: none"> Spotlighting over two consecutive nights by two people throughout the study area. Approximately 8 person-hours. Roost watching for 30 minutes prior to spotlighting. Approximately 2 person-hours. Incidental observations.
Reptiles and amphibians	<ul style="list-style-type: none"> Daytime searches of water habitats and other potential habitats including logs, rocks etc. Approximately 2 person-hours Spotlighting over two consecutive nights by two people throughout the study area. Approximately 8 person-hours Incidental observations.

Vegetation types within the subject site and the surrounding study area were identified according to the NSW Plant Community Type (PCT) (OEH 2012b) and classification and condition classes assigned according to the BioBanking definition of low condition vegetation (DEC 2009):

- Native woody vegetation with an overstorey percent foliage cover less than 25 per cent of the lower value of the over storey percent foliage cover benchmark for that vegetation type

- Native woody vegetation where less than 50 per cent of vegetation in the ground layer is indigenous species
- Native grassland where less than 50 per cent of vegetation in the ground layer is indigenous species
- Native woody vegetation or grassland where less than 90 per cent is ploughed or fallowed.

2.2.3 Vegetation communities

Surveys of vegetation communities across the subject site were undertaken to characterise vegetation formation, class, structure and condition. Plant community composition is especially important in relation to those areas that have the potential to be a threatened ecological community.

Flora surveys enabled determination of the composition and extent of ecological communities occurring in the study area. The study area was investigated by random meandering transect to identify vegetation communities present and to identify any areas with the potential to be classified as a threatened ecological community.

2.2.4 Tree removal

The location of all hollow-bearing trees in the subject site that would be removed by the proposal, or had the potential to be impacted, were recorded using a GPS and notes were taken on species, diameter at breast height (dbh), size and number of hollows, and distance from the edge of the subject site.

2.2.5 Fauna

Fauna surveys comprised diurnal bird surveys, habitat assessment for all fauna groups, observations of fauna signs, spotlighting and Anabat detection. Fauna habitat resources were assessed to identify areas of potential habitat within the study area. Specific resources such as shelter, basking, roosting, nesting and foraging sites for birds, bats, arboreal mammals, amphibians, ground-dwelling mammals and reptiles were noted. Particular attention was given to the location of hollow-bearing trees and the number and size of hollows in each tree within the subject site.

Habitat details recorded included:

- Presence/absence of:
 - Hollow-bearing trees (potential den/nest/roost sites for arboreal mammals, hollow-nesting birds and microchiropteran bats)
 - Feed trees (eg *Allocasuarina* spp. and mistletoe)
 - Roost sites (hollow-bearing trees or caves/rocky outcrops for bats)
 - Waterbodies (amphibians)
 - Nests (birds)
 - Rocky outcrops and ground debris (reptiles)
 - Other features likely to provide potential habitat for threatened fauna.

Searches for potential mammal, amphibian, and reptile habitat were undertaken and recorded during flora surveys and bird surveys. Opportunistic sightings of all fauna species were also recorded.

Birds

Bird surveys were conducted throughout the study area on the morning and afternoon of 4 and 5 September 2012. These involved walking through areas of potential bird habitat, and stationary surveys. Birds were identified by direct observation and call identification.

In addition to the dedicated bird surveys, any additional species observed at other times (such as during flora surveys) were recorded as opportunistic observations.

Observation of fauna signs

Any indirect evidence of fauna (i.e. scats, feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash) was recorded.

Spotlighting

The Squirrel Glider (*Petaurus norfolcensis*) is known to occur in the subject site and parts of the study area and wider locality. In the subject site, this species has been identified during spotlighting and identification of a dead specimen (D. Read pers. comm 2012). Individuals are known to occur at Wilks Park (North Wagga flats) in the study area. A number of studies have documented records of the species in the wider locality (CSU 2002, CSU 2003 and CSU 2005, GHD 2012).

No trapping was undertaken for the Squirrel Glider in this study as the species is known to occur in the subject site and suitable habitat is present. Spotlighting techniques were used to supplement previous surveys, as these techniques are less intrusive than trapping when the species is already known to occur. Unless a designed survey with specific aims is required e.g. determining crossing points etc, it is assumed the species is present and further trapping would only confirm this. Current surveys consisted of a random meander technique through areas of suitable habitat on two survey nights, with particular focus on potential habitat trees. This involved two people spotlighting over three sites for a total of six person-hours and recording all fauna calls and observations.

Anabat detection

Two Anabat detectors were used for two survey nights with each placed at a different site on each night. Surveys were completed at four locations, for one night in each during September within the study area. The units were placed in potential fly-ways of bats and near water. Data was analysed for identification of bat species recorded. Craig Grabham (GHD) undertook analysis of all bat calls.

Bat calls were recorded during field surveys using Anabat detectors (Titley Scientific Brisbane). Data from each detector was downloaded via the CF card using CFCread (Corben 2011). Calls were identified using zero-crossing analysis and AnaloookW software (version 3.8s, Chris Corben 2011) by visually comparing the sonogram and call characteristics (e.g. characteristic frequency and call shape) with reference calls and/or species call descriptions from published guidelines.

The *Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay *et al.* 2004) and the authors own reference call collection was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Pennay *et al.* 2011; Churchill 2008; van Dyck and Strahan 2008) and records from the Atlas of NSW Wildlife (OEH 2012a). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of four or more consecutive pulses of similar frequency. Calls with less than four defined pulses were excluded from the analysis. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills *et al.* 1996 & Duffy *et al.* 2000) as

summarised in Table 5. Due to the high level of variability and overlap in call characteristics, a conservative approach was taken when analysing calls.

Species nomenclature follows Pennay *et al.* (2011), then van Dyck and Strahan (2008).

Table 5: Confidence ratings applied to calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail.
Species Group	Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species e.g. <i>Chalinolobus gouldii</i> / <i>M. Mormopterus</i> sp. <i>Nyctophilus</i> spp. The calls of <i>Nyctophilus geoffroyi</i> and <i>N. gouldi</i> cannot be distinguished during the analysis process and are therefore grouped together.

2.2.6 Survey timing and potential limitations

Surveys were undertaken during an optimal survey period for most species. Surveys were undertaken in early September when many plant species have begun flowering in the locality making them easier to detect. An assessment of the suitability of habitat and a likelihood of occurrence was conducted for species that were not detectable at the time of the survey, but which had the potential to occur at a site.

Some fauna species are mobile and transient in their use of resources. Consequently, it is likely that not all species either resident or transitory to the site would have been recorded during the field surveys. The disadvantage of this limitation was reduced by undertaking database searches and referring to previous ecological surveys in the locality. It was also reduced by assessing the habitat value of the study area for threatened and migratory species known to occur in the wider area to determine their likelihood of occurrence.

The survey was not designed to enable all species to be detected. The aim was to provide an overall assessment of the ecological values of the study area with emphasis on threatened and migratory species. This allowed an assessment of the potential impacts of the proposal. An assessment of the likelihood of occurrence was made on species of conservation significance that were not detected but with the potential to occur, based on known habitat requirements. An assessment of significance was conducted for threatened and migratory species that may depend on the habitat resources in the study area where a possibility of impact was considered likely.

2.3 Assessment of the likelihood of occurrence

An assessment of the likelihood of occurrence was completed to review whether threatened species, migratory species, and ecological communities may occur within the study area, and whether the proposal has the potential to have an impact on each species and ecological community. The literature review and database search identified a number of species and communities listed as threatened or migratory under the TSC Act and EPBC Act that may occur in the study area (see section 4). The dates and sources of observation records were reviewed in order to assess the accuracy and relevance of each record.

Profiles were reviewed for each of the threatened biota using the information from the OEH (2012a) threatened species website, the DSEWPaC (2011) species profile and threats database

and other sources where information was available. These profiles provide information on ecological requirements and other characteristics including statewide, regional, and local abundance and distribution; and habitat requirements, including home range, feeding, roosting and breeding requirements.

In assessing which of these species, populations and communities are 'likely' to occur within the study area the following factors were taken into consideration:

- The presence of potential habitat within the study area
- Condition and approximate extent of potential habitat within the study area
- Species occurrence within the locality and region (including results of current and previous surveys and results of database searches and literature review).

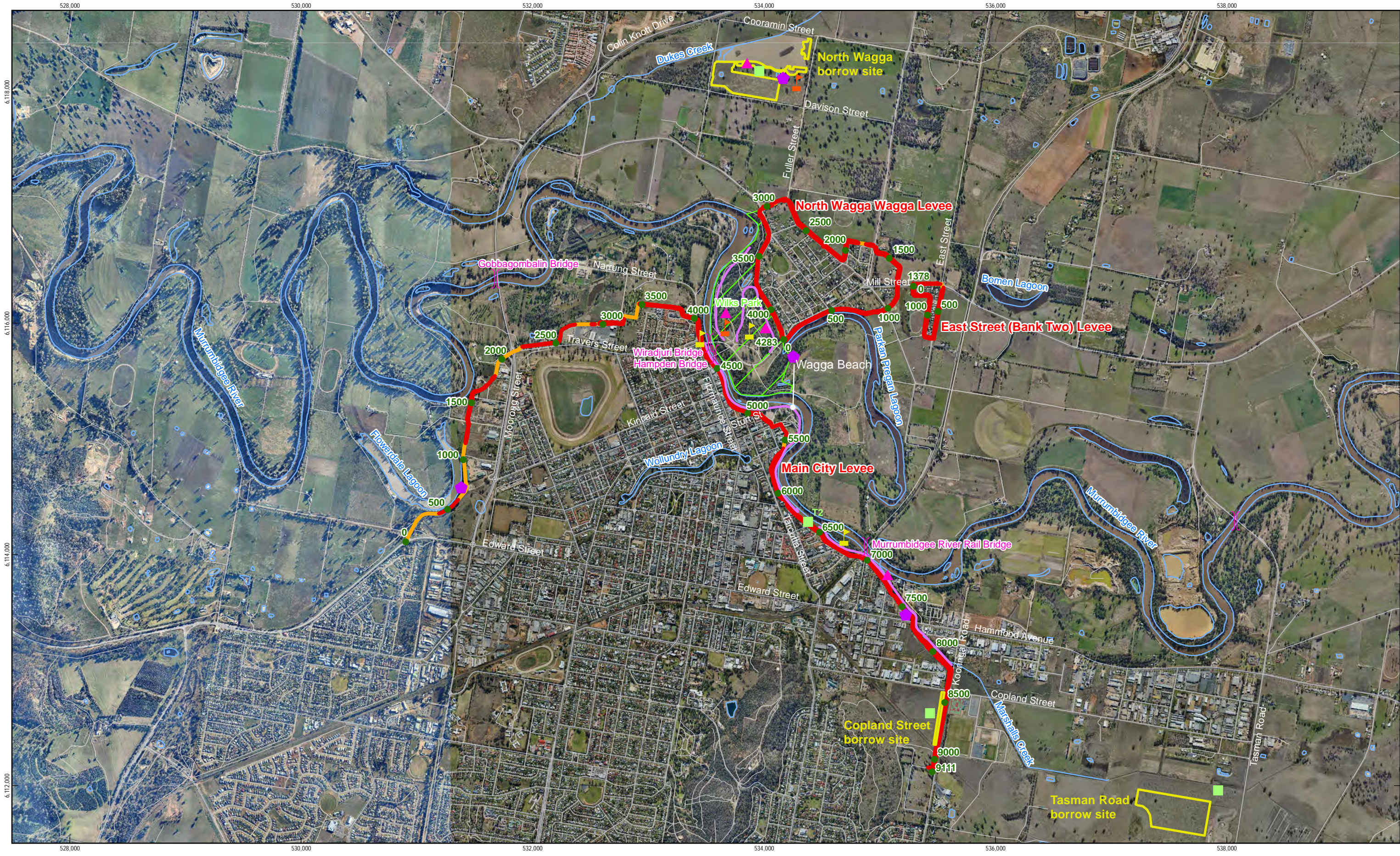
2.4 Likelihood of occurrence assessment criteria

The criteria used for the assessment of the likelihood of occurrence, and their meanings are as follows:

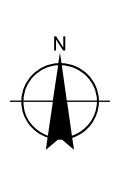
- Unlikely – species, population or ecological community is not likely to occur. Lack of previous records and suitable potential habitat limited or not available in the study area
- Likely – species, population or ecological community could occur and study area is likely to provide suitable habitat. Previous records in the locality and/or suitable potential habitat in the study area
- Present – species, population or ecological community were recorded during the field investigations or are otherwise known to occur.

In addition, the possibility of impact by the proposal on threatened biota was assessed, and therefore whether an EP&A Act assessment of significance and/or EPBC Act significance assessment is required to assess the significance of the impact. This assessment was assigned as follows:

- Unlikely – the proposal would be unlikely to impact this species, population or ecological community or its habitats. No EP&A Act assessment of significance and/or EPBC Act significance assessment is necessary for this species, population or ecological community
- Likely – the proposal could impact this species, population or ecological community or its habitats. An EP&A Act assessment of significance and/or EPBC Act significance assessment is required for this species, population or ecological community.



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 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 55



LEGEND
 Flora quadrat
 Bird survey
 Anabat survey
 Levee chainage (metres)

Threatened species observation
 Brown Treecreeper
 Superb Parrot

Bridge
 Spotlight survey
 Road
 Creek

Proposed levee upgrade
 Proposed works
 No works

Proposed borrow site
 Waterbody
 Wilks Park



Wagga Wagga City Council
 Wagga Wagga levee upgrade ecological assessment

Flora and fauna surveys and threatened species records

Job Number 23-14536
 Revision 0
 Date 23 Nov 2012

Figure 2

3. Results

3.1 Landscape context

The study area occurs within the jurisdiction of the Murrumbidgee Catchment Management Authority (CMA), within the Murrumbidgee – Tarcutta Channels and Floodplains Mitchell landscape. Ninety-one percent of the Murrumbidgee – Tarcutta Channels and Floodplains landscape has been cleared within the Murrumbidgee CMA area, and it is therefore considered to be an over-cleared landscape (i.e. greater than 70 per cent cleared) (DEC 2005).

Native woodland exists along the riparian corridor of the Murrumbidgee River along the length of the subject site, extending into Wilks Park and Wiradjuri Reserve at the north-eastern end. The North Wagga Wagga borrow pit site contains sparse remnant woodland with the roadside reserve adjacent to the site also containing remnant woodland.

A brief landscape analysis was conducted in order to gauge the landscape value of the vegetation in the study area. The landscape assessment has taken into account the spatial configuration of vegetation, vegetation cover, connectivity and adjacent native vegetation.

Vegetation within a two kilometre radius of the subject site was viewed using satellite imagery. This analysis is strictly limited to an analysis of the overstorey vegetation. The class and quality of overstorey were not comprehensively assessed for vegetation in the surrounding landscape. The assessment method detailed in DEC (2009) was used to assess the landscape value of the vegetation in the study area, as described in Table 6.

The geology of the study area consists of an unnamed Quaternary formation evident throughout the subject site. The formation consists of alluvium-gravel, sand, silt and clay. Quaternary deposits of the same materials also occur throughout the subject site.

Table 6: Assessment of the landscape value of vegetation in the study area

Landscape value	Subject site
Size/Shape	The subject site covers an area of 47 hectares (including 31.3 hectares at the three borrow pits) and is linear in shape for the Main City Levee and encompasses the main and eastern residential areas of North Wagga Wagga for the remaining two levees.
Location in landscape	The study area occurs within the city of Wagga Wagga and is surrounded by agricultural, commercial and residential land. The Murrumbidgee River runs through the study area.
Per cent cover native vegetation within two kilometre radius of site	<10 per cent
Connectivity value	<p>The subject site includes vegetation that:</p> <ul style="list-style-type: none"> • Is in low to moderate condition • Has an average width less than 10 metres • Links to surrounding native vegetation on two compass quarters of the proposal. <p>The connectivity value is therefore moderate.</p>
Next nearest remnants, distance, size and connectivity	Wilks Park is in the study area. Willans Hill occurs about two kilometres south of the study area, is zoned E2 (Environmental Protection) and links the riparian habitat of the river to a number of other reserves in the area. The next nearest remnant is Pomingalarna Park about 2.8 kilometres west of the subject site, which has an area of about 225

Landscape value	Subject site
	hectares. Silvalite Reserve is about three kilometres south-west of the subject site and has an area of about 60 hectares.
Distance to nearest large remnant > 1000 hectares	Murrumbidgee Valley National Park (Berry Jerry Precinct) is located about 22 kilometres west of the study area and has an area of 1197 hectares. Livingstone National Park is located about 23 kilometres south of the study area of just under 2000 hectares.

Note: Consideration of habitat value, vegetation class and landownership of vegetation outside the study area was not included as part of this assessment.

3.2 Desktop review results

The results of the background research, including database searches (Appendix F) and review of existing information, identified six threatened species, one endangered population and one endangered ecological community known to occur in the study area listed under the NSW TSC Act, FM Act and the Commonwealth EPBC Act (Table 7).

Table 7: Species known to occur in the study area and their listing under NSW (TSC Act and FM Act) and National (EPBC Act) legislation.

Species	NSW* status	National* status	Closest known record
Aquatic ecological community in the lowland Murray River	EEC	Not listed	Murrumbidgee River in stream and associated riparian vegetation and tributaries.
Barking Owl (<i>Ninox connivens</i>)	V	Not listed	Riparian vegetation near Flowerdale lagoon.
Brown Treecreeper – eastern subspecies (<i>Climacteris picumnus victoriae</i>)	V	Not listed	Wilks Park, riparian vegetation near railway viaduct.
Murray Cod (<i>Maccullochella peelii peelii</i>)	V	V	Murrumbidgee River in stream
Silver Perch (<i>Bidyanus bidyanus</i>)	V	Not listed	Murrumbidgee River in stream
Squirrel Glider (<i>Petaurus norfolcensis</i>)	EP	Not listed	Levee bank at railway viaduct. Wilks Park. Wiradjuri Reserve.
Superb Parrot (<i>Polytelis swainsonii</i>)	V	V	North Wagga flats and Murrumbidgee River riparian corridor in and around Wagga Wagga.
Trout Cod (<i>Maccullochella macquariensis</i>)	E	E	Murrumbidgee River in stream

EEC – endangered ecological community, E – endangered, V – vulnerable, EP – endangered population

In addition, a number of species are likely to occur in the study area based on previous records and known habitat attributes in the study area. The species known and likely to occur are further discussed in section 4.

3.3 Flora

Surveys undertaken by GHD identified 103 flora species, of which 28 are native and 75 are introduced (Appendix A).

No threatened flora species were identified in the study area during surveys.

Canopy species in the study area were dominated by one eucalypt species; River Red Gum (*Eucalyptus camaldulensis*). Other naturally occurring native tree species recorded included

Yellow Box (*E. melliodora*), Mugga Ironbark (*E. sideroxylon*), River Sheoak (*Casuarina cunninghamiana*) and Kurrajong (*Brachychiton populneus*).

There was some evidence of dieback of eucalypt species observed during field surveys. This was observed along the North Wagga Wagga Levee and appeared to have affected only one tree.

Naturally occurring shrub species were restricted to a small area at Wilks Park, on the western side of the North Wagga Wagga Levee, where Silver Wattle (*Acacia dealbata*) was the only occurring species. No other shrub species were identified; however, the wider study area contains shrubs that occur as plantings and environmental weeds.

The ground layer is predominately introduced across the entire study area with commonly occurring introduced species including Great Brome (*Bromus diandrus*), Phalaris (*Phalaris aquatica*) and Wimmera Ryegrass (*Lolium rigidum*). Native grasses and forbs were generally uncommon with Couch (*Cynodon dactylon*) the most commonly occurring native species.

3.4 Vegetation communities

Vegetation throughout the subject site is relatively uniform in terms of the vegetation type present. Native vegetation is largely restricted to the upper stratum of the riparian corridor along the Murrumbidgee River and along Marshall's Creek and the lagoons within the subject site (Figure 3). The North Wagga Wagga borrow pit site contains River Red Gums occurring as scattered mature paddock trees and within woodland along the road reserve (Figure 4). No native canopy vegetation occurs at the Copland Street borrow pit site with three Grey Box (*E. microcarpa*) paddock trees present in or near the Tasman Road borrow pit site. The Grey Box trees do not constitute a threatened vegetation community (Grey Box woodland and derived grassland) due to their isolated nature, the relatively degraded understorey and absence of regeneration.

The vegetation community along the river is dominated by River Red Gum. The plant community type as listed in the NSW Plant Community Type (PCT) classification is *River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion* (PCT ID 5).

This community is not listed under State or Commonwealth legislation as an endangered or threatened ecological community. No other native vegetation communities were identified in the subject site.

Four isolated Yellow Box trees occur in the subject site. These trees occur as isolated paddock trees with predominately introduced groundcover species e.g. two at North Wagga Wagga along Maher Street.

Due to their isolated nature, below minimum patch size, degraded understorey and the absence of regeneration and little regeneration potential, these trees do not form part of the White Box Yellow Box Blakely's Red Gum Woodland endangered ecological community listed under the TSC Act or the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland listed under the EPBC Act.



Figure 3: River Red Gum forest in the subject site - along Marshall's Creek looking north-west



Figure 4: North Wagga Wagga borrow pit site showing remnant River Red Gum trees

Noxious weeds

Seven plants listed as noxious for the Wagga Wagga control area (DPI 2011) were recorded during current flora surveys (Table 8). Paterson's Curse and St John's Wort are relatively common throughout the study area, with only small, localised occurrences of the other noxious weed species evident. The Copland Street and, to a lesser extent, Tasman Road borrow pit sites contain a high abundance of introduced weed species, including noxious species such as

St Barnaby's Thistle. All of the noxious weeds recorded are Class 4 weeds meaning that the growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction.

Table 8: Noxious weeds in the study area

Name	Class	Occurrence
African Boxthorn <i>Lycium ferocissimum</i>	Four	Uncommon. One individual plant located along Flowerdale Lagoon at the western end of the Main City Levee.
Bathurst Burr <i>Xanthium spinosum</i>	Four	Uncommon. Scattered individuals located at the North Wagga Wagga borrow pit site.
Paterson's Curse <i>Echium plantagineum</i>	Four	Common. Scattered individuals throughout the study area.
St Barnaby's Thistle <i>Centaurea solstitialis</i>	Four	Uncommon. Scattered plants located at the Copland Street and Tasman Road borrow pit sites.
St John's Wort <i>Hypericum perforatum</i>	Four	Common. Scattered individuals throughout the study area.
Sweet Briar <i>Rosa rubiginosa</i>	Four	Uncommon. Scattered plants recorded at the Copland Street and Tasman Road borrow pit sites.
White Horehound <i>Marrubium vulgare</i>	Four	Uncommon. Localised occurrences evident throughout the study area.



Figure 5: Copland Street borrow pit site



Figure 6: Tasman Road borrow pit site

3.5 Fauna

Surveys undertaken by GHD identified 75 fauna species, of which 67 are native and eight are introduced (Appendix B).

The woodland community of the study area provides habitat for a variety of bird species. Fifty-seven bird species were identified during field surveys, five of which were introduced; the Common Blackbird (*Turdus merula*), Common Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), Rock Dove (*Columba livia*) and European Goldfinch (*Carduelis carduelis*). Commonly occurring native species included the Australian Magpie (*Gymnorhina tibicen*), Yellow Rosella (*Platycercus elegans flaveolus*), Sulphur-crested Cockatoo (*Cacatua galerita*) and Australian Wood Duck (*Chenonetta jubata*).

Two threatened bird species were recorded during surveys (see Figure 2);

- Brown Treecreeper (*Climacteris picumnus victoriae*)
- Superb Parrot (*Polytelis swainsonii*).

Both species are listed under the TSC Act as vulnerable and were observed in River Red Gum Woodland. The Superb Parrot is also listed as vulnerable under the EPBC Act. The woodland trees provide foraging, roosting and nesting resources for the species. In the study area and locality, Superb Parrots are only known to breed in the hollows of River Red Gum trees along the Murrumbidgee River. This species is known to breed in River Red Gum trees on the North Wagga Wagga flats.

Ten species of mammal were recorded during field surveys. Three of these were introduced species; the Fox (*Vulpes vulpes*), Cat (*Felis catus*) and Rabbit (*Oryctolagus cuniculus*). Native mammals that were recorded included the Eastern Grey Kangaroo (*Macropus giganteus*), Common Brushtail Possum (*Trichosurus vulpecula*) and White-striped Freetail Bat (*Tadarida australis*). No threatened species of mammals were recorded during field surveys.

During remote Anabat surveys five bat species were positively (Definite) identified, including; Gould's Wattled Bat (*Chalinolobus gouldii*) and the Little Forest Bat (*Vespadelus vulturnus*).

Three species were identified as probable, including the Inland Broad-nosed Bat (*Scotorepens balstoni*) (See Table 9). An additional two species were recorded but could only be identified to species group. No threatened bat species were recorded.

Three species of amphibian were recorded during surveys, including the Eastern Sign-bearing Froglet (*Crinia parinsignifera*), Peron's Tree Frog (*Litoria peronii*) and Spotted Marsh Frog (*Limnodynastes tasmaniensis*). No threatened species of amphibian were recorded during field surveys. These species were heard in the areas surrounding the Murrumbidgee River and Marshall's Creek in the study area. Drainage lines, lagoons and areas of ephemeral water ponding may provide breeding habitat for additional frog species.

No species of reptile were recorded during field surveys. Woody debris in the study area is likely to provide suitable habitat for commonly occurring species such as skinks and snakes. The warm weather experienced during the survey period was optimal for observations of reptile species, although none were sited; however, given the suitable potential habitat; reptiles are considered highly likely to occur here.

Table 9: Summary of Anabat analysis for each unit for each night deployed

Species	CR	Unit 1		Unit 2	
		24/9/12	25/9/12	24/9/12	25/9/12
<i>Tadarida australis</i>	D	0	0	0	1
<i>Chalinolobus gouldii</i>	D	1	0	3	0
<i>Mormopterus</i> species 4	Pr	1	0	0	2
<i>Mormopterus</i> species / <i>C. gouldii</i>	✓	4	0	0	0
<i>Scotorepens balstoni</i>	Pr	13	0	0	0
<i>Scotorepens</i> sp	✓	10	0	0	0
<i>Vespadelus darlingtoni</i>	D	0	0	1	0
<i>Vespadelus vulturnus</i>	D	0	0	10	0
<i>Chalinolobus morio</i>	D	4	8	2	0
<i>Chalinolobus morio</i>	Pr	5	0	14	0
<i>Nyctophilus</i> spp.	✓	1	0	0	0
Total D species	5				
Total PR species	3				

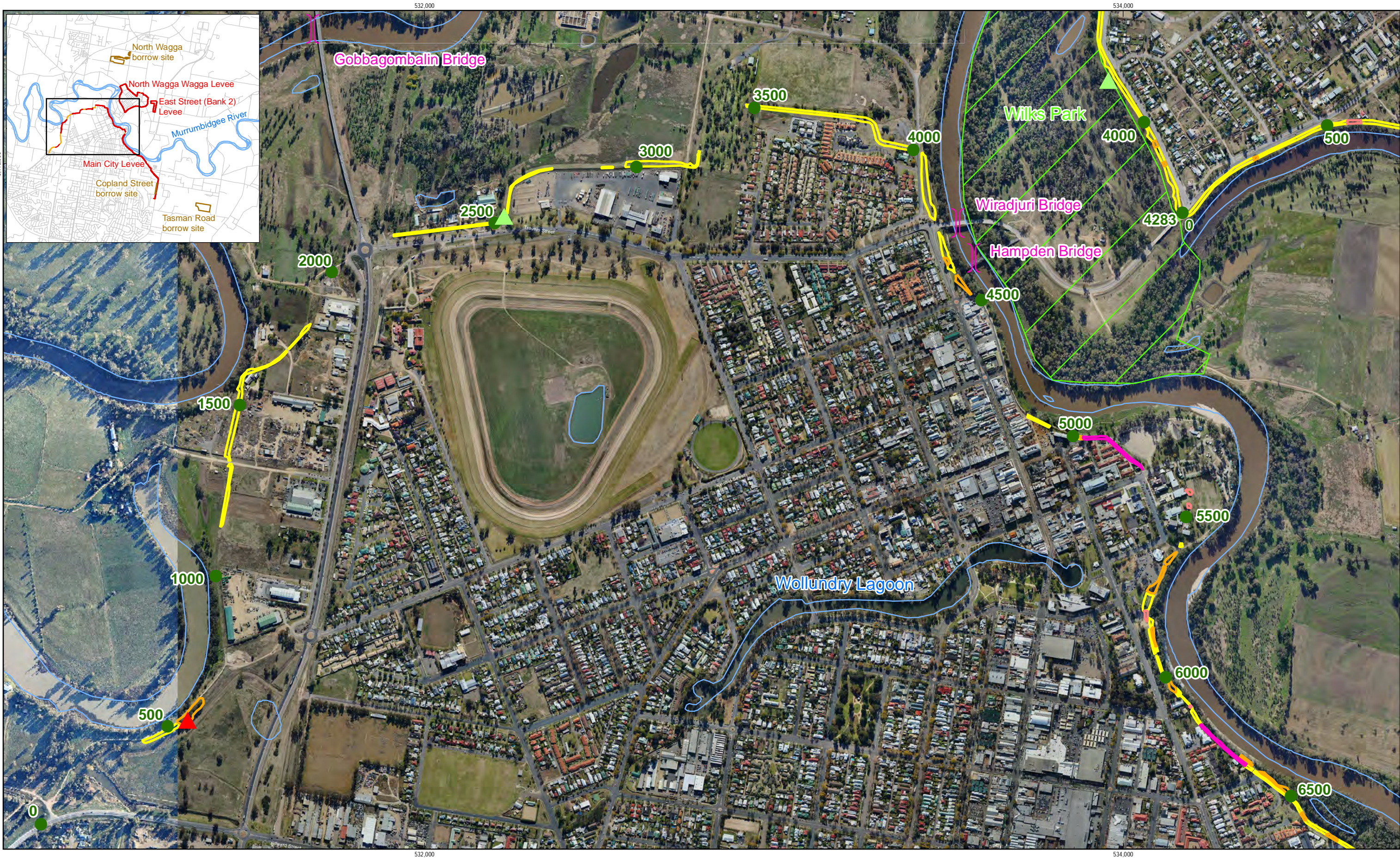
Note:

Total number of species recorded for each night/site is based on definite (D) identification only.

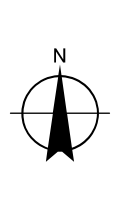
CR = confidence rating, d- definite, Pr - probable (see Table 5).

✓ = species group recorded.

0 = not recorded.



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LEGEND	
Hollow-bearing tree	Levee chainage (metres)
Remove	Vegetation proposed to be removed
Retain	Introduced garden vegetation
Bridge	Introduced groundcover vegetation
Creek	Introduced trees
	River Red Gum forest
	Waterbody
	Wilks Park



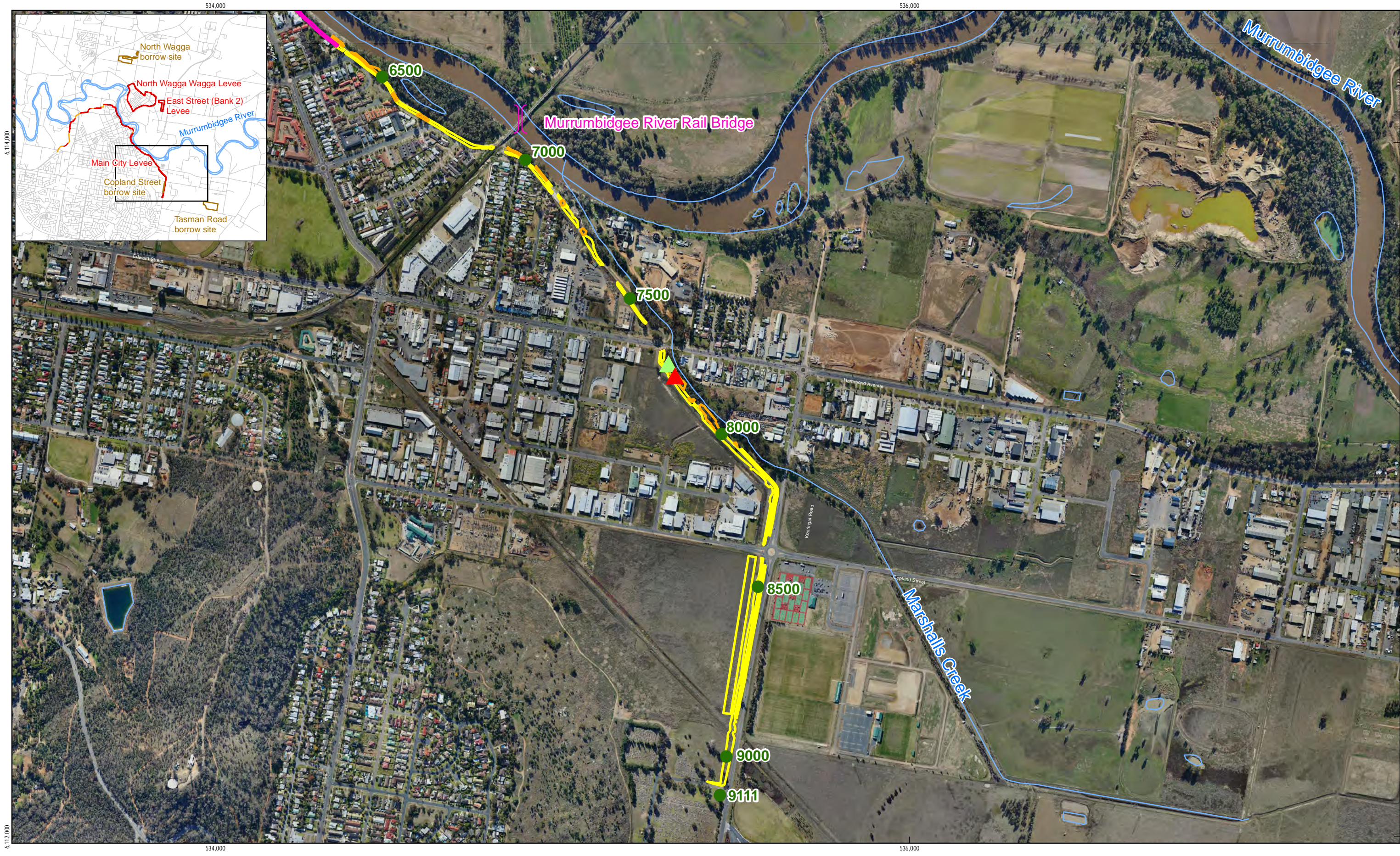
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Job Number 23-14536
 Revision 0
 Date 23 Nov 2012

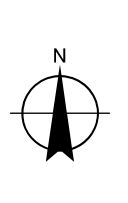
Vegetation proposed to be removed and hollow-bearing trees

Figure 7a

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 © 2012. Whilst every care has been taken to prepare this map, GHD, Wagga Wagga City Council and LPI make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.
 Data source: Wagga Wagga City Council: Aerial photographs - 2012 & 2010; LPI: Roads, waterbodies, creeks - 2008. Created by:rtrobinson



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 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 55



LEGEND	
Hollow-bearing tree	Levee chainage (metres)
Remove	Bridge
Retain	Creek
Vegetation proposed to be removed	Waterbody
Introduced garden vegetation	Wilks Park
Introduced groundcover vegetation	
Introduced trees	
River Red Gum forest	



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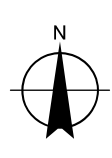
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 Revision | 0
 Date | 23 Nov 2012

Vegetation proposed to be removed and hollow-bearing trees

Figure 7b



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 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 55



LEGEND

- Hollow-bearing tree
 - ▲ Remove
 - ▲ Retain
- Levee chainage (metres)
- { } Bridge
- Creek

- Vegetation proposed to be removed
 - Introduced garden vegetation
 - Introduced groundcover vegetation
 - Introduced trees
 - River Red Gum forest

- Waterbody
- Wilks Park

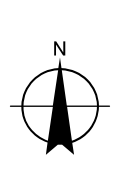
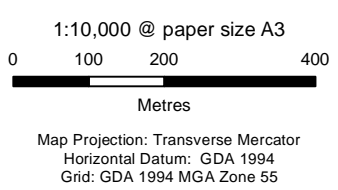
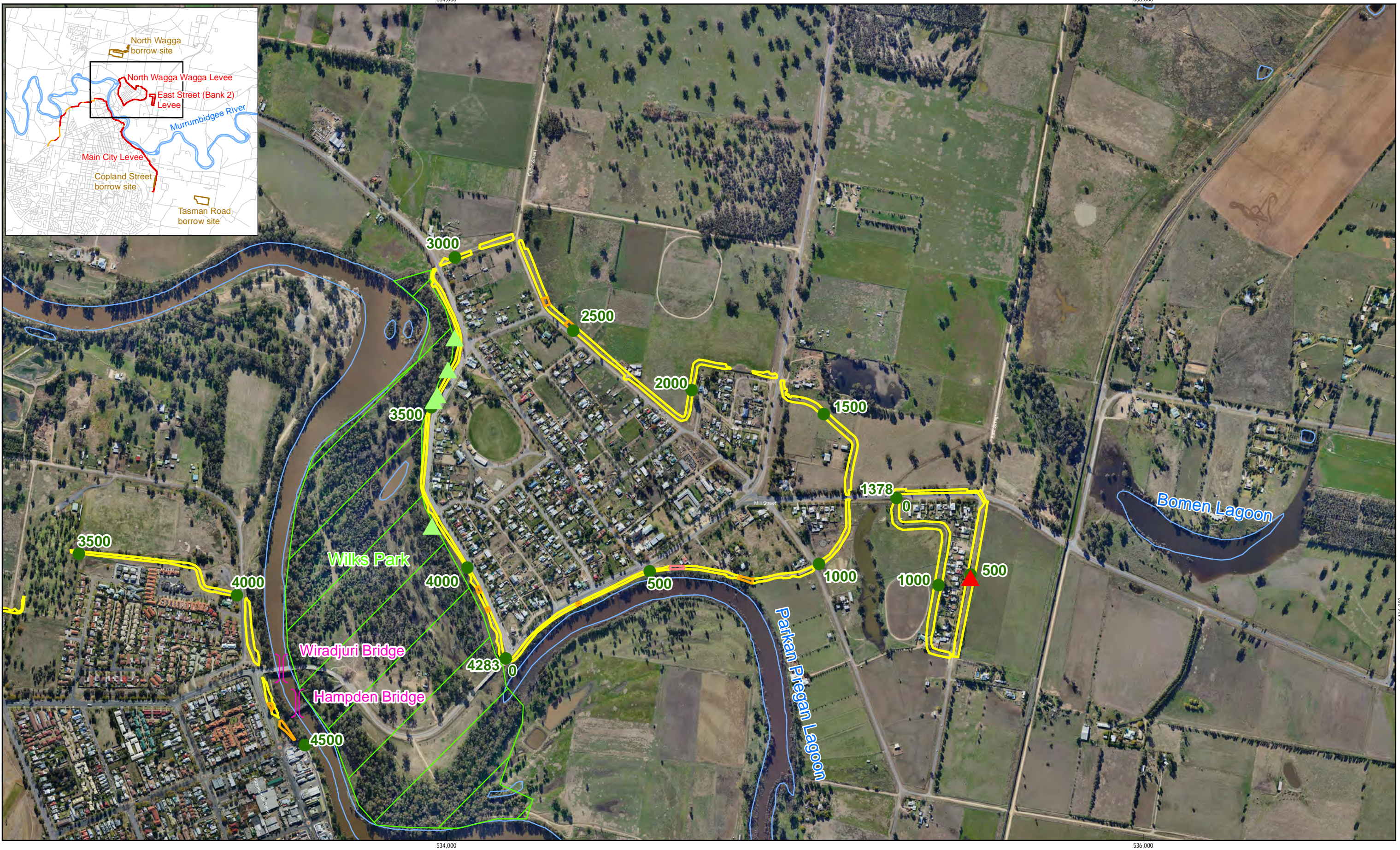


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Job Number | 23-14536
 Revision | 0
 Date | 23 Nov 2012

Vegetation proposed to be removed and hollow-bearing trees

Figure 7c



LEGEND	
Hollow-bearing tree	● Levee chainage (metres)
▲ Remove	■ Vegetation proposed to be removed
▲ Retain	■ Introduced garden vegetation
— Bridge	■ Introduced groundcover vegetation
— Creek	■ Introduced trees
	■ River Red Gum forest
	■ Waterbody
	■ Wilks Park



Wagga Wagga City Council
Wagga Wagga levee upgrade ecological assessment

Job Number 23-14536
Revision 0
Date 23 Nov 2012

Vegetation proposed to be removed and hollow-bearing trees

Figure 7d

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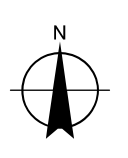
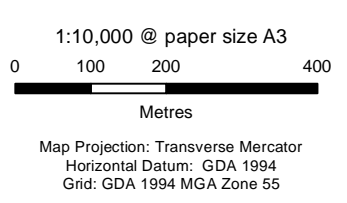
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LEGEND	
Hollow-bearing tree	Levee chainage (metres)
Remove	Bridge
Retain	Creek
Vegetation proposed to be removed	Waterbody
Introduced garden vegetation	Wilks Park
Introduced groundcover vegetation	
Introduced trees	
River Red Gum forest	



Wagga Wagga City Council
Wagga Wagga levee upgrade ecological assessment

Job Number 23-14536
Revision 0
Date 23 Nov 2012

Vegetation proposed to be removed and hollow-bearing trees

Figure 7e

3.6 Terrestrial fauna habitats

Fauna habitat in the study area occurs in the remnant native vegetation and to a lesser extent planted trees throughout the study area. Remnant vegetation in the study area predominately exists as the riparian corridor of the Murrumbidgee River, along Marshall's Creek in the eastern section of the study area and Flowerdale Lagoon in the western section. The North Wagga Wagga borrow pit site contains patchy River Red Gum forest throughout, with a roadside vegetation corridor leading to the site. Isolated paddock trees occur along roadsides and throughout the study area surrounding the subject site.

Remnant vegetation within the subject site and study area provides foraging and breeding habitat for a variety of bird species, including the threatened species observed on site. It may also provide habitat for other threatened species not recorded in the study area during current surveys but known from the study area and locality, such as the Barking Owl (*Ninox connivens*) and Squirrel Glider (*Petaurus norfolcensis*).

Mature trees exist throughout the study area, mostly along the riparian corridor but also as isolated paddock and roadside trees. Regeneration of canopy species is occurring along Flowerdale Lagoon in the south-western section of the subject site and along the Main City Levee between Wiradjuri Bridge and Hammond Avenue in the central-eastern section of the subject site. No regeneration is occurring along the East Street (Bank Two) Levee with only the western section of the North Wagga Wagga Levee comprising regeneration. The trees in the study area would be used for nesting and foraging by a range of woodland birds, arboreal mammals and microchiropteran bats. Nocturnal birds such as owls and nightjars may also use the study area for foraging.

Hollow-bearing trees occur commonly throughout the subject site and study area with 32 identified within the subject site that occur within or close to the subject site (see Figure 7a-e). Hollow-bearing trees in the study area are likely to provide roosting and nesting habitat for microchiropteran bats (such as the White-striped Freetail Bat), arboreal mammals (such as the Squirrel Glider and Common Brushtail Possum) and a range of woodland birds.

Although no Squirrel Gliders were observed during the survey period, they are known to occur in the study area. The species has previously been recorded and is known to occur in the River Red Gum forest in Wilks Park in the eastern section of the subject site as well as the levee bank near the railway viaduct and Wiradjuri Reserve.

Vegetation along the riparian corridor in the subject site provides connectivity to other remnant vegetation within the wider study area and locality including Pomingalarna Park, Silvalite Reserve and the Kapooka Military Area to the west and south-west of the subject site. The connectivity of the riparian vegetation aids in facilitating the movement of fauna across the landscape to other areas of vegetation within the locality and beyond. These areas of woodland are an important fauna corridor in the locality for woodland birds, mammals and other fauna.

Grassy areas in the study area provide feeding habitat for mammals such as the Eastern Grey Kangaroo (*Macropus giganteus*), which was observed in introduced grassland during field surveys. Grassy areas may also provide foraging habitat for woodland birds, including threatened species such as the Diamond Firetail.

3.7 Aquatic fauna habitat

The Murrumbidgee River is a major, permanent watercourse in the study area and provides potential habitat for a variety of aquatic fauna species. Marshall's Creek, the two lagoons in the study area and the North Wagga Wagga borrow pit also provide aquatic habitat, but these will not be impacted by the proposal as fill would be obtained from south of the existing artificial wetland. Three amphibians were heard calling within the area of the river and Marshall's Creek during current surveys.

The river contains fringing riparian vegetation, and submerged rocks and woody debris and provides suitable habitat for fish species that are known to occur, including; Murray Cod (*Maccullochella peelii peelii*) and Golden Perch / Yellowbelly (*Macquaria ambigua*). These species favour habitats with slow-flowing, turbid waters and cover of vegetation or similar, as provided within the rivers' habitat.

The Murrumbidgee River including riparian areas and the floodplain are part of the endangered aquatic ecological community in the natural drainage system of the lower Murray River catchment (hereafter referred to as the Lowland Murray River aquatic ecological community). This community includes all native fish and aquatic invertebrates within all natural creeks, rivers, and associated lagoons, billabongs and lakes of the regulated portions of the Murray River (of which the Murrumbidgee River is a tributary).

Numerous aquatic bird species were observed within the different types of aquatic habitat available within the subject site. These areas provide foraging and breeding habitat for birds and other aquatic fauna species. In stream habitats would not be removed or altered as part of the proposal.

4. Species, populations and communities of conservation concern

4.1 Matters of national environmental significance

One species listed as threatened under the EPBC Act was recorded during the field surveys for this study; the Superb Parrot (*Polytelis swainsonii*), which is listed as vulnerable. No flora species or threatened ecological communities listed under the EPBC Act were recorded.

The literature review, database search and field surveys identified 12 fauna species, which are threatened or migratory and are known or likely to occur in the study area (Appendix D). For those species which are known or likely to occur in the study area, and for which an impact is likely (Table 10), the EPBC Act Policy Statement *Matters of National Environmental Significance: Significance impact guidelines 1.1* (DEWHA 2009) was used to assist in determining if a significant impact is likely for the proposal (Appendix E).

4.2 State-listed species, communities and populations

The literature review, database search and field surveys identified 20 fauna species and an endangered population, which are known or likely to occur in the study area, as listed under the TSC Act and/or FM Act (Appendix D).

Two species listed as vulnerable under the TSC Act were recorded during the current survey period; the Brown Treecreeper and Superb Parrot. No flora species or endangered ecological communities listed under the TSC Act were recorded. The Lowland Murray River aquatic ecological community listed under the FM Act occurs in the subject site and study area.

For those species listed in Table 10, which are known or likely to occur in the study area, and for which the possibility of impact is likely (including nine bird species, three bat species and endangered ecological community and an endangered population), an assessment of significance (7 part test) was applied under Section 5A of the EP&A Act to assist in determining if a significant impact is likely (Appendix E).

Table 10: Threatened and migratory species and ecological communities that have the potential to be impacted by the proposal

Species / ecological community	Status
Birds	
Barking Owl <i>Ninox connivens</i>	V – TSC Act
Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	V – TSC Act
Diamond Firetail <i>Stagonopleura guttata</i>	V – TSC Act
Flame Robin <i>Petroica phoenicea</i>	V – TSC Act
Little Eagle <i>Hieraaetus morphnoides</i>	V – TSC Act
Rainbow Bee-eater <i>Merops ornatus</i>	Mi – EPBC Act
Scarlet Robin <i>Petroica boodang</i>	V – TSC Act

Species / ecological community	Status
Superb Parrot <i>Polytelis swainsonii</i>	V – EPBC Act V – TSC Act
Varied Sittella <i>Daphoenositta chrysoptera</i>	V – TSC Act
White-fronted Chat <i>Epthianura albifrons</i>	V – TSC Act
Mammals	
Squirrel Glider population in the Wagga Wagga Local Government Area <i>Petaurus norfolcensis</i>	EP – TSC Act
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	V – TSC Act
Little Pied Bat <i>Chalinolobus picatus</i>	V – TSC Act
Southern Myotis <i>Myotis macropus</i>	V – TSC Act
Ecological community	
Lowland Murray River endangered ecological community	EEC – FM Act

E – endangered, V – vulnerable, EP – endangered population, Mi – Migratory, EEC - endangered ecological community

5. Potential impacts

5.1 Potential direct impacts

5.1.1 Vegetation removal

The proposal would result in the removal of 43.9 hectares of vegetation over the total 14.8 kilometre length and three borrow pits. About 97 per cent (42.5 hectares) of the vegetation to be disturbed or removed is introduced groundcover vegetation. The total disturbance footprint for the proposal includes:

- Approximately 42.5 hectares of introduced groundcover vegetation
- Approximately 1.1 hectares of remnant River Red Gum forest
- Approximately 0.3 hectares of tree/garden plantings

River Red Gum forest in the study area is about 170 hectares. The removal of 1.1 hectares of River Red Gum forest represents about 0.6 per cent of this vegetation community in the study area and an even smaller proportion of this vegetation community in the locality.

Groundcover vegetation to be removed is mostly introduced species and would comprise removal along the three levees in addition to the three borrow pit locations. No shrub removal would be required. The use of machinery to fell trees and the felling process is likely to result in the loss of some groundcover vegetation and disturbance to groundcovers, in addition to the clearing that would occur for the earthworks.

No threatened ecological communities occur in the study area. The River Red Gum forest to be removed in small sections in the subject site is not a threatened or endangered ecological community. Impacts on River Red Gum forest in the subject site and study area involve the long-term modification of the structure of the vegetation community due to tree and groundcover removal with the potential loss of regeneration capabilities.

Tree removal

Removal of trees would occur sporadically throughout the subject site. The proposal would require the most removal of trees from the eastern section of the Main City Levee where vegetation is growing close to the existing levee bank structure. Limited removal would occur along the East Street (Bank Two) Levee where the land has largely been cleared of canopy vegetation for agriculture and farming practices. No tree removal would be required at the three borrow pit sites due to clearing having previously occurred. The North Wagga Wagga borrow pit site still contains remnant mature trees; these would be avoided during excavation.

A total of 190 trees would be removed from the subject site (1.1 hectares). This includes five stags, the three hollow-bearing trees identified previously and a total of 47 trees with a diameter at breast height of over 40 centimetres. Most of the trees to be removed are regrowth trees less than 40 centimetres dbh. Of the trees to be removed, 28 are to be removed from the North Wagga Wagga Levee and East Street (Bank Two) Levee subject site and 162 from the Main City Levee subject site. Trees to be removed were classified into five categories based on their size in diameter at breast height (dbh). The number of trees to be removed for each category is provided in Table 11. This table is inclusive of the hollow-bearing trees identified in Table 13. Tree species to be removed are provided in Table 12.

The removal of trees would reduce the amount of nesting, roosting, movement and foraging habitat for fauna in the study area and permanently remove known threatened species habitat from the subject site. Mortality or injury may occur to fauna present during the clearing process unless protection measures are implemented.

Table 11: Tree categories and numbers to be removed

Diameter at breast height	Total of trees to be removed
0-20 centimetres	62
20-40 centimetres	81
40-60 centimetres	21
60-80 centimetres	13
> 80 centimetres	13
TOTAL	190

Table 12: Tree species and numbers to be removed

Species	Total of trees to be removed
River Red Gum (<i>Eucalyptus camaldulensis</i>)	165
River Sheoak <i>Casuarina cunninghamiana</i>	7
Mugga Ironbark <i>E. sideroxylon</i>	6
Yellow Box <i>E. melliodora</i>	4
Kurrajong (<i>Brachychiton populneus</i>)	2
Mallee eucalypt	1
Stag	5
TOTAL	190

Hollow-bearing tree removal

Numerous hollow-bearing trees, which provide habitat for fauna were observed in the study area. Hollow bearing trees are an important habitat resource for many species and should be retained wherever possible.

The proposal would remove three hollow-bearing trees, including one a stag. Hollow-bearing trees to be removed or retained are mapped in Figure 7a-e and Table 10. There are at least another 29 hollow-bearing trees within 10 metres of the subject site and more in the wider study area (i.e. within 500 m of the subject site). All of the recorded hollow-bearing trees are River Red Gums with the exception of one stag. Hollow-bearing trees on the banks of the Murrumbidgee River are common and were observed throughout the Main City Levee, North Wagga Wagga Levee and Wilks Park near North Wagga Wagga. One of the hollow-bearing trees to be removed is located on the East Street (Bank Two) Levee with the remaining two

located on the Main City Levee. Due to the greater number of hollow-bearing trees in the study area, the proposed removal of three hollow-bearing trees, one of which exists as an individual, isolated tree in a residential and agricultural area, is unlikely to significantly impact fauna in the study area. Details of hollow-bearing trees recommended for retention are provided in Appendix C.

Table 13: Hollow bearing trees in the subject site to be removed

Species	DBH (cm)	No. of hollows / diameter (cm)		Location
		< 10	10-20	
<i>E. camaldulensis</i>	180		3	East Street (Bank Two) Levee; Chainage 500 to Chainage 520
<i>E. camaldulensis</i>	140	4		Proposed spillway; Chainage 420 to Chainage 620
Stag	80		1	Marshall's Creek; Chainage 7760 to Chainage 7780

Hollow-bearing trees are critical habitat components for many fauna species in the study area and their removal would result in a loss of potential hollow resources for tree-dwelling species such as arboreal mammals, microchiropteran bats and woodland birds. These species may rely on hollows for shelter and breeding habitat.

Two threatened species that utilise hollow-bearing trees were recorded during current surveys. The Superb Parrot, which is listed as vulnerable under both the TSC Act and EPBC Act, is predominately known to breed in the hollows of River Red Gum trees along the Murrumbidgee River in the locality. The Brown Treecreeper, which is listed as vulnerable under the TSC Act, also relies on hollows for its nesting requirements. The endangered population of Squirrel Gliders in the Wagga Wagga LGA are also known to occur in the study area and rely on trees with hollows for breeding and denning. The removal of hollow-bearing trees has the potential to impact on the breeding cycle of these species.

The hollow-bearing trees identified during field surveys contain 148 hollows. Eight of these hollows are in the trees that are to be removed by the proposal. This represents a loss of about five per cent of the hollows within 10 metres of the subject site and even less of what occurs in the wider study area. Due to the long timeframe it takes for hollows to form in eucalypts (usually greater than 150 years) (*Gibbons et al*, 2000), the loss of any hollows represents a long-term reduction in habitat resources for fauna.

5.1.2 Soil surface and drainage disturbance

The removal of vegetation, in addition to the earthworks required, would create substantial disturbance to the soil surface in the study area. The stability of the soil profile would be disturbed with the removal of groundcover vegetation to occur, creating the potential for increased risk of erosion and loss of topsoil. The drainage patterns of the study area would be slightly altered with the increased height of the levee banks likely to change the angle of runoff from the surface of the levees and an increased impervious surface area, resulting in increased run-off. The construction of spillways would also alter drainage patterns with the surfaces to be constructed of rock-fill, allowing water to enter the areas protected by the levees, particularly in the case of a large flood.

If water is present in the existing North Wagga borrow pit at the time of construction, it would be pumped out of the pit (subject to necessary approval). The borrow pit provides limited aquatic habitat for species such as frogs. The pumping of water out of the pit would be unlikely to have a substantial impact on flora or fauna.

5.2 Indirect impacts

5.2.1 Trees

Trees that do not require removal but are on the margins of other trees being removed have the potential to have damage caused to their critical root zone. The critical root zones of trees should be protected during the tree removal process in accordance with *the Australian Standard – Protection of trees on development sites (AS4970-2009)*. The critical root zones of each tree will vary depending on its age class, growth or vigour and crown spread. Protection of this zone is particularly important for hollow bearing trees on the margins on the subject site (e.g. chainage 3100 to 4200 in North Wagga Wagga levee).

5.2.2 Weeds

The groundcover vegetation in the study area is dominated by introduced species. The proposal has the potential to further introduce and spread weeds in the study area by movement of machinery and light vehicle traffic and disturbance associated with vegetation removal.

Seven noxious weed species were identified during current surveys. The proposal has the potential to introduce and spread noxious weeds in the study area by movement of machinery and light vehicle traffic and disturbance associated with vegetation removal.

Although introduced species are common in the study area, with the groundcover dominated by introduced species, it is important to prevent the further spread of noxious weeds. St John's Wort and Paterson's Curse are the most commonly occurring noxious weed species. Paterson's Curse is generally common and widespread in the Wagga Wagga LGA, with St John's Wort prevalent but less common. The spread of noxious weeds poses the increased risk of their encroachment into areas of native vegetation and the degradation of habitat for native species in the locality.

5.2.3 Disturbance of fauna

The proposal has the potential to temporarily affect the use of the study area by fauna as a result of increased disturbance during vegetation removal and the construction process. The use of machinery may temporarily deter some fauna species from utilising potential habitat in the study area. This is likely to be only during construction and not operation.

5.2.4 Sedimentation

Sedimentation of the Murrumbidgee River may result from the proposal due to vegetation removal and machinery works adjacent to the river banks. These works have the potential to destabilise the banks, leading to further erosion of the channel and deposition of sediment. This is a particular risk where the river banks are likely to be unstable; however, vegetation would not be removed from the banks. Sedimentation from construction works would be short-term and be for the duration of works. Normally fish will move away from highly turbid water; however, turbid water may block fish passage if it occurs during migration periods. More extreme impacts on fish species as a result of sedimentation and accompanying turbidity increases in the river can include:

- Smothering of gill surfaces with sediment leading to asphyxiation
- Swallowing of large amounts of sediment leading to illness

- Inhibition of light penetration into the water column which can affect predator-prey interactions
- Impacts on habitat diversity in the immediate area and downstream by smothering and filling of interstitial spaces inhabited by fish.

5.2.5 Water quality

The proposal has the potential to degrade water quality within the Murrumbidgee River, both in the immediate area and downstream, which has the potential to impact on local and downstream aquatic fauna. Due to retention of vegetation and the limited movement of machinery on the banks of the river, impacts on water quality are unlikely to substantially affect aquatic flora and fauna.

Water quality may also be impacted by potential spills during the construction process.

5.3 Cumulative impacts

The proposal would cause impacts additional to those that have occurred due to previous land use activities in the study area; including residential, commercial and agricultural activities. The proposal would reduce the overall extent of native vegetation cover in a fragmented residential and commercial landscape, which are the main land uses in the study area. Other works that may contribute to cumulative ecological impacts in the study area include vegetation maintenance for linear infrastructure such as roads and powerlines.

The proposal occurs in a locality where there is ongoing development pressure for residential and commercial purposes. The proposal would contribute to the cumulative impacts of the continuing expansion and proposed growth of these areas, placing increased pressure on threatened fauna in the study area. However, the removal of native vegetation represents about 0.6 per cent of native vegetation in the study area and even less in the locality.

5.4 Significance of potential impacts

5.4.1 NSW legislation

When assessing proposed actions, determining authorities have a statutory responsibility under the EP&A Act to determine whether there is likely to be a significant effect on threatened species, populations, or ecological communities, or their habitats. Section 5A, of the EP&A Act presents seven factors to assist in determining if the proposed development or activity '*is likely to have a significant effect on the threatened species, populations or ecological communities, or their habitats*' (the seven part test). The seven part test enables a decision to be made as to whether there is likely to be a significant effect on the species, population or ecological community, and hence if a SIS is required.

Species and ecological communities listed as threatened under the NSW TSC Act

The habitat assessment found that the proposed development may potentially impact nine bird species, three bat species and an endangered population listed as threatened under the TSC Act. One endangered ecological community listed under the FM Act may also be impacted. Seven part tests were undertaken for these species (Appendix E).

Based on the results of these seven part tests the proposed development is unlikely to have a significant impact on any species listed under the TSC Act or FM Act due to the limited removal of habitat resources such as hollow bearing trees and native vegetation and therefore a SIS is not required

Relevant key threatening processes in NSW

The NSW TSC Act and FM Act have listed a number of Key Threatening Processes (KTPs) that contribute to a loss of species, populations and communities. The following KTPs are relevant to the proposal:

- Clearing of native vegetation (TSC Act)
- Loss of hollow-bearing trees (TSC Act)
- Removal of dead wood and dead trees (TSC Act)
- Degradation of native riparian vegetation (FM Act)
- In stream structures and other mechanisms that alter flow (FM Act)

The proposal would contribute to clearing of native vegetation and loss of hollow bearing trees. Seven part tests completed in Appendix E found that the proposal would be unlikely to have a significant impact on any threatened species, populations or ecological communities which includes increases in threatening processes that can lead to a significant impact.

The proposal would result in the loss of three hollow-bearing trees over the 14.8 kilometre length. The removal of this number of trees across a large area is not considered to pose a significant threat to the species and ecological communities in the study area. The removal of 1.1 hectares of River Red Gum vegetation may reduce hollow availability in the long term (i.e. >100 years), however other River Red Gum trees that are more mature as well as regenerating will be retained.

5.4.2 Commonwealth legislation

The EPBC Act provides a mechanism for assessing the environmental impact of activities and developments, where 'matters of national environmental significance' may be affected by the proposed activities. If the proposal is likely to have a significant impact on a matter of NES it must be referred to the Commonwealth Minister for the Environment. After the Referral is completed and assessed, the Commonwealth Minister may determine that no further assessment is required, accredit the assessment of the proposal in accordance with the NSW Planning system under the bilateral agreement, or require additional assessment and approval under the EPBC Act.

Matters of NES relevant to the proposal include:

- Migratory species protected under international agreements
- Ramsar wetlands of international importance
- Listed threatened species and communities

The EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DEWHA 2009) was reviewed when determining if a significant impact is likely on matters of NES.

Species and ecological communities listed under the Commonwealth EPBC Act

The habitat assessment found that the proposed development could potentially impact two bird species listed as threatened or migratory under the EPBC Act, or their habitats. Significance assessments (EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1*) were completed for these matters of NES (Appendix E).

The significance assessments concluded that the proposed development is unlikely to have a significant impact on any species listed under the EPBC Act due to the limited removal of

habitat resources such as hollow bearing trees and native vegetation and therefore the preparation of a Referral to the Minister of the Environment is not required.

Relevant Commonwealth key threatening processes

EPBC Act lists a number of Key Threatening Processes (KTPs) that contribute to a loss of species, populations and communities. Land clearance is the only Commonwealth KTP relevant to the proposal.

6. Safeguards and mitigation measures

The safeguards and mitigation measures detailed in Table 14 would be implemented to minimise the impacts of the proposal on the ecology of the study area. These safeguards and management measures would be incorporated into a Construction Environmental Management Plan (CEMP) to be implemented during construction.

Table 14: Safeguards and mitigation measures to be implemented for the proposal

Potential impact	Measures to reduce impacts
Loss of areas of native vegetation communities	<ul style="list-style-type: none"> Removal of native canopy vegetation would be minimised wherever possible All staff will be inducted and informed of the limits of vegetation clearing and the areas of vegetation to be retained. Areas of vegetation not to be removed would be clearly marked prior to construction.
Loss of mature trees and hollow-bearing trees	<ul style="list-style-type: none"> Pruning and lopping of limbs would be conducted in preference to tree removal, wherever practicable, particularly in the case of hollow-bearing trees Where practicable, removal of hollow-bearing trees would not occur in the main fauna breeding season (August to December) Suitably trained personnel must be on site during the removal of hollow-bearing trees to assist in the rescue and/or relocation of any resident fauna Habitat pruning techniques (see Appendix G) would be used to offset the loss of hollows at a 10:1 ratio into non hollow-bearing trees. Habitat pruning should be used in preference to placement of nest boxes where possible. Where WWCC elect to use nest boxes, placement of nest boxes in the study area at a minimum 10:1 ratio for the loss of hollows during construction. Nest boxes should be checked and potentially replaced every five years. Where appropriate hollow limbs of trees would be retained on the ground as potential habitat for ground dwelling fauna Excavation of material from the North Wagga Wagga borrow site would not encroach on the drip line of the trees in the vicinity of the site.
Disturbance of woodland habitat	<ul style="list-style-type: none"> All vehicles and equipment used for operations will remain on existing tracks, roadside verges, bitumen roads, the existing levee bank or cleared agricultural areas.
Loss of woody debris habitat	<ul style="list-style-type: none"> Where appropriate woody debris generated from the lopping of trees would be retained as habitat on the ground on Council owned land. The woody debris retained will not be stacked but spread in a fashion that replicates the natural occurrence of woody debris in the environment and would not exceed 56 metres in every 0.1 hectare area.
Spread of weeds	<ul style="list-style-type: none"> A weed management plan would be prepared before works commencing, for implementation before, during and after the works

Potential impact	Measures to reduce impacts
	<ul style="list-style-type: none"> • Vehicle and machinery wash/brush downs may be required to ensure that noxious weed species are not spread to previously non-infested areas (e.g. Chilean Needle Grass in the Wilks Park area of North Wagga Wagga). • Declared noxious weeds will be managed according to requirements under the NSW <i>Noxious Weeds Act 1993</i>. All noxious weeds and environmental weed species removed in consultation with WWCC Noxious Weeds officers.
Soil disturbance and erosion	<ul style="list-style-type: none"> • Soil disturbance will be avoided as much as possible to minimise the potential for spreading weeds and generating sediment. • Erosion and sediment control measures would be placed on the bank side of the Murrumbidgee River to prevent runoff to the river during construction. • No construction would occur during heavy rainfall events. • Sediment and erosion control should be undertaken in accordance with the document <i>Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition (The Blue Book)</i>.
Disturbance of aquatic habitat	<ul style="list-style-type: none"> • Vehicle movement on the river banks would be restricted wherever practicable to avoid siltation of the river. • Construction would not occur during rainfall events to prevent runoff to the Murrumbidgee River

7. Conclusion

The study area of the proposal includes large sections of residential developed land and agricultural land that is mostly cleared of native vegetation with introduced groundcover species. The study area including the Murrumbidgee River provides habitat for 20 fauna species and an endangered population, which are known or likely to occur in the study area, as listed under the TSC Act and/or FM Act. Twelve fauna species listed as threatened or migratory under the EPBC Act are known or likely to occur in the study area.

Two species listed as vulnerable under the TSC Act were recorded during the current survey period; the Brown Treecreeper and Superb Parrot. The Superb Parrot is also listed as vulnerable under the EPBC Act. The Lowland Murray River aquatic ecological community listed under the FM Act occurs in the subject site and study area.

The proposal would remove 43.9 hectares of vegetation over the total 14.8 kilometre length and three borrow pits. About 97 per cent (42.5 hectares) of the vegetation to be disturbed or removed is introduced groundcover vegetation. The proposal would remove 1.1 hectares of River Red Gum forest which represents about 0.6 per cent of this vegetation community in the study area and an even smaller proportion of this vegetation community in the locality.

A number of safeguards and mitigation measures are proposed to minimise the impacts of the proposed activity within the study area on native flora and fauna and especially threatened biota. The proposal is unlikely to have a significant impact on any species, population or ecological community listed as threatened or migratory under the TSC Act or EPBC Act and therefore a Species Impact Statement and EPBC Act referral would not be required. This ecological assessment satisfies Wagga Wagga City Council's requirements under the EP&A Act.

8. References

The following references have either been referenced in this document or have been consulted during the completion of field studies and background research.

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Appendices

Appendix A Flora list

FLORA LIST

* Introduced species

✓ Species present

Scientific Name	Common Name	Copland St Borrow Pit	Tasman Rd Borrow Pit	North Wagga Borrow Pit	T1	Incidentals
<i>Agave americana</i> *	Century Plant					✓
<i>Alternanthera pungens</i> *	Khaki Weed					✓
<i>Anagallis arvensis</i> *	Scarlet Pimpernel					✓
<i>Arctotheca calendula</i> *	Capeweed				✓	
<i>Austrodanthonia</i> sp.	Wallaby Grass	✓	✓			
<i>Austrostipa bigeniculata</i>	A Speargrass		✓			
<i>Avena fatua</i> *	Wild Oats				✓	
<i>Brachychiton populneus</i>	Kurrajong					✓
<i>Brassica rapa</i> *	Field Mustard					✓
<i>Bromus</i> sp. *				✓		
<i>Bromus diandrus</i> *	Great Brome				✓	
<i>Bromus hordeaceus</i> *	Soft Brome				✓	
<i>Bromus molliformis</i> *	Soft Brome					✓

Scientific Name	Common Name	Copland St Borrow Pit	Tasman Rd Borrow Pit	North Wagga Borrow Pit	T1	Incidentals
<i>Capsella bursa-pastoris</i> *	Shepherd's Purse			✓		
<i>Carduus nutans</i> *	Nodding Thistle			✓		
<i>Centaurea solstitialis</i> *	St Barnaby's Thistle	✓	✓			
<i>Centipeda cunninghamii</i>	Common Sneezeweed			✓		
<i>Cerastium glomeratum</i> *	Mouse-ear Chickweed			✓		✓
<i>Chloris truncata</i>	Windmill Grass					✓
<i>Chondrilla juncea</i> *	Skeleton Weed					✓
<i>Cirsium vulgare</i> *	Spear Thistle	✓		✓	✓	
<i>Conyza bonariensis</i> *	Flaxleaf Fleabane			✓	✓	
<i>Conyza sumatrensis</i> *	Tall Fleabane	✓	✓			
<i>Corymbia citriodora</i>						✓
<i>Cotula bipinnata</i> *	Ferny Cotula		✓			
<i>Crassula colorata</i>				✓		
<i>Cynodon dactylon</i>	Couch				✓	
<i>Cyperus eragrostis</i> *		✓	✓	✓		
<i>Echium plantagineum</i> *	Paterson's Curse	✓	✓	✓		
<i>Ehrharta erecta</i> *	Veldt Grass					✓
<i>Epilobium hirtigerum</i>			✓			
<i>Eragrostis cilianensis</i> *	Stinkgrass					✓

Scientific Name	Common Name	Copland St Borrow Pit	Tasman Rd Borrow Pit	North Wagga Borrow Pit	T1	Incidentals
<i>Erodium moschatum</i> *	Musky Crowfoot					✓
<i>Eucalyptus camaldulensis</i>	River Red Gum			✓	✓	
<i>Eucalyptus melliodora</i>	Yellow Box					✓
<i>Eucalyptus sideroxylon</i>	Mugga Ironbark					✓
<i>Fumitory capreolata</i> *	Climbing Fumitory					✓
<i>Fumaria muralis</i> *	Wall Fumitory					✓
<i>Galium aparine</i> *	Cleavers				✓	
<i>Galium</i> sp.	Native Galium					✓
<i>Geranium retrorsum</i>	Common Cranesbill	✓				
<i>Hordeum leporinum</i> *	Barley Grass			✓		
<i>Hypericum perforatum</i> *	St John's Wort		✓			
<i>Hypochaeris radicata</i> *	Flatweed				✓	
<i>Eleocharis acuta</i>			✓			
<i>Juncus</i> sp.			✓	✓	✓	
<i>Juncus usitatus</i>		✓	✓			
<i>Lactuca serriola</i> *	Prickly Lettuce				✓	
<i>Leiocarpa panaetioides</i>	Wooly Buttons		✓			
<i>Lepidium africanum</i> *						✓
<i>Ligustrum lucidum</i> *						✓

Scientific Name	Common Name	Copland St Borrow Pit	Tasman Rd Borrow Pit	North Wagga Borrow Pit	T1	Incidentals
<i>Lolium rigidum</i> *	Wimmera Ryegrass		✓	✓	✓	
<i>Lycium ferocissimum</i> *	African Boxthorn					
<i>Malva parviflora</i> *	Small-flowered Mallow			✓	✓	
<i>Marrubium vulgare</i> *	White Horehound					✓
<i>Marsilea drummondii</i>	Common Nardoo			✓		
<i>Medicago arabica</i> *	Spotted Medic					✓
<i>Medicago polymorpha</i> *	Burr Medic					✓
<i>Melia azedarach</i> *	White Cedar				✓	
<i>Olea europaea</i> subsp. <i>europaea</i> *	Olive					✓
<i>Oxalis corniculata</i> *						✓
<i>Oxalis pes-caprae</i> *	Soursob				✓	
<i>Panicum effusum</i>	Hairy Panic	✓				
<i>Papaver somniferum</i> *	Opium Poppy					✓
<i>Paspalum dilatatum</i> *	Paspalum	✓			✓	
<i>Paspalum distichum</i>	Water Couch	✓	✓			
<i>Pennisetum clandestinum</i> *	Kikuyu Grass				✓	
<i>Phalaris aquatica</i> *	Phalaris	✓		✓		
<i>Phoenix dactylifera</i> *	Date Palm				✓	
<i>Phragmites australis</i>	Common Reed					✓

Scientific Name	Common Name	Copland St Borrow Pit	Tasman Rd Borrow Pit	North Wagga Borrow Pit	T1	Incidentals
<i>Phyla canescens</i> *						✓
<i>Phyla nodiflora</i> *	Lippia			✓		
<i>Pinus halepensis</i> *	Aleppo Pine					✓
<i>Pinus radiata</i> *	Radiata Pine					✓
<i>Plantago lanceolata</i> *	Lamb's Tongues	✓				
<i>Poa annua</i> *	Winter Grass			✓		
<i>Polygonum aviculare</i> *	Wireweed	✓		✓		
<i>Romulea minutiflora</i> *	Small-flowered Onion Grass					✓
<i>Romulea rosea</i> *	Onion Grass	✓	✓		✓	
<i>Rosa rubiginosa</i> *	Sweet Briar	✓	✓			
<i>Rumex brownii</i>	Swamp Dock			✓	✓	
<i>Rumex crispus</i> *	Curled Dock	✓	✓	✓		
<i>Rytidosperma caespitosum</i>	Ringed Wallaby Grass					✓
<i>Salix babylonica</i> *	Weeping Willow					✓
<i>Salsola kali</i>				✓		
<i>Salvia verbenaca</i> *	Vervain		✓			
<i>Silybum marianum</i> *	Variegated Thistle			✓		
<i>Sisymbrium irio</i> *	London Rocket			✓		
<i>Solanum nigrum</i> *	Black-berry Nightshade					✓

Scientific Name	Common Name	Copland St Borrow Pit	Tasman Rd Borrow Pit	North Wagga Borrow Pit	T1	Incidentals
<i>Sonchus oleraceus</i> *	Common Sowthistle		✓		✓	
<i>Sorghum halepense</i> *	Johnson Grass					✓
<i>Stachys arvensis</i> *	Stagger Weed	✓				
<i>Taraxacum officinale</i> *	Dandelion					✓
<i>Trifolium sp.</i> *			✓			
<i>Trifolium arvense</i> *	Haresfoot Clover		✓			
<i>Trifolium subterraneum</i> *	Subterranean Clover			✓		
<i>Urtica urens</i> *	Small Nettle			✓		
<i>Verbena bonariensis</i> *	Purpletop				✓	
<i>Vicia sativa</i> *	Common Vetch		✓	✓	✓	✓
<i>Vulpia bromoides</i> *	Squirrel Tail Fescue			✓	✓	
<i>Xanthium spinosum</i> *	Bathurst Burr			✓		
<i>Zaleya galericulata</i>	Hogweed				✓	✓

Appendix B Fauna list

* Introduced species

✓ Species present

Bold indicates threatened species

Common name	Scientific name	Targeted survey	Incidentals
Birds			
Australian Magpie	<i>Gymnorhina tibicen</i>	✓	
Australian Pelican	<i>Pelecanus conspicillatus</i>		✓
Australian Raven	<i>Corvus coronoides</i>	✓	
Australian Wood Duck	<i>Chenonetta jubata</i>	✓	
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	✓	
Black-shouldered Kite	<i>Elanus axillaris</i>		✓
Brown Thornbill	<i>Acanthiza pusilla</i>		✓
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	✓	
Common Blackbird	<i>Turdus merula*</i>	✓	
Common Starling	<i>Sturnus vulgaris*</i>	✓	
Crested Pigeon	<i>Ocyphaps lophotes</i>		✓
Eastern Rosella	<i>Platycercus eximius</i>		✓
Eastern Shrike-tit	<i>Falcunculus frontatus frontatus</i>	✓	
Eurasian Coot	<i>Fulica atra</i>		✓
European Goldfinch	<i>Carduelis carduelis*</i>	✓	
Fairy Martin	<i>Petrochelidon ariel</i>		✓
Galah	<i>Eolophus roseicapillus</i>	✓	
Great Cormorant	<i>Phalacrocorax carbo</i>	✓	
Great Egret	<i>Ardea modesta</i>		✓
Grey Fantail	<i>Rhipidura albiscapa</i>	✓	
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	✓	

Grey Teal	<i>Anas gracilis</i>		✓
Hardhead	<i>Aythya australis</i>		✓
House Sparrow	<i>Passer domesticus*</i>	✓	
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	✓	
Magpie-lark	<i>Grallina cyanoleuca</i>	✓	
Masked Lapwing	<i>Vanellus miles</i>	✓	
Nankeen Kestrel	<i>Falco cenchroides</i>		✓
Noisy Friarbird	<i>Philemon corniculatus</i>		✓
Pacific Black Duck	<i>Anas superciliosa</i>	✓	
Pacific Heron	<i>Ardea pacifica</i>		✓
Pied Cormorant	<i>Phalacrocorax varius</i>	✓	
Pied Currawong	<i>Strepera graculina</i>	✓	
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	✓	
Red-browed Finch	<i>Neochmia temporalis</i>	✓	
Red-capped Robin	<i>Petroica goodenovii</i>	✓	
Red-kneed Dotterel	<i>Erythrogonyx cinctus</i>	✓	
Red-rumped Parrot	<i>Psephotus haematonotus</i>	✓	
Red Wattlebird	<i>Anthochaera carunculata</i>	✓	
Rock Dove	<i>Columba livia*</i>	✓	
Rufous Whistler	<i>Pachycephala rufiventris</i>	✓	
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	✓	
Striated Pardalote	<i>Pardalotus striatus</i>	✓	
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	✓	
Superb Fairy-wren	<i>Malurus cyaneus</i>	✓	
Superb Parrot	<i>Polytelis swainsonii</i>	✓	
Tawny Frogmouth	<i>Podargus strigoides</i>	✓	
Welcome Swallow	<i>Hirundo neoxena</i>	✓	
White-browed Scrubwren	<i>Sericornis frontalis</i>	✓	
White-faced Heron	<i>Egretta novaehollandiae</i>	✓	
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	✓	

White-throated Treecreeper	<i>Cormobates leucophaea</i>	✓	
Willie Wagtail	<i>Rhipidura leucophrys</i>	✓	
Yellow-billed Spoonbill	<i>Platalea flavipes</i>		✓
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	✓	
Yellow Rosella	<i>Platycercus elegans flaveolus</i>	✓	
Yellow Thornbill	<i>Acanthiza nana</i>	✓	
Mammals			
A microchiropteran Bat	<i>Scotorepens</i> sp.	✓	
A microchiropteran Bat	<i>Nyctophilus</i> sp.	✓	
Cat	<i>Felis catus</i> *	✓	
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	✓	
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	✓	
Eastern Grey Kangaroo (scat)	<i>Macropus giganteus</i>		✓
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	✓	
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>	✓	
Large Forest Bat	<i>Vespadelus darlingtoni</i>	✓	
Little Forest Bat	<i>Vespadelus vulturnus</i>	✓	
Rabbit (scat)	<i>Oryctolagus cuniculus</i> *		✓
Red Fox	<i>Vulpes vulpes</i> *	✓	
Southern Forest Bat	<i>Vespadelus regulus</i>	✓	
Southern Freetail Bat	<i>Mormopterus</i> species 4	✓	
White-striped Freetail Bat	<i>Tadarida australis</i>	✓	
Amphibians			
Eastern Sign-bearing Froglet	<i>Crinia parinsignifera</i>	✓	
Peron's Tree Frog	<i>Litoria peronii</i>	✓	
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	✓	

Appendix C Hollow-bearing trees in the study area

Species	DBH (cm)	Number of hollow / diameter (cm)				Location	Recommendation
		< 10	10-20	20-30	> 30		
<i>E. camaldulensis</i>	200	3		1	2	North Wagga Wagga Levee; Chainage 3360 to Chainage 3640	Retain
<i>E. camaldulensis</i>	250		5			North Wagga Wagga Levee; Chainage 3360 to Chainage 3640	Retain
<i>E. camaldulensis</i>	180	3	1	1		North Wagga Wagga Levee; Chainage 3360 to Chainage 3640	Retain
<i>E. camaldulensis</i>	250	2	3		2	North Wagga Wagga Levee; Chainage 3720 to Chainage 3740	Retain
<i>E. camaldulensis</i>	180	1			1	North Wagga Wagga Levee; Chainage 3800 to Chainage 3820	Retain
<i>E. camaldulensis</i>	200		5	1		Main City Levee; proposed sheet pile wall Chainage 4900	Retain

Species	DBH (cm)	Number of hollow / diameter (cm)				Location	Recommendation
		< 10	10-20	20-30	> 30		
<i>E. camaldulensis</i>	120	2				Main City Levee; Chainage 5020	Retain
<i>E. camaldulensis</i>	200	1			3	Main City Levee; Chainage 7780	Retain
<i>E. camaldulensis</i>	140		1			North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	130		1		2	North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	120	2	1			North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	120	4				North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	120	4	2	1	1	North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	100	1	2	1		North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	140	4	3	1		North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	160	1		1		North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	120	4	2	1		North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	160	4	2			North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	140	2	1			North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	150	3				North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	120		1	4		North Wagga Wagga borrow pit	Retain

Species	DBH (cm)	Number of hollow / diameter (cm)				Location	Recommendation
		< 10	10-20	20-30	> 30		
<i>E. camaldulensis</i>	100	3				North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	140	4	1	2		North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	120	1	3	1		North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	110		2	1	1	North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	120	3	3	1		North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	120	5		1	1	North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	120	2	2	1	1	North Wagga Wagga borrow pit	Retain
<i>E. camaldulensis</i>	130	5			2	North Wagga Wagga borrow pit	Retain

Appendix D Habitat assessment table

An evaluation of the likelihood and extent of impact to threatened and migratory fauna recorded from within the Wagga Wagga LGA (TSC Act threatened species); and within a 10 km radius of the subject site (EPBC Act threatened and migratory species). Records are from a search of the Office of Environment and Heritage (OEH) Wildlife Atlas, OEH Biobanking Credit Calculator, and the EPBC Environmental Reporting Tool available from the Department of Sustainability, Environment, Water, Population and Community (SEWPaC) website. Ecology information has been obtained from the Threatened Species Profiles on the NSW OEH website (<http://www.environment.nsw.gov.au/threatenedspecies/>) and from the Species Profiles and Threats Database on the Commonwealth SEWPaC website (<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>).

Likelihood of Occurrence in Study Area

- Unlikely: Species, population or ecological community is not likely to occur. Lack of previous records and suitable potential habitat limited or not available in the study area.
- Likely: Species, population or ecological community could occur and study area is likely to provide suitable habitat. Previous records in the locality and/or suitable potential habitat in the study area.
- Present: Species, population or ecological community was recorded during the field investigations.

Possibility of Impact

- Unlikely: The proposal would be unlikely to impact this species or its habitats. No EP&A Act 7-Part Test or EPBC Act significance assessment is necessary for this species.
- Likely: The proposal could impact this species, population or ecological community or its habitats. An EP&A Act 7-Part Test and/or EPBC Act significance assessment is required for this species, population or ecological community.

Status

- National Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
- NSW NSW *Threatened Species Conservation Act 1995*
- E: Endangered
- CE: Critically Endangered
- V: Vulnerable
- Mi: Migratory
- M: Marine

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
ECOLOGICAL COMMUNITIES				
Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	E	E	<p>Unlikely - Inland Grey Box Woodland includes those woodlands in which the most characteristic tree species, <i>Eucalyptus microcarpa</i> (Inland Grey Box), is often found in association with <i>E. populnea</i> subsp. <i>bimbil</i> (Bimble or Poplar Box), <i>Callitris glaucophylla</i> (White Cypress Pine), <i>Brachychiton populneus</i> (Kurrajong), <i>Allocasuarina luehmannii</i> (Bulloak) or <i>E. melliodora</i> (Yellow Box), and sometimes with <i>E. albens</i> (White Box). Shrubs are typically sparse or absent, although this component can be diverse and may be locally common, especially in drier western portions of the community. A variable ground layer of grass and herbaceous species is present at most sites. At severely disturbed sites the ground layer may be absent. Occurs predominately within the Riverina and South West Slopes regions of NSW down to the Victorian border.</p> <p>Grey Box does not occur in the study area or locality and is not known to have previously occurred; therefore the community does not occur.</p>	Unlikely – The ecological community does not occur within the study area or locality.
Lowland Murray River aquatic ecological community	-	E (FM Act)	<p>Likely - The ecological community includes all natural creeks, rivers, and associated lagoons, billabongs and lakes of the regulated portions of the Murray River below the Hume Weir, the Murrumbidgee River below Burrinjuck Dam, and the Tumut River below Blowering Dam, as well as all their tributaries and branches.</p> <p>The community occurs within the study area due to its location on the Murrumbidgee River.</p>	Likely – The proposal has the potential to impact the community due to the removal of vegetation adjacent to the Murrumbidgee River.
Weeping Myall Woodlands / Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions'	E	E	<p>Unlikely - The structure of this community varies from low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history. The tree layer grows up to a height of about 10 metres and invariably includes <i>Acacia pendula</i> (Weeping Myall or Boree) as one of the dominant species or the only tree species present. The understorey includes an open layer of chenopods and other woody plant species and an open to continuous groundcover of grasses and herbs.</p>	Unlikely – The ecological community does not occur within the study area or locality.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			The keystone species of the community, <i>Acacia pendula</i> does not occur in the study area or locality and is not known to have previously occurred; therefore the community does not occur.	
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland)	CE	E	<p>Likely - Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. Commonly co-occurring eucalypts include <i>Eucalyptus bridgesiana</i>, <i>E. polyanthemos</i>, <i>E. rubida</i>, <i>E. pauciflora</i>, <i>E. cinerea</i>, <i>E. mannifera</i>, <i>E. macrorhyncha</i>, <i>E. microcarpa</i> and others.</p> <p>The subject site does not contain White Box, Yellow or Blakely's Red Gum as it is largely restricted to riverine areas dominated by River Red Gum. This species occurs in the wider study area off the Murrumbidgee River floodplain.</p>	Unlikely – Direct and indirect impacts will be restricted to floodplain areas where this community does not occur.
BIRDS				
Australasian Bittern <i>Botaurus poiciloptilus</i>	E	E	<p>Likely - This species favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails.</p> <p>The species has not been recorded within the locality. The species may use the emergent vegetation along the Murrumbidgee River, various wetlands (e.g. Flowerdale and Parkan Pregaran lagoon) and Marshalls Creek in the study area as habitat.</p>	Unlikely – The proposal would not impact upon emergent vegetation along the river or wetlands in the study area.
Australian Painted Snipe <i>Rostratula australis</i> <i>Rostratula benghalensis s. lat.</i>	V, M, Mi	E	<p>Likely - Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Forages nocturnally on mud-flats and in shallow water.</p> <p>The species has not been recorded within the locality. The species may use the emergent vegetation along the Murrumbidgee River and various wetlands (e.g. Flowerdale and Parkan Pregaran lagoon) in the study area as habitat.</p>	Unlikely – The proposal would not impact upon emergent vegetation along the river or wetlands in the study area.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
Barking Owl <i>Ninox connivens</i>	-	V	<p>Likely - Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as <i>Acacia</i> and <i>Casuarina</i> species, or the dense clumps of canopy leaves in large <i>Eucalypts</i>. Nests in hollows of large, old eucalypts including River Red Gum (<i>Eucalyptus camaldulensis</i>). They require hollows greater than 20 centimetres in diameter and at least 4 metres from the ground for nesting.</p> <p>The species has been recorded about 100 metres west of the subject site near Flowerdale Lagoon. The study area contains eucalypt woodland the species may use as habitat, with tree hollows in large, old eucalypts available for nesting.</p>	Likely – The removal of mature and juvenile trees from the study area may reduce roosting and foraging habitat for the species.
Black-chinned Honeyeater (eastern subspecies) <i>Melithreptus gularis gularis</i>	-	V	<p>Unlikely - Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>Eucalyptus albens</i>), Grey Box (<i>Eucalyptus microcarpa</i>), Yellow Box (<i>Eucalyptus melliodora</i>) and Forest Red Gum (<i>Eucalyptus tereticornis</i>). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees.</p> <p>The species has been recorded most recently 3.5 kilometres west of the subject site. The study area contains minimal box eucalypt habitat and is unlikely to be suitable for the species to occur</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable potential habitat.
Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	-	V	<p>Present - Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. Also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses. Usually not found in woodlands with a dense shrub layer. Fallen timber is an important habitat component for foraging.</p> <p>The species was recorded in the study area during current surveys and there are historical records for this species along the Murrumbidgee River.</p>	Likely – The removal of mature and juvenile trees from the study area may reduce nesting, roosting and foraging habitat for the species.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			The study area contains River Red Gum Woodland and sufficient woody debris, which the species requires as habitat components.	
Bush Stone-curlew <i>Burhinus grallarius</i>	-	E	<p>Unlikely - Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber.</p> <p>The species has been recorded four kilometres south-west of the study area at the Country Golf Club Course adjacent to Lake Albert. This is a resident single individual whose partner was accidentally killed about 10 years ago. The study area does not contain sufficient open grassy woodland to provide suitable habitat for the species to occur.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable potential habitat.
Cattle Egret <i>Ardea ibis</i>	M, Mi	-	<p>Likely - The Cattle Egret is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Will also forage at garbage dumps, and is often seen with cattle and other stock.</p> <p>The species has not been recorded within the locality since 1988 when it was recorded 6.5 kilometres to the south-east. The species may, however inhabit the grassland and woodland within the study area.</p>	Likely – The proposal at the Copland Street borrow pit could potentially remove habitat suitable for this species.
Curlew Sandpiper <i>Calidris ferruginea</i>	-	E	<p>Likely - The species generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland.</p> <p>It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach cast seagrass or seaweed.</p> <p>The species has been recorded three times in the locality; however the most recent sighting was two kilometres south of the subject site in 1978. The species may inhabit the wetland habitat in the study area.</p>	Unlikely – The proposal would not impact on wetlands such as Flowerdale and Parkan Pagan lagoons where the species is most likely to occur.
Diamond Firetail <i>Stagonopleura guttata</i>	-	V	<p>Likely - Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum <i>Eucalyptus pauciflora</i> Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds</p>	Likely – The removal of mature and juvenile trees from the study area may reduce nesting and foraging habitat for the species.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			<p>exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects.</p> <p>The species has been recorded 1.3 kilometres west of the subject site at Pomingarlarna Reserve. The study area contains riparian woodland with a sufficient grassy understorey for the foraging requirements of the species.</p>	
Flame Robin <i>Petroica phoenicea</i>	-	V	<p>Likely - The Flame Robin's preferred habitat type is forests and woodlands up to about 1800 m above sea level. In winter, birds move to lower and more open areas, including gardens. In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains.</p> <p>The species was recorded in the locality most recently in 1994, 3.5 kilometres west of the subject site. The study area contains eucalypt woodland with areas of open understorey for the species habitat requirements.</p>	Likely – The removal of mature and juvenile trees from the study area may reduce and roosting and foraging habitat for the species.
Fork-tailed Swift <i>Apus pacificus</i>	M, Mi	-	<p>Likely - Migratory marine visitor to eastern Australia. It is a highly nomadic and dispersive species which feeds on insects in the air.</p> <p>The species has not been recorded in the locality since 1980. The species may forage above the study area.</p>	Unlikely – The species is almost exclusively aerial and the proposal would not impact on the aerial resources of the species.
Freckled Duck <i>Stictonetta naevosa</i>	-	V	<p>Likely - Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.</p> <p>The species has been recorded one kilometres south of the subject site. The species may inhabit the river, lagoon or creek habitats in the study area.</p>	Unlikely – The proposal would not impact upon the fringing vegetation of the waterways in the study area.
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>	-	V	<p>Unlikely - In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			<p>forests and woodlands, and often found in urban areas. Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages. Favours old growth attributes for nesting and roosting.</p> <p>The species has not been recorded in the area since 1979. The study area is generally too far west for the species, although there may be rare vagrants to the area.</p>	potential habitat.
<p>Gilbert's Whistler <i>Pachycephala inornata</i></p>	-	V	<p>Unlikely - In NSW it occurs mostly in mallee shrubland, but also in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests. Within the mallee the species is often found in association with an understorey of spinifex and low shrubs including acacias, hakeas, sennas and grevilleas. In woodland habitats, the understorey comprises dense patches of shrubs.</p> <p>The species has been recorded 3.6 kilometres west of the study area. The study area contains River Red Gum habitat that the species may inhabit; however, the species has not been recorded in the locality since 1995 and is considered likely to be locally extinct.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable potential habitat.
<p>Glossy Black-cockatoo <i>Calyptorhynchus lathami</i></p>	E (SA sub species)	V	<p>Unlikely – Glossy Black-cockatoos inhabit open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) or Drooping She-oak (<i>A. verticillata</i>) occur.</p> <p>In the Riverina area, again usually associated with woodlands containing Drooping She-oak but also recorded in open woodlands dominated by Belah (<i>Casuarina cristata</i>). Feeds almost exclusively on the seeds of several species of she-oak (<i>Casuarina</i> and <i>Allocasuarina</i> species).</p> <p>The species has been recorded 3.7 kilometres west of the subject site in Pomingarlarna Reserve. There is no suitable feed trees in the study area for the species to be likely to occur.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of preferred foraging habitat.
<p>Great Egret <i>Ardea alba</i></p>	M, Mi	-	<p>Likely - Reported in a wide range of wetland habitats including swamps and marshes, margins of rivers and lakes, damp or flooded grasslands, pastures or agricultural lands, reservoirs, sewage treatment ponds, and</p>	Likely – The proposal would not disturb vegetation on the direct margins of the wetland

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			<p>drainage channels.</p> <p>The species has been recorded several times in the locality, as close as 300 metres from the subject site. The study area provides preferred habitat for the species along the margins of the river, lagoons and creek.</p>	habitats the species prefers but the Copland Street borrow pit may contain suitable potential habitat for the species.
<p>Grey-crowned Babbler (eastern subspecies) <i>Pomatostomus temporalis temporalis</i></p>	-	V	<p>Unlikely - Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas.</p> <p>The species has been recorded five kilometres north-east of the subject site. The study area does not contain the preferred Box-Gum Woodland habitat of the species and the species is likely to utilise preferred habitat in the locality.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable potential habitat.
<p>Hooded Robin <i>Melanodryas cucullata cucullatas</i></p>	-	V	<p>Unlikely - Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.</p> <p>The species has been recorded four kilometres west of the subject site in Pomingarlarna Reserve. The study area contains eucalypt woodland and is adjacent open areas; however the groundlayer is predominately introduced and does not contain the structural diversity the species requires. The species is likely to utilise alternative habitat in the locality.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable potential habitat.
<p>Latham's Snipe <i>Gallinago hardwickii</i></p>	M, Mi	-	<p>Unlikely - Occurs in permanent and ephemeral wetlands. The species usually inhabits open, freshwater wetlands with low, dense vegetation.</p> <p>The species has not been recorded in the locality since 1979. The species is unlikely to utilise habitat within the study area due to a lack of suitable dense low growing wetland vegetation. It may sporadically utilise habitat outside the locality.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable potential habitat.
<p>Little Eagle <i>Hieraaetus morphnoides</i></p>	-	V	<p>Likely - Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs</p>	Likely – The removal of mature and juvenile trees from a major river riparian area may impact

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			<p>build a large stick nest in winter.</p> <p>There species was recorded in the study area in 1978 and most recently six kilometres south of the subject site, in 2009. The study area contains suitable habitat for the species in the form of eucalypt woodland and acacias, with tall trees available for nesting.</p>	roosting, nesting and foraging habitat for the species.
<p>Little Lorikeet <i>Glossopsitta pusilla</i></p>	-	V	<p>Likely - Mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. On the western slopes and tablelands White Box and Yellow Box are particularly important food sources for pollen and nectar and mistletoe is also a common habitat feature.</p> <p>The most recent record of the species in the locality was in 1994, 3.5 kilometres west of the subject site. The study area contains eucalypt woodland as potential habitat for the species; however there are no White Box and Yellow Box trees, which are an important food source for the species. The species is likely to utilise preferred habitat outside the study area.</p>	Unlikely – The species is likely to use preferred habitat outside the study area in remnant woodland
<p>Major Mitchell's Cockatoo <i>Cacatua leadbeateri</i></p>	-	V	<p>Unlikely - Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines.</p> <p>The species has been recorded twice in the locality, most recently 5.5 kilometres north of the subject site, in 1999. The study area is at the western extent of the species' range. The species may be a rare vagrant to the study area, but it is unlikely to provide preferred habitat.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable potential habitat.
<p>Rainbow Bee-eater <i>Merops ornatus</i></p>	M, Mi	-	<p>Likely - The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation.</p> <p>There are numerous records of the species within the locality, with the nearest record 100 metres east of the subject site. The study area contains woodland and riverine habitat the species may utilise as roosting and</p>	Likely – The removal of mature trees from the site may impact upon foraging and roosting habitat for the species.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			foraging habitat.	
Regent Honeyeater <i>Anthochaera phrygia</i>	E	E	<p>Unlikely - The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.</p> <p>The species has not been recorded within the locality since 1980 when it was recorded 600 metres east of the subject site. The species is highly nomadic and unlikely to utilise woodland in the study area. The study area is unlikely to represent preferred habitat for the species and does not contain mistletoes.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack breeding habitat and occurring outside the species breeding range.
Scarlet Robin <i>Petroica boodang</i>	-	V	<p>Likely - In NSW it occupies open forests and woodlands from the coast to the inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat.</p> <p>The species has been recorded most recently, 3.5 kilometres west of the subject site in 2007. The study area contains the required habitat structure for the species, consisting of eucalypt woodland containing woody debris and occasional shrubs needed for nesting, roosting and foraging.</p>	Likely – The removal of mature and juvenile trees from the study area may reduce nesting and roosting habitat for the species.
Speckled Warbler <i>Pyrholaemus saggitatus</i>	-	V	<p>Unlikely - The Speckled Warbler lives in a wide range of <i>Eucalyptus</i> dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.</p> <p>The species has been recorded once in the locality, 1.8 kilometres south of the subject site in 1977 but it has been more recently recorded in in the Gregadoo Hills south of Wagga Wagga. The study area is unlikely to provide suitable preferred habitat for the species due to its disturbed nature</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of preferred habitat and the disturbed nature of the study area.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			and the species is likely to use preferred habitat outside the study area.	
Spotted Harrier <i>Circus assimilis</i>	-	V	<p>Likely - Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (eg chenopods) (Marchant and Higgins 1993; Aumann 2001a). It is found mostly commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.</p> <p>The species has been recorded once in the locality; four kilometres south of the subject site in 1977. The study area contains riparian woodland as suitable habitat for the species.</p>	Unlikely – The species is unlikely to be impacted by the proposal due to the limited impact area in a disturbed environment away from the edges of wetlands
Superb Parrot <i>Polytelis swainsonii</i>	V	V	<p>Present - The species inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. May forage up to 10 kilometres from nesting sites, primarily in grassy box woodland.</p> <p>The species was recorded at the subject site during current surveys at Wilks Park in North Wagga and at the North Wagga borrow pit site. The study area contains large River Red Gum trees and the species is known to breed in the study area on the North Wagga flats.</p>	Likely – The removal of mature and juvenile trees from the study area may impact foraging, roosting and breeding habitat for the species.
Swift Parrot <i>Lathamus discolor</i>	E, Mi, M	E	<p>Unlikely - The species occurs in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i>, Spotted Gum <i>Corymbia maculata</i>, Red Bloodwood <i>C. gummifera</i>, Mugga Ironbark <i>E. sideroxylon</i>, and White Box <i>E. albens</i>. Commonly used lerp infested trees include Grey Box <i>E. microcarpa</i>, Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i>.</p> <p>The species has been recorded three kilometres north of the subject site. The study area contains minimal preferred tree species and the species is likely to utilise preferred habitat outside the study area.</p>	Unlikely – The species is unlikely to be impacted by the proposal due impacts being limited to a non-preferred riverine habitat type.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
Turquoise Parrot <i>Neophema pulchella</i>	-	V	<p>Unlikely - Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter.</p> <p>The species has been recorded once in the locality; 5.5 kilometres east of the subject site. The eucalypt woodland in the study area may provide habitat for the species; however due to the degraded nature of the groundlayer, the species is likely to utilise preferred habitat outside the study area.</p>	Unlikely – The species is unlikely to be impacted by the proposal due impacts being limited to a non-preferred riverine habitat type.
Varied Sittella <i>Daphoenositta chrysoptera</i>	-	V	<p>Likely - Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and <i>Acacia</i> woodland.</p> <p>The species has been recorded once in the locality; 3.5 kilometres west of the subject site in 1994. The eucalypt woodland and acacias of the study area may provide habitat for the species.</p>	Likely – The removal of mature and juvenile eucalypt trees from the subject site may impact on foraging, roosting and nesting habitat of the species.
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	M, Mi	-	<p>Likely - Characterised by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats.</p> <p>The species has not been recorded within the locality. The study area contains suitable habitat in the form of the Murrumbidgee River. Despite it having not been recorded, suitable habitat is available in the study area.</p>	Unlikely – The species is unlikely to be impacted by the proposal as works will be limited to the levee banks and borrow pit rather than riverine impacts where this species may sporadically occur.
White-fronted Chat <i>Epthianura albifrons</i>	-	V	<p>Likely - The White-fronted Chat lives in salt marsh and other damp areas with low vegetation such as swampy farmland and roadside verges. Sometimes occurs on beaches and the edges of lakes.</p> <p>The species was recorded most recently three kilometres north-east of the subject site in 1992. The study area contains suitable wetland habitat the species may utilise.</p>	Likely – The removal of mature and juvenile eucalypt trees from the subject site may impact on foraging habitat of the species.
White-throated Needle-tail	M, Mi	-	<p>Likely - This is a highly nomadic and dispersive species, which follows low pressure atmospheric pockets where it feeds on insects. The species is</p>	Unlikely – The proposal is unlikely to have an impact on

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
<i>Hirundapus caudacutus</i>			<p>generally found in eastern New South Wales and occasionally in inland NSW.</p> <p>The species was recorded most recently two kilometres south of the subject site, in 1994. The species is almost exclusively aerial in Australia and may forage over the study area.</p>	foraging habitat for the species.
BATS				
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	-	V	<p>Likely - Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested and woodland areas, catching moths and other flying insects above the tree tops.</p> <p>The species has previously been recorded once in the locality; 5.2 kilometres east of the subject site, in 2007. The species may use the woodland in the study area for foraging.</p>	Likely – The removal of mature and juvenile eucalypt trees from the subject site may impact on foraging habitat for the species.
Grey-headed Flying-fox <i>Pteropus polycephalus</i>	V	V	<p>Likely - This species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.</p> <p>The species has been previously sighted in the Wagga Wagga LGA and although not commonly found here has the potential to occur in the eucalypt woodland when there are resource shortages in its preferred habitat along the east coast of Australia.</p>	Unlikely – Although the species may inhabit the study area, it is unlikely to be impacted due to its nomadic nature and ability to travel long distances for foraging resources.
Inland Forest Bat <i>Vespadelus baverstocki</i>	-	V	<p>Unlikely - Roosts in tree hollows and abandoned buildings. Known to roost in very small hollows in stunted trees only a few metres high. It has been recorded from a variety of woodland formations, including mallee, mulga and River Red Gum but is primarily known from inland and western NSW. Most records are from drier woodland habitats with riparian areas inhabited by the Little Forest Bat. However, other habitats may be used for foraging and/or drinking.</p> <p>The species has been recorded once in the locality; four kilometres west of</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of preferred habitat for the species to be impacted.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			the subject site in 2007. Records of the species this far east have not been confirmed, and the species is unlikely to occur .	
Little Pied Bat <i>Chalinolobus picatus</i>	-	V	Unlikely - The species occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. The species has not been recorded in the locality; however it may utilise the woodland in the study area for foraging and hollow bearing trees for roosting.	Unlikely – The species is unlikely to inhabit the study area due to a lack of preferred habitat.
Southern Myotis <i>Myotis macropus</i>	-	V	Likely - Preferred habitat is riparian. Roosts in caves, mines, tree hollows, aqueduct tunnels and under bridges and in dense vegetation in the vicinity of bodies of slow-flowing or still water (including estuaries). The species has been recorded once in the locality, 90 metres east of the subject site in 2000. The study area contains the species preferred riparian habitat along the Murrumbidgee River and the species may utilise the study area for foraging and roosting.	Likely – The removal of mature and juvenile eucalypt trees from the subject site may impact on the edges of foraging habitat (over water) for the species.
South-eastern Long-eared Bat / Corben's Long-eared Bat <i>Nyctophilus corbeni</i>	V	V	Unlikely - The species inhabits a variety of vegetation types, including mallee, Buloke <i>Allocasuarina luehmannii</i> and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. The species has not been recorded within the locality and the study area does not contain the species preferred habitat. The species is more likely to utilise preferred habitat outside the study area.	Unlikely – The species is unlikely to inhabit the study area due to a lack of preferred habitat for the species.
MAMMALS				
Brush-tailed Phascogale <i>Phascogale tapoatafa</i>	-	V	Unlikely - In NSW the species is mainly found east of the Great Dividing Range although there are occasional records west of the divide. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			<p>forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span.</p> <p>The species has not been recorded in the locality and is more likely to occur along the coast. The study area does not contain preferred suitable habitat with a diverse and sparse groundcover and the species is likely to utilise habitat outside the locality.</p>	potential habitat.
Brush-tailed Rock-wallaby <i>Petrogale penicillata</i>	V	E	<p>Unlikely - The species occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. This species is rare west of the Great Dividing Range and only occurs in the Warrambungles and Mt Kaputar areas</p> <p>The species has not been recorded in the locality. The study area does not contain the preferred complex rocky areas required by the species.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable rocky habitat.
Greater Bilby <i>Macrotis lagotis</i>	V	Ex	<p>Unlikely - Occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas.</p> <p>The species has not been recorded in the locality since 1912, and is thought to be extinct in NSW.</p>	Unlikely - The species is unlikely to inhabit the study area due to a lack of potential habitat to be impacted and the species is likely extinct in NSW.
Koala <i>Phascolarctos cinereus</i> (combined populations of QLD, NSW and ACT)	V	V	<p>Unlikely - In NSW it mainly occurs on the central and north coasts with some populations in the western region. Inhabits eucalypt woodlands and forests.</p> <p>The species has been recorded 3.6 kilometre south-west of the subject site. This record is from Dan Lunney's Community Wildlife Survey and the age of the record is not known, but is likely to be an old observation that was only reported recently. This species has not be recorded as a new specimen record in the LGA since the mid 1960's.</p>	Unlikely – The species is unlikely to inhabit the study area due to a lack of suitable potential habitat.
Spotted-tailed Quoll	E	V	Unlikely - Recorded across a range of habitat types, including rainforest,	Unlikely – The species is

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
<i>Dasyurus maculatus maculatus</i> (SE mainland population)			<p>open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.</p> <p>The species was recorded once in the locality, 4.6 kilometres south of the study area (Dan Lunney's Community Wildlife Survey). The study area provides marginal foraging habitat suitable for the species, and although hollow bearing trees are available for the species breeding requirements the species is unlikely to occur.</p>	unlikely to inhabit the study area due to a lack of suitable potential habitat.
<p>Squirrel Glider in the Wagga Wagga Local Government Area</p> <p><i>Petaurus norfolcensis</i></p>	-	EP	<p>Likely - Inhabits a wide range of open forest, woodland and riverine forest habitats. Utilise remnants of various sizes, including small remnants and even small stands of trees within Travelling Stock Reserves, roadside reserves or private land. Often utilise linear remnant vegetation along roadsides or rivers and streams. Eucalypt species known to provide suitable denning and foraging resources include (but are not restricted to): Blakely's Red Gum, Grey Box, Red Box, Mugga Ironbark, River Red Gum, White Box and Yellow Box.</p> <p>The species has been recorded within the study area in Wilks Park, about 75 metres east of the subject site and on the levee bank near the railway viaduct over the Murrumbidgee River. The species is known to occur in the River Red Gum habitat in Wilks Park, which is connected to the subject site.</p>	Likely – The removal of mature and hollow-bearing trees would reduce potential denning and foraging habitat of the species.
AMPHIBIANS				
<p>Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog</p> <p><i>Litoria raniformis</i></p>	V	E	<p>Unlikely - This species is found mostly amongst emergent vegetation, including <i>Typha</i> spp. (bullrush), <i>Phragmites</i> spp. (reeds) and <i>Eleocharis</i> spp. (sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams.</p> <p>The species has not been recorded in the locality. The lagoon and its emergent vegetation in the study area may provide potential habitat for the species to occur.</p>	Unlikely – The proposal would not impact on the emergent vegetation of the wetlands in the study area.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
FISH				
Eel-tailed Catfish – Murray Darling Basin population <i>Tandanus tandanus</i>	-	EP	<p>Unlikely - The western population of the Eel-tailed Catfish was originally widely distributed throughout the Murray-Darling River System in NSW, Queensland, Victoria and South Australia, with the exception of the cooler parts of the southern tributaries. It was relatively uncommon upstream of Wagga Wagga on the Murrumbidgee River and Lake Mulwala on the Murray River. Lives in a wide range of habitats including rivers, creeks, lakes, billabongs and lagoons, and although it inhabits flowing streams, prefers sluggish or still waters. It can be found in clear to turbid waters, and over substrates ranging from mud to gravel and rock.</p> <p>The species is absent or rare in the Murrumbidgee River, however it is known from a stocked population in Lake Albert at Wagga Wagga. Records indicate the species is absent from the Murrumbidgee River.</p>	Unlikely - the activities proposed would be unlikely to have an impact on potential habitat for the species.
Macquarie Perch <i>Macquaria australasica</i>	E	E	<p>Unlikely - The species is found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW. They are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries.</p> <p>The species has not been recorded in the locality. The species is not known to occur within the LGA; however it is known to occur in the Murrumbidgee River, which runs through the study area.</p>	Unlikely – The proposal would not impact on the riverine habitat of the species.
Murray Cod <i>Maccullochella peelii peelii</i>	V	-	<p>Likely – The species was once abundant throughout the Murray-Darling river system. They generally prefer slow flowing, turbid water in streams and rivers, favouring deeper water around boulders, undercut banks, overhanging vegetation and logs.</p> <p>The species has been recorded within the study area and is known to inhabit the Murrumbidgee River in the study area and locality.</p>	Unlikely – The proposal would not impact on the riverine habitat of the species.
Silver Perch <i>Bidyanus bidyanus</i>	-	V	<p>Likely – The species was once abundant throughout the Murray-Darling river system. They generally prefer fast-flowing, open waters, especially where there are rapids and races, however they will also inhabit warm, sluggish water with cover provided by large woody debris and reeds.</p>	Unlikely – The proposal would not impact on the riverine habitat of the species.

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
			A stocked population of the species occurs in Lake Albert, about four kilometres south of the subject site. The species is not known to occur naturally within the LGA or the Murrumbidgee River, however stocked individuals do occur. The only secure and self-sustaining wild population occurs in the Murray River, downstream of the Yarrawonga weir.	
Trout Cod <i>Maccullochella macquariensis</i>	E	E	<p>Likely - The species is endemic to the southern Murray-Darling river system, including the Murrumbidgee and Murray Rivers, and the Macquarie River in central NSW. They are often found close to cover and in relatively fast currents, especially in fairly deep water close to the bank, and often congregate around large woody debris (snags).</p> <p>Although the last known reproducing population of the species is confined to the Murray River, the species has been re-stocked into the Murrumbidgee River and is known to occur in the study area and locality.</p>	Unlikely – The proposal would not impact on the riverine habitat of the species.
PLANTS				
Claypan Daisy <i>Brachyscome muelleroides</i>	V	V	<p>Unlikely - Grows in damp areas on the margins of claypans in moist grassland with <i>Pycnosorus globosus</i>, <i>Agrostis avenacea</i> and <i>Austrodanthonia duttoniana</i>. Also recorded from the margins of lagoons in mud or water, and in association with <i>Calotis anthemoides</i>.</p> <p>The species has been recorded 700 metres south of the subject site on an unknown date. Due to the degraded nature of the groundcover in the study area and limited claypan habitat the species is unlikely to occur.</p>	Unlikely – The proposal would not impact on any potential habitat for the species
Slender Darling Pea <i>Swainsona murrayana</i>	V	V	<p>Unlikely - The species grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with <i>Maireana</i> species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated.</p> <p>The species has not been recorded in the locality. The species is not known to occur in the area and due to the degraded nature of the groundcover in the study area it is not likely to provide suitable habitat for the species.</p>	Unlikely – The proposal would not impact on any potential habitat for the species

Species	Status		Likelihood of occurrence in study area	Possibility of impact
	National	NSW		
Small Purple-pea <i>Swainsona recta</i>	E	E	<p>Unlikely - Before European settlement Mountain Swainson-pea occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum <i>Eucalyptus blakelyi</i>, Yellow Box <i>E. melliodora</i>, Candlebark Gum <i>E. rubida</i> and Long-leaf Box <i>E. goniocalyx</i>.</p> <p>The species was known from the Wagga Wagga area historically, but it is now thought to be extinct in the area and is unlikely to occur.</p>	Unlikely – T The proposal would not impact on any potential habitat for the species
Small Scurf-pea <i>Cullen parvum</i>	-	E	<p>Unlikely - In known populations in Victoria and NSW, plants are found in grassland, River Red Gum (<i>Eucalyptus camaldulensis</i>) Woodland and even grazing country and table drains; in areas with rainfall of between 450 and 700 mm. Plants often occur near watercourses.</p> <p>The species has not been recorded in the locality and is unlikely to occur due to the degraded and introduced nature of the groundcover layer.</p>	Unlikely – The proposal would not impact on any potential habitat for the species
Woolly Ragwort <i>Senecio garlandii</i>	V	V	<p>Unlikely - Woolly Ragwort occurs on sheltered slopes of rocky outcrops. The species is known from The Rock Nature Reserve 30 km south east of Wagga Wagga where it exists with an overstorey of <i>Eucalyptus macrorhyncha</i> with some <i>E. polyanthemos</i>, <i>E. albens</i> and <i>Brachychiton populneus</i>.</p> <p>The species has been recorded once in the locality on the Grnage Road off Holbrook Road. The study area does not provide suitable rocky outcrop habitat for the species to occur.</p>	Unlikely – The proposal would not impact on any potential habitat for the species.

Appendix E Significance assessments

EP&A Act / FM Act assessments of significance

Non-predatory woodland birds

- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) – Vulnerable
- Diamond Firetail (*Stagonopleura guttata*) – Vulnerable
- Flame Robin (*Petroica phoenicea*) – Vulnerable
- Scarlet Robin (*Petroica boodang*) – Vulnerable
- Superb Parrot (*Polytelis swainsonii*) – Vulnerable
- Varied Sittella (*Daphoenositta chrysoptera*) – Vulnerable
- White-fronted Chat (*Epthianura albifrons*) – Vulnerable.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The woodland in the study area is known to provide habitat for the Brown Treecreeper and Superb Parrot, both of which were observed during current surveys.

Based on resources present and records in the locality, the woodland in the study area may also provide habitat for five other threatened woodland bird species listed above.

The trees provide nectar and pollen during periods of flowering, as well as invertebrates for the Brown Treecreeper, Superb Parrot and Varied Sittella.

The grassy understorey and shrubs of the woodland provide potential foraging resources for the Brown Treecreeper, Diamond Firetail, Flame Robin, Scarlet Robin, Superb Parrot and White-fronted Chat.

Hollow-bearing trees may be used by the Brown Treecreeper for breeding, given that a resident population exists in the study area. In the locality, Superb Parrots are known to breed in the hollow-bearing River Red Gums along the Murrumbidgee River, as occur in the study area.

The Diamond Firetail, Flame Robin, Little Eagle, Scarlet Robin and White-fronted Chat may also build nests in the branches of trees or low vegetation in the study area.

The woodland in the study area provides movement habitat for all these species.

The proposed removal of woodland would reduce the amount of nesting, roosting, movement and foraging habitat for woodland birds in the study area. The proposal would remove 190 trees (1.1 ha) from the subject site, of which 47 have a dbh greater than 40 centimetres. This would not result in the complete removal of vegetation and habitat resources within the subject site. Tree removal is unlikely to be highly important in the context of habitat available in the study area and wider locality, particularly remnant vegetation along the riparian corridor and in patches of woodland such as Pomingalarna Park. The remaining sections of the study area have previously been cleared for residential, commercial and residential purposes.

The Brown Treecreeper, which is resident in the study area, is less mobile than the other species assessed and has a relatively small home range. The proposed removal of trees would not, however, represent a significant loss in habitat for these species due to the connectivity of the woodland

available within the section of the study area they are, and are likely, to inhabit other patches of remnant woodland within the study area and locality.

Other more mobile species are unlikely to be adversely impacted due to the small area of vegetation to be removed and the remaining patches of remnant woodland within the study area and locality, which are likely to provide high quality similar habitat. These patches include those located west (Pomingalarna Park), and south-west (Kapooka Military Area and Silvalite Reserve), of the study area. The Superb Parrots were observed at the North Wagga Wagga borrow pit site where no tree removal is to occur. The proposal is unlikely that the proposal would remove a significant amount of habitat for these species.

Three hollow-bearing trees would be removed from the subject site. The removal of a small number of habitat trees is unlikely to substantially affect the life cycle of any of the threatened woodland bird species due to the presence of many more habitat trees in the study area and wider locality, including another 29 surveyed in the subject site. The proposal would not remove a significant proportion of the hollow-bearing tree resources within the home ranges of the local populations of these woodland birds, including the Brown Treecreeper. The removal of 1.1 hectares of River Red Gum forest would result in a long term (i.e. >100 year) loss of future hollow-bearing trees. However there are variable ages and stages of recruitment of River Red Gum occurring in the study area and locality including recent regeneration from floods.

The proposal would, however, remove groundcover vegetation, which may potentially be used by all non-predatory threatened woodland birds as foraging and movement habitat, although groundcover in the study area is predominately of an introduced nature and low quality habitat for these species. Shrubs (although minimal) and woody debris would be retained by the proposal.

The proposed removal of native vegetation (1.1 ha), including three hollow-bearing trees is a relatively small proportion of the potential habitat for these species in the study area and locality. High quality habitat for these species is present in other parts of the study area and outside the study area. Given this and the mobility of most of these species, it is unlikely that the proposal would have an adverse effect on the life cycle of a threatened woodland bird species such that a viable local population is likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

An endangered population of a woodland bird species does not occur in the study area.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Ecological communities are not the subject of this assessment of significance.

d) in relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed removal of woodland would reduce the amount of nesting, roosting, movement and foraging habitat for woodland birds in the study area. The proposal would remove 190 trees (1.1 ha) in the study area, of which 47 have a dbh greater than 40 centimetres, including three hollow-bearing trees. This would not result in the complete removal of vegetation and habitat resources within the subject site. The riparian corridor, in which the subject site is located, provides additional quality habitat that would remain undisturbed by the proposal. Tree removal is unlikely to be important in the context of habitat available in the study area and wider locality and due to the connectivity of the riparian vegetation species are still able to readily disperse.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for residential, commercial and agricultural purposes and for the construction of linear infrastructure. These developments have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities and habitat preferences. However, they have not prevented Brown Treecreepers from using the study area and are unlikely to have impacted other woodland birds due to the remaining connectivity of the riparian vegetation of the study area.

The proposal is unlikely to further increase fragmentation of the study area due to vegetation removal occurring on the edges of the woodland and tree removal being scattered over the 14.8 kilometre length of the proposal. Connectivity of the riparian corridor would remain intact along the entire length of the proposal. Groundcover vegetation to be removed is predominately introduced and of low quality habitat value for threatened woodland bird species.

Shrubs (although minimal) and woody debris would be maintained within the subject site. Retention of these habitat features enables less mobile fauna to continue to move through the study area without an increased risk of exposure to predation.

The proposal would reduce the extent of overall native vegetation cover, however, the distances between mature trees is not likely to increase substantially and inhibit the movement of threatened birds throughout the subject site. The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

Due to the mobility of most of the threatened birds assessed, and the small amount of vegetation removal (1.1 ha) scattered across a 14.8 kilometre subject site, the proposal is unlikely to create any significant barriers to movement for these species.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposal would remove 190 trees (1.1 ha), of which 47 have a dbh greater than 40 centimetres, including three hollow-bearing trees. An additional 29 hollow-bearing trees were surveyed in the subject site. This represents only a small portion of the available remnant vegetation within the study area and locality. Areas of high quality habitat value exist in patches connected to the study area, including Pomingalarna Park and Silvalite Reserve to the west and south-west, respectively.

The amount of habitat for threatened woodland bird species proposed to be removed is a relatively small proportion of the potential habitat for these species in the study area and locality. High quality habitat for these species is present in other parts of the study area and outside the study area and as such the removal of the proposed vegetation does not represent critical habitat to any of the threatened woodland bird species.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The proposal would not affect any habitat listed on the critical habitat register.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

None of the woodland bird species listed above have had recovery plans prepared. However, in the profiles for these species on the OEH (2012a) Threatened Species website, a number of actions are identified that need to occur to recover these species. An important action is the prevention of habitat loss, including loss of woodland habitat, hollow-bearing trees and woody debris. Prevention of weed invasion is also identified as an important action for some species.

The proposal would remove potential habitat for seven non-predatory threatened woodland bird species, but this would only be a small proportion of the potential habitat available in the study area and the wider locality, and is not likely to significantly affect any of the threatened bird species within the study area.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed action constitutes two listed key threatening processes relevant to the threatened woodland birds listed above:

- Clearing of native vegetation – the proposal would remove 190 trees (1.1 ha) from the subject site, although groundcover to be removed is predominately comprised of introduced species. This is unlikely to represent a significant loss of habitat for any of the threatened woodland bird species for the reasons detailed above; and
- Loss of hollow-bearing trees – the proposal would remove three hollow-bearing trees from the subject site. This is unlikely to represent a significant loss of breeding habitat for any of the threatened woodland bird species, for the reasons detailed above.

Conclusion

The proposal would be unlikely to cause a significant ecological impact on any non-predatory threatened woodland bird species.

Predatory woodland birds

- Barking Owl (*Ninox connivens*) – Vulnerable
- Little Eagle (*Hieraaetus morphnoides*) – Vulnerable

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Based on resources present and records in the locality, the woodland in the study area may provide habitat for the two threatened predatory woodland bird species listed above. The woodland provides potential foraging, movement and roosting habitat for these species.

Hollow-bearing trees in the study area may be used by the Barking Owl for nesting and breeding habitat, while the Little Eagle may build nests in the branches of trees in the study area.

The proposed removal of woodland would reduce the amount of nesting, roosting, movement and foraging habitat for the Barking Owl and Little Eagle in the study area. The proposal would remove 190 trees (1.1 ha) from the subject site, of which 47 have a dbh greater than 40 centimetres. This would not result in the complete removal of vegetation and habitat resources within the subject site. Tree removal is unlikely to be highly important in the context of habitat available in the study area and wider locality, particularly remnant vegetation along the riparian corridor and in patches of woodland such as Pomingalarna Park. The remaining sections of the study area have previously been cleared for residential, commercial and residential purposes.

Given the mobility of both of these species, they are unlikely to be adversely impacted due to the limited proposed removal of vegetation and the remaining patches of remnant woodland within the study area and locality, which are likely to provide high quality habitat. These patches include those located west (Pomingalarna Park), and south-west (Kapooka Military Area and Silvalite Reserve), of the study area. Due to their mobility and relatively large ranges it is unlikely that the proposal would remove a significant amount of habitat for these species.

Three hollow-bearing trees would be removed from the subject site. None of the hollows to be removed are currently large enough to be potential nesting hollows for the Barking Owl (i.e. >20 cm diameter and > 4 metres above the ground). The removal of a small number of habitat trees is unlikely to substantially affect the life cycle of either of the threatened predatory woodland bird species due to the presence of many more habitat trees in the study area and wider locality, including another 29 surveyed in the subject site that are to be retained. The proposal would not remove a significant proportion of the hollow bearing tree resources within the home range of the local populations of the Barking Owl. The removal of 1.1 hectares of River Red Gum forest would result in a long term (i.e. >100 year) loss of future hollow-bearing trees. However there are variable ages and stages of recruitment of River Red Gum occurring in the study area and locality including recent regeneration from floods. The Little Eagle does not rely on tree-hollows for habitat.

The proposal would, however, remove groundcover vegetation, which may potentially be used as foraging habitat for both predatory species, although groundcover in the study area is predominately of an introduced nature and low quality habitat for these species. Shrubs (although minimal) and woody debris would be retained by the proposal.

The proposed removal of vegetation, including three hollow-bearing trees is a relatively small proportion of the potential habitat for these species in the study area and locality. High quality habitat for these species is present in other parts of the study area and outside the study area. Given this and the mobility of these species, it is unlikely that the proposal would have an adverse effect on the life cycle of a threatened predatory woodland bird species such that a viable local population is likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

An endangered population of a woodland bird species does not occur in the study area.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Ecological communities are not the subject of this assessment of significance.

d) in relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed removal of woodland would reduce the amount of nesting, roosting, movement and foraging habitat for predatory woodland birds in the study area. The proposal would remove 190 trees (1.1 ha) in the study area, of which 47 have a dbh greater than 40 centimetres, including three hollow-bearing trees. This would not result in the complete removal of vegetation and habitat resources within the subject site. The riparian corridor, in which the subject site is located, provides additional quality habitat that would remain undisturbed by the proposal. Tree removal is unlikely to be highly important in the context of habitat available in the study area and wider locality and due to the connectivity of the riparian vegetation species are still able to readily disperse.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for residential, commercial and agricultural purposes and for the construction of linear infrastructure. These developments have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities and habitat preferences. However, given the mobility of both species and due to the connectivity of the riparian vegetation of the study area, fragmentation is unlikely to have prevented the species from using the study area.

The proposal is unlikely to further increase fragmentation of the study area due to vegetation removal occurring on the edges of the woodland and tree removal being scattered over the 14.8 kilometre length of the proposal. Connectivity of the riparian corridor would remain intact along the entire length of the proposal. Groundcover vegetation to be removed is predominately introduced and of low quality habitat value for the predatory woodland bird species.

Shrubs (although minimal) and woody debris would be maintained within the subject site. Retention of these habitat features maintains potential foraging habitat for predatory species.

The proposal would reduce the extent of overall native vegetation cover, however, the distances between mature trees is not likely to increase substantially and inhibit the movement of threatened birds throughout the subject site. The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

Due to the mobility of both of the threatened birds assessed, and the small amount of vegetation removal scattered across a 14.8 kilometre subject site, the proposal is unlikely to create any significant barriers to movement for these species.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposal would remove 190 trees (1.1 ha), of which 47 have a dbh greater than 40 centimetres, including three hollow-bearing trees. An additional 29 hollow-bearing trees were surveyed in the subject site and would be retained. This represents only a small portion of the available remnant vegetation within the study area and locality. Areas of high quality habitat value exist in patches connected to the study area, including Pomingalarna Park and Silvalite Reserve to the west and south-west, respectively.

The amount of habitat for the Barking Owl and Little Eagle proposed to be removed is a relatively small proportion of the potential habitat for these species in the study area and locality. High quality habitat for these species is present in other parts of the study area and outside the study area and as such the removal of the proposed vegetation does not represent critical habitat to either of the threatened predatory woodland bird species.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The proposal would not affect any habitat listed on the critical habitat register.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan exists for the Barking Owl. One of the objectives of this recovery plan is *Action 3.1 Protect known Barking Owl nest sites and surrounding habitat*. While the Barking Owl may nest in habitat along the Murrumbidgee River, the proposal would not remove a potential nest site for the species due to the small size of the hollows being removed compared with the requirements of the species (greater than 20 centimetres). The proposal may, however, potentially remove woodland used by the species as foraging and movement habitat.

The Little Eagle does not have a recovery plan established. However, in the profile for this species on the OEH (2012a) Threatened Species website, a number of actions are identified that need to occur to assist this species. An important activity is the retention and protection of nesting and foraging habitat.

The proposal would remove potential habitat for both threatened bird species, but this would only be a small proportion of the potential habitat available in the study area and the wider locality, and is not likely to significantly affect either of the threatened bird species within the study area.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed action constitutes two listed key threatening processes relevant to the threatened woodland birds listed above:

- Clearing of native vegetation – the proposal would remove 190 trees from the subject site, although groundcover to be removed is predominately comprised of introduced species. This is unlikely to represent a significant loss of habitat for either of the threatened predatory woodland bird species for the reasons detailed above; and
- Loss of hollow-bearing trees – the proposal would remove three hollow-bearing trees from the subject site. This is unlikely to represent a significant loss of breeding habitat for the Barking Owl, for the reasons detailed above.

Conclusion

The proposal would be unlikely to cause a significant ecological impact on any threatened predatory woodland bird species.

Bats

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) – Vulnerable
- Southern Myotis (*Myotis macropus*) – Vulnerable

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Based on resources present and records in the locality, the woodland in the study area may provide habitat for the two threatened bat species listed above.

The Eastern Bentwing-bat is a predominately cave roosting species that requires nursery caves for breeding of which none occur in the locality. The study area may represent occasional foraging areas for this species during the non-breeding season.

The Southern Myotis primarily roosts in caves or under bridges and occasionally in hollow-bearing trees. This species forages primarily over waterbodies and in inland NSW is often associated with major watercourse such as the Murray and Murrumbidgee River. This species may forage over the water of the Murrumbidgee River and nearby wetlands.

The woodland in the study area provides potential foraging habitat for both bat species and may also provide potential roosting and breeding habitat for the Southern Myotis in hollows and under loose bark or bridges in the study area.

The woodland in the study area provides movement habitat for both species.

The proposed removal of woodland would reduce the amount of foraging habitat for threatened bats in the study area. The proposal would remove 190 trees (1.1 ha) from the study area, of which 47 have a dbh greater than 40 centimetres. This would not result in the complete removal of vegetation and habitat resources within the subject site. Tree removal is unlikely to be highly important in the context of habitat available in the study area and wider locality, particularly remnant vegetation along the riparian corridor and in patches of woodland such as Pomingalarna Park.

Vegetation removal is only a small proportion of woodland in the study area and within the locality there are patches of remnant woodland located west (Pomingalarna Park) south-west (Silvalite Reserve) of the study area. Due to the mobility and relatively large ranges of the threatened bats, it is unlikely that the proposal would remove a significant amount of habitat for these species.

Three hollow-bearing trees would be removed from the subject site. An additional 29 hollow-bearing trees were surveyed in the subject site. The removal of these trees has the potential to affect the life cycle of the Eastern Bentwing-bat and Southern Myotis, which could potentially use tree hollows in the study area. However, there are large areas of potential breeding habitat for the Southern Myotis in the locality, as described above, and the removal of these trees would be unlikely to represent a significant loss of potential breeding habitat for this species. No breeding habitat for the Eastern Bentwing-bat would be impacted as it requires caves for breeding of which none occur in the locality..

The amount of habitat for threatened bat species proposed to be removed is a relatively small proportion of the potential habitat for these species in the study area and locality. Similar habitat for these species is present in other parts of the study area and outside the study area. As well, tree hollows do not form primary roosting habitat for the Eastern Bentwing-bat, which prefers to roost in caves. Given the mobility of all bat species, it is unlikely that the proposal would have an adverse effect on the life cycle of a threatened bat species such that a viable local population of the species is likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

An endangered population of a bat species does not occur in the study area.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Ecological communities are not the subject of this assessment of significance.

d) in relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed removal of trees would reduce the amount of potential foraging, and movement habitat for threatened bats in the study area. No breeding habitat for the Eastern Bentwing-bat would be removed or impacted by the proposal as it is primarily of cave roosting and breeding bat. The proposal would remove 190 trees (1.1 ha) from the subject site, of which 47 have a dbh greater than 40 centimetres, and predominately introduced groundcover.

This is only a small proportion of woodland in the study area and within the locality there are patches of remnant woodland located west (Pomingalarna Park) and south-west (Silvalite Reserve) of the study area. The riparian corridor, in which the subject site is located, provides additional quality habitat that would remain undisturbed by the proposal. Due to the mobility and relatively large ranges of the threatened bats, it is unlikely that the proposal would remove a significant amount of habitat for these species.

Three hollow-bearing trees would be removed from the subject site. The removal of these trees has the potential to affect the life cycle of the threatened bats, which could potentially use tree hollows in the study area. However, there are large areas of potential breeding habitat in the study area and locality.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for residential, commercial and agricultural purposes and for the construction of linear infrastructure. These developments have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities and habitat preferences. However, the threatened bat species listed above are unlikely to have been affected by past fragmentation.

The proposal is unlikely to further increase fragmentation of the study area due to vegetation removal occurring on the edges of the woodland and tree removal being scattered over the 14.8 kilometre length of the proposal. Connectivity of the riparian corridor would remain intact along the entire length of the proposal. Groundcover vegetation to be removed is predominately introduced and does not provide habitat for the bat species.

The proposal would reduce the extent of overall native vegetation cover, however, the distances between mature trees is not likely to increase substantially and inhibit the movement of threatened bats throughout the subject site. The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

Due to the mobility of the threatened bats assessed, and their relatively large ranges, the proposal is unlikely to create any significant barriers to movement for these species.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The habitat to be removed is unlikely to be important habitat for the Eastern Bentwing-bat as it is a predominately cave roosting species that requires nursery caves for breeding of which none occur in the locality. The study area may represent occasional foraging areas for this species during the non-breeding season.

The habitat to be removed is unlikely to be important habitat for the Southern Myotis which primarily roosts in caves or under bridges and occasionally in hollow-bearing trees. This species forages primarily over waterbodies and in inland NSW is often associated with major watercourse such as the Murray and Murrumbidgee River. This species may forage over the water of the Murrumbidgee River and nearby wetlands.

The proposal would remove 190 trees (1.1 ha), of which 47 have a dbh greater than 40 centimetres, including three hollow-bearing trees. An additional 29 hollow bearing trees were surveyed in the subject site. This represents only a small portion of the available remnant vegetation within the study area and locality. Areas of high quality habitat value exist in patches connected to the study area, including Pominalarna Park and Silvalite Reserve to the west and south-west, respectively.

The habitat to be removed provides high quality woodland habitat for threatened bats. These species are both likely to use the woodland in the study area for foraging and movement. As well, hollow-bearing trees in the study area could potentially be used for roosting and breeding by both species.

The amount of habitat for threatened bat species proposed to be removed is a relatively small proportion of the potential habitat for these species in the study area and locality. High quality habitat for these species is present in other parts of the study area and outside the study area. As well, tree hollows do not form primary roosting habitat for the Eastern Bentwing-bat which prefers to roost in caves. Given the mobility of both bat species, it is unlikely that the relatively small area of habitat to be removed would be important to any of these species.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The proposal would not affect any habitat listed on the critical habitat register.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan has not been established for either of the threatened bat species. However, the OEH Threatened Species website identifies a number of actions relevant to the proposal that need to occur to recover these species:

- Retain remnant woodland
- Protect roosting sites from damage or disturbance
- Retain native vegetation that is floristically and structurally diverse.

The proposal would remove potential habitat for the two threatened bats. The loss of habitat would include 190 trees, including three hollow bearing trees.

Due to the proposed removal of woodland, the proposal is not consistent with the recovery actions identified on the OEH (2012a) Threatened Species website. The proposed removal of habitat is however unlikely to significantly affect any of the threatened bat species, as described above.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed action constitutes one listed key threatening process relevant to the proposal being:

- Clearing of native vegetation – the proposal would remove 190 trees (1.1 ha) within riparian woodland in the subject site; however this is unlikely to represent a significant loss of habitat for any of the bat species, for the reasons detailed above; and

Conclusion

The proposal would be unlikely to cause a significant ecological impact on any threatened bat species.

Mammals

- Squirrel Glider population in the Wagga Wagga Local Government Area (*Petaurus norfolcensis*) – Endangered Population

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Squirrel Gliders in the Wagga Wagga LGA are listed as an endangered population.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Woodland within the study area potentially provides breeding and foraging habitat for this species in the form of hollow-bearing trees, shrubs and other woodland vegetation. The trees in the study area provide nectar and pollen during periods of flowering. The woodland in the study area may also provide movement habitat for the species.

The proposal would remove 190 trees (1.1 ha) from within riparian woodland habitat for Squirrel Gliders in the study area, of which 47 have a dbh greater than 40 centimetres. Tree removal would occur sporadically over the 14.8 kilometre length of the subject site, with some removal occurring in areas the species is unlikely to inhabit due to the paucity of hollow-bearing trees and lack of connectivity (e.g. East Street Levee). This represents a small proportion of woodland in the study area that may provide habitat for the species. None of the trees to be removed would create breaks in or increases in connectivity.

Three hollow-bearing trees would be removed from the subject site. This represents about five percent of the hollow-bearing trees in the subject site and much less than occurs in the wider study area which includes hollow-bearing trees on the banks of the river. This is only a small number of hollow-bearing trees in relation to those available in the study area and locality. Squirrel Gliders are known to occur in the riparian zone of the Murrumbidgee River along the Main City Levee and in Wilks Park near the North Wagga Wagga flats.

Squirrel Gliders are dependent on hollows in trees for diurnal denning. Within the region they are known to use on average seven different hollows (some use as many as 13 different hollows) in response to the availability of food resources (Crane *et. al.* 2010). The loss of hollow-bearing trees

from the study area is unlikely to represent significant loss of denning resources due to the trees being removed away from known areas of habitat, lack of connectivity to these trees (East Street Levee and east of Flowerdale Lagoon). The removal of 1.1 hectares of River Red Gum forest would result in a long term (i.e. >100 year) loss of future hollow-bearing trees. However there are variable ages and stages of recruitment of River Red Gum occurring in the study area and locality including recent regeneration from floods.

The proposal would not remove shrubs, which may be used by Squirrel Gliders for foraging.

Due to the proposed limited removal of potential habitat, and the removal of hollow-bearing trees away from known breeding habitat, the proposal would be unlikely to adversely affect the life cycle of the Squirrel Glider such that the viable population of the species is likely to be placed at risk of extinction.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Ecological communities are not the subject of this assessment of significance.

d) in relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal would remove 190 trees (1.1 ha) from the subject site within potential and known woodland habitat for Squirrel Gliders in the study area. This represents only a small proportion of woodland in the study area and vegetation removal would not occur within Wilks Park where the species is known to occur, but adjacent to it in more degraded habitat with minimal tree cover. The proposal is therefore unlikely to significantly affect the availability and quality of habitat for the local population of the species.

Three hollow-bearing trees would be removed from the subject site. The removal of these trees has the potential to affect the life cycle of the Squirrel Glider, which is known to use tree hollows in the study area. However the three trees to be removed are in agricultural areas with minimal connectivity and represent a small amount of marginal hollow-bearing habitat trees relative to those available in the study area and locality.

The proposal would not remove shrubs, which may be used by Squirrel Gliders for foraging.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for residential, commercial and agricultural purposes and for the construction of linear infrastructure. These developments have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities such as the Squirrel Glider.

The proposal is unlikely to further increase fragmentation of the study area due to vegetation removal occurring on the edges of the woodland and the 1.1 hectares of tree removal being scattered over the

14.8 kilometre length of the proposal. Connectivity of the riparian corridor would remain intact along the entire length of the proposal. Groundcover vegetation to be removed is predominately introduced. Shrubs (although minimal) would be retained by the proposal, which may be used by Squirrel Gliders for foraging.

The proposal would reduce the extent of overall native vegetation cover, however, the distances between mature trees is not likely to increase substantially and inhibit the movement of the Squirrel Glider throughout the subject site. Connectivity to known habitat of the species would remain intact. The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

The woodland in the study area is likely to facilitate the movement of Squirrel Gliders to known habitat in the Kapooka Military Area to the south-west via a vegetation corridor running north-south. This vegetation corridor links remnant vegetation within the riparian corridor of the study area to Pomingalarna Park, Silvalite Reserve and the Kapooka Military Area. The corridor also links to remnant vegetation patches further south such as Livingstone National Park.

The Squirrel Glider has an average gliding width of 20 to 40 metres, and a maximum gliding width of about 70 to 80 metres (van der Ree *et al.* 2003). Squirrel Gliders are rarely known to travel across the ground (Jackson 1999; van der Ree and Bennett 2003) and treeless gaps of more than 75 metres between woodland fragments therefore pose a physical limit to the ability of individuals to traverse gaps by gliding (van der Ree *et al.* 2003). The proposal is unlikely to fragment the population in the study area from that in the south-west due to the sporadic removal of trees only occurring along the edges of woodland habitat and the negligible increase in distances between mature trees.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposal would remove 190 trees (1.1 ha), of which 47 have a dbh greater than 40 centimetres, including three hollow-bearing trees. An additional 29 hollow-bearing trees were surveyed in the subject site that would be retained. This represents only a small portion of the available remnant vegetation within the study area and locality. Areas of high quality habitat value exist in patches connected to the study area, including Pomingalarna Park and Silvalite Reserve to the west and south-west, respectively. In addition, a known population of Squirrel Gliders exists to the south-west in the Kapooka Military Area, which is also connected to the study area.

The removal of 1.1 hectares of River Red Gum forest would result in a long term (i.e. >100 year) loss of future hollow-bearing trees that are connected to known habitat for this species in the study area. However there are variable ages and stages of recruitment of River Red Gum occurring in the study area and locality including recent regeneration from floods.

The amount of habitat for the Squirrel Glider proposed to be removed is a relatively small proportion of the potential habitat for the species in the study area and locality. High quality habitat for this species is present in other parts of the study area and outside the study area to the south and south-west and as such the removal of the proposed vegetation does not represent critical habitat to the species.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The proposal would not affect any habitat listed on the critical habitat register.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A preliminary draft recovery plan has been prepared for the Squirrel Glider population in the Wagga Wagga LGA (NPWS 2004). The plan outlines 22 recovery actions under five objectives for the population.

The proposal is not consistent with the draft recovery plan due to the removal of remnant habitat for the species, including hollow-bearing trees, and fragmentation of habitat.

The removal of 1.1 hectares of River Red Gum forest and three hollow bearing trees that are not likely to be important denning trees for this species due to their limited connectivity to other vegetation would result in a long term (i.e. >100 year) loss of future hollow-bearing trees that are connected to known habitat for this species in the study area. However there are variable ages and stages of recruitment of River Red Gum occurring in the study area and locality including recent regeneration from floods.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed action constitutes two listed key threatening processes relevant to the Squirrel Glider:

- Clearing of native vegetation – the proposal would remove 190 trees (1.1 ha) from within woodland habitat in the study area. This is unlikely to represent a significant loss of habitat for the Squirrel Glider, for the reasons detailed above; and
- Loss of hollow-bearing trees – the proposal would remove three hollow-bearing trees from the subject site. This is unlikely to represent a significant loss of breeding habitat for the Squirrel Glider, for the reasons detailed above.

Conclusion

The proposal would be unlikely to cause a significant ecological impact on the Squirrel Glider population within the study area.

Endangered ecological communities

- Lowland Murray River aquatic ecological community

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Threatened species are not the subject of this assessment of significance.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Endangered populations are not the subject of this assessment of significance.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The proposal would remove 190 trees (1.1 ha) from within the riparian corridor where the community occurs, along the Murrumbidgee River. Tree removals would not occur directly on the banks of the river but adjacent to the river banks and occur sporadically over the 14.8 kilometre length of the proposal. No works would occur in stream in the Murrumbidgee River. The community has a widespread extent within the locality and is connected both upstream and downstream riparian and aquatic vegetation. While the proposal may alter the composition of the community locally through the removal of riparian vegetation, the community would remain connected and only limited vegetation removal would occur. No aquatic vegetation or fauna species would be impacted by the proposal and groundcover to be removed is comprised of predominately introduced species. It is therefore unlikely that the proposal represents an adverse effect on the extent or composition of the community such that it would be placed at risk of local extinction.

d) in relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal would remove 190 trees (1.1 ha) from within the riparian corridor where the community occurs. Tree removals would not occur directly on the banks of the river but adjacent to the river banks and occur sporadically over the 14.8 kilometre length of the proposal. Vegetation and woody debris on the banks of the river would be retained, maintaining the integrity of the community.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for residential, commercial and agricultural purposes and for the construction of linear infrastructure. These developments have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities and habitat preferences.

The proposal is unlikely to further increase fragmentation of the study area due to vegetation removal occurring on the edges of the woodland and tree removal being scattered over the 14.8 kilometre length of the proposal. Connectivity of the riparian corridor would remain intact along the entire length of the proposal. Groundcover vegetation to be removed is predominately introduced and of low quality habitat value.

Shrubs (although minimal) and woody debris would be maintained within the subject site. Retention of these habitat features enables less mobile fauna to continue to move through the study area without an increased risk of exposure to predation.

The proposal would reduce the extent of overall native vegetation cover, however, the distances between mature trees is not likely to increase substantially and inhibit the movement of fauna throughout the subject site. The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The habitat to be modified as a result of the proposal is widespread along the upper and mid reaches of the Murrumbidgee River where the subject site exists. The proposal would remove 190 trees, including three hollow-bearing trees from within the community. An additional 29 hollow-bearing trees were surveyed in the subject site. This represents only a small portion of the community within the

study area and locality. Vegetation removal would occur sporadically along the 14.8 kilometre length of the proposal, would not occur on the banks of the river, and the community would retain its connectivity throughout the study area.

The habitat to be removed would therefore not put the long-term survival of the ecological community in the locality at risk.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The proposal would not affect any habitat listed on the critical habitat register.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan does not exist for the community, however a number of priority recovery strategies have been outlined by the Department of Primary Industries – Fisheries and aquaculture (DPI), including:

- Remediate fish barriers to passage
- Protect and reinstate large woody debris
- Restore riparian vegetation
- Pest species eradication and control
- Advice to consent and determining authorities
- Recovery plan preparation

The proposal would not impact on in-stream habitat but would, however, remove riparian vegetation, which conflicts with the above strategy to restore riparian vegetation. Vegetation removal would occur sporadically over the 14.8 kilometre length of the proposal, would not directly take place on the banks of the river and is unlikely to substantially alter riparian habitat. Woody debris would be retained.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed action constitutes one listed key threatening process relevant to the endangered ecological community, as defined by the FM Act:

- Degradation of native riparian vegetation along New South Wales water courses – the proposal would remove 190 trees from within the riparian corridor where the community occurs. This is unlikely to represent a significant loss of riparian vegetation that constitutes the community, for the reasons detailed above.

Conclusion

The proposal would be unlikely to cause a significant ecological impact on the Lowland Murray River endangered ecological community.

EPBC Act significance assessments

1) Are there any matters of national environmental significance located in the area of the proposed action?

The following matters of NES are known or likely to occur in the area of the proposed action:

- Cattle Egret (*Ardea ibis*) (Migratory)
- Great Egret (*Ardea alba*) (Migratory)
- Rainbow Bee-eater (*Merops ornatus*) (Migratory)
- Superb Parrot (*Polytelis swainsonii*) (Vulnerable).

2) Considering the proposed action at its broadest scope, is there potential for impacts on matters of national environmental significance?

The proposal would remove 190 trees (1.1ha) from within native woodland, of which 47 have a dbh greater than 40 centimetres. This would not result in the complete removal of vegetation and habitat resources within the subject site. Tree removal is unlikely to be highly important in the context of habitat available in the study area and wider locality. The remaining sections of the study area have previously been cleared for residential, commercial and agricultural purposes.

Species are unlikely to be adversely impacted due to the remaining patches of remnant woodland within the study area and locality, which are likely to provide high quality alternative habitat. These patches include those located west (Pomingalarna Park) and south-west (Silvalite Reserve), of the study area.

Three hollow-bearing trees would be removed from the subject site. The removal of such a small number of habitat trees is unlikely to substantially affect any matters of NES due to the presence of many more habitat trees in the study area and wider locality. An additional 29 hollow-bearing trees were surveyed within the subject site that would be retained. The proposal would not remove a significant proportion of the hollow-bearing tree resources within the study area.

The proposal would not remove shrubs or woody debris, which may potentially be used as foraging and movement habitat. Groundcover vegetation would be removed, however, is predominately comprised of introduced species and therefore provides low quality habitat value.

The proposed removal of vegetation including three hollow-bearing trees is a relatively small proportion of the potential habitat available in the study area and locality. High quality habitat is present in other parts of the study area and outside the study area. The proposal would; however, remove woodland that is known or likely to provide habitat for the matters of NES listed above. The proposal would therefore have impacts on matters of NES.

3) Are there any proposed measures to avoid or reduce impacts on matters of national environmental significance?

Safeguards and mitigation measures have been prepared with the aim of minimising impacts of the proposal on the ecology of the study area and on matters of NES. These are detailed in section 0 of this report.

4) Are any impacts of the proposed action on matters of national environmental significance likely to be significant impacts?

Vulnerable Species – Superb Parrot

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **Lead to a long-term decrease in the size of an important population of a species;**

The woodland in the study area is known to provide habitat for the Superb Parrot, which was observed in the study area during current surveys. No important populations of the species have been identified. There are no separate or distinct populations of the Superb Parrot. All individuals of the species are treated as one population.

The trees, shrubs and groundcover vegetation in the study area provide foraging and movement habitat for the Superb Parrot. Hollow-bearing trees in the study area also provide nesting and breeding habitat for the Superb Parrot, which is known to breed in River Red Gums along the Murrumbidgee River, where the subject site is located.

Habitat would be removed as described in 2) above.

The proposal would remove three hollow-bearing trees, which provide breeding habitat for the Superb Parrot. The removal of 1.1 hectares of River Red Gum forest would result in a long term (i.e. >100 year) loss of future hollow-bearing trees that are connected to known habitat for this species in the study area. However there are variable ages and stages of recruitment of River Red Gum occurring in the study area and locality including recent regeneration from floods.

The proposed removal of woodland may reduce the amount of foraging habitat for Superb Parrots in the study area through the removal of trees. The proposal would remove 190 trees (1.1ha) from within native woodland in the study area, of which 47 have a dbh greater than 40 centimetres. Groundcover vegetation to be removed is unlikely to provide quality foraging habitat for the species.

The proposal would remove a relatively small amount of vegetation, compared to that which is present in the surrounding area of woodland, particularly along the riparian corridor where the subject site is located. Within the locality there are patches of remnant woodland located west (Pomingalarna Park) and south-west (Silvalite Reserve), of the study area. Due to the mobility and relatively large range of Superb Parrots, it is unlikely that the proposal would lead to a long-term decrease in the size of a population of the species.

- **Reduce the area of occupancy of an important population;**

The proposal would not remove areas of habitat to the extent that habitat would be entirely eliminated from the study area. The areas of habitat to be removed are relatively small in relation to the areas of surrounding habitat in the locality. The proposal would not therefore reduce the area of occupancy of an important population of the Superb Parrot.

- **Fragment an existing important population into two or more populations;**

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for residential, commercial and agricultural purposes and for the construction of linear infrastructure. Although these developments have created barriers to movement for some fauna species, they have not prevented the Superb Parrot from using the study area. Woodland in the study area would facilitate the movement of Superb Parrots to other areas of remnant vegetation in the study

area and wider locality, via a vegetation corridor that runs north-south to Pomingalarna Park, Silvalite Reserve and the Kapooka Military Area where the species has previously been recorded. This corridor also links to remnant vegetation further south, including Livingstone National Park.

The proposal is unlikely to further increase fragmentation of the study area due to vegetation removal occurring on the edges of the woodland and tree removal being scattered over the 14.8 kilometre length of the proposal. Connectivity of the riparian corridor would remain intact along the entire length of the proposal. Groundcover vegetation to be removed is predominately introduced and of low quality habitat value for Superb Parrots.

Shrubs, although minimal, would be maintained within the subject site and provide potential foraging habitat for Superb Parrots.

The proposal would reduce the extent of overall native vegetation cover, however, the distances between mature trees is not likely to increase substantially and inhibit the movement of Superb Parrots throughout the subject site. The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

Due to the mobility of the Superb Parrot and its large range, the proposal is unlikely to create any significant barriers to movement for the species.

The proposal would not therefore fragment a population of any of the species into two or more populations.

- **Adversely affect habitat critical to the survival of a species;**

River Red Gum woodland is important to the survival of the Superb Parrot, as it is known breeding habitat for the species. The habitat to be removed provides quality woodland habitat for the species, which use the woodland in the study area for movement and foraging, in addition to using hollow-bearing trees for nesting and breeding.

The amount of habitat for these species proposed to be removed is a relatively small proportion of the potential habitat for the species in the locality. High quality habitat for the species is present in other parts of the study area and outside the study area. Given the mobility of the species, it is unlikely that the relatively small area of habitat to be removed would be important to the Superb Parrot.

The proposal is therefore unlikely to adversely affect habitat critical to the survival of the Superb Parrot.

- **Disrupt the breeding cycle of an important population;**

Superb Parrots in the Wagga Wagga LGA breed mostly in River Red Gum riverine habitats. The subject site is located along the Murrumbidgee River and contains such habitat. Breeding habitat for the Superb Parrot is therefore present within the study area.

Three hollow-bearing trees would be removed from the subject site. The removal of three hollow-bearing trees is unlikely to substantially affect the life cycle of the Superb Parrot due to the presence of many more habitat trees in the locality. An additional 29 hollow-bearing trees were surveyed in the subject site that would be retained.

The removal of a relatively small amount of vegetation and low number of habitat trees when compared to the locality would be unlikely to disrupt the breeding cycle of the Superb Parrot population.

- **Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

Habitat for the Superb Parrot would be removed as described in 2) above. The amount of habitat for the species proposed to be removed is a relatively small proportion of the potential habitat for the species in the locality. High quality habitat for the species is present in other parts of the study area and outside the study area. Given the mobility of the species, it is unlikely that the relatively small area of habitat to be removed would be important to the Superb Parrot. The proposal would therefore be unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species are likely to decline.

- **Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The proposal has the potential to facilitate the introduction and spread of weed species. This could occur through general disturbance from machinery and vehicles, and foot traffic. These conditions could lead to the further spread of invasive species such as Paterson's Curse and St. John's Wort.

The subject site is currently predominately comprised of introduced weed species. The existing presence of weeds in the study area is likely to have occurred through disturbance created by the development of residential and commercial area and construction of the levee banks themselves. Although most of the subject site is already affected by the invasion of introduced weeds mitigation measures would be put in place to reduce their spread, particularly for noxious species.

The Superb Parrot would be unlikely to be directly affected by the spread of introduced weed species in the study area, due to the currently degraded state of the groundcover and its continued use by the species. Due to the species' large range and mobility, the effects of weed introduction to the study area would be unlikely to significantly affect the species.

- **Introduce disease that may cause the species to decline; or**

All machinery and equipment would be cleaned prior to conducting the proposed works. The proposal would therefore be unlikely to introduce disease that may cause the Superb Parrot to decline.

- **Interfere substantially with the recovery of the species.**

Areas of woodland within the study area and locality are likely to be important to the future long-term recovery of the Superb Parrot. However, the relatively small amount of vegetation to be removed by the proposal, compared to the area of habitat in the locality would be unlikely to significantly interfere with the recovery of the species.

Conclusion

The proposal would be unlikely to cause a significant ecological impact on the Superb Parrot.

Migratory Species – Cattle Egret, Great Egret, Rainbow Bee-eater

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- **Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;**

Habitat for a migratory species is defined as important if it is:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- Habitat that is of critical importance to the species at particular life-cycle stages, and/or
- Habitat utilised by a migratory species which is at the limit of the species range, and/or
- Habitat within an area where the species is declining.

The woodland in the study area would be likely to provide foraging and movement habitat for the Cattle Egret, Great Egret and Rainbow Bee-eater, all of which have been recorded in the locality except the Cattle Egret.

The woodland and riverine habitat may also provide breeding habitat for all three species.

The woodland in the study area is however unlikely to be important to the above species because:

- The habitat does not occur within a region that supports an ecologically significant proportion of the population of the species. The species has a large distribution and the region of the proposal is not recognised as having a large proportion of the species
- The study area does not occur at the limit of the range of the species
- The species are not documented as declining in the locality of the proposal.

Woodland habitat would be cleared as described in 2) above.

The proposed removal of woodland would reduce the amount of foraging habitat for all three species in the study area. The proposal would remove 190 trees (1.1 ha) from within native woodland, of which 47 have a dbh greater than 40 centimetres. This is not a significant proportion of woodland in the study area or locality. Within the locality there are patches of remnant woodland located west (Pomingalarna Park) and south-west (Silvalite Reserve) of the study area. Due to the mobility and relatively large ranges of these species, it is unlikely that the proposal would significantly affect any of the species.

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for residential, commercial and agricultural purposes and for the construction of linear infrastructure. Although these developments have created barriers to movement for some fauna species, they would be unlikely to prevent the Cattle Egret, Great Egret or Rainbow Bee-eater from using the study area.

Woodland in the study area forms part of a vegetation corridor that runs north-south to Pomingalarna Park, Silvalite Reserve and the Kapooka Military Area. This corridor also links to remnant vegetation further south, including Livingstone National Park. The woodland in the study area is likely to facilitate the movement of these species.

The proposal is unlikely to further increase fragmentation of the study area due to vegetation removal occurring on the edges of the woodland and tree removal being scattered over the 14.8 kilometre length of the proposal. Connectivity of the riparian corridor would remain intact along the entire length of the proposal. Groundcover vegetation to be removed is predominately introduced, but may provide foraging habitat for the species.

Shrubs, although minimal, would be maintained within the subject site.

Due to the mobility of the three species and their large ranges, the proposal is unlikely to create any significant barriers to movement for the species.

Nutrient cycles or hydrological cycles would not be significantly altered by the proposal.

The proposal would therefore be unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.

- **Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or**

The proposal has the potential to facilitate the introduction and spread of weed species. This could occur through general disturbance from machinery and vehicles, and foot traffic. These conditions could lead to the further spread of invasive species such as Paterson's Curse and St. John's Wort.

The subject site is currently predominately comprised of introduced weed species. The existing presence of weeds in the study area is likely to have occurred through disturbance created by the development of residential and commercial area and construction of the levee banks themselves. Although most of the subject site is already affected by the invasion of introduced weeds mitigation measures would be put in place to reduce their spread, particularly for noxious species.

The Cattle Egret and Rainbow Bee-eater would be unlikely to be directly affected by the spread of introduced weed species in the study area, although indirect impacts could occur if an insect prey species was substantially affected. The Great Egret is likely to forage in shallow waters, which would not be impacted by the proposal. Due to the species' large ranges and mobility, the effects of weed introduction to the study area would be unlikely to significantly affect the species.

- **Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

The Cattle Egret, Great Egret and Rainbow Bee-eater may use the study area for breeding and the woodland and riverine habitat in the study area for foraging, movement and resting. The proposed removal of woodland would reduce the amount of foraging and breeding habitat for the three species in the study area, however the river banks the Rainbow Bee-eater may use to breed would not be impacted upon. The proposal would 190 trees within native woodland.

This is not a significant proportion of woodland in the study area or locality. Within the locality there are patches of remnant woodland located west (Pomingalarna Park) and south-west (Silvalite Reserve) of the study area. Due to the mobility and relatively large ranges of the species, it is unlikely that the proposal would significantly affect any of the above species.

The proposal would therefore be unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the Cattle Egret, Great Egret or Rainbow Bee-eater.

Conclusion

The proposal would be unlikely to cause a significant ecological impact on the above listed migratory species.

Appendix F Database searches

Threatened Species Predicted on Site

Assessor Name:

Assessor Accreditation Number: 0050

Tool Version: 1.2

Report Created: 25-Sep-2012 09:57

Threatened Species reliably predicted to utilize the site. No surveys are required for these species. Ecosystem credits apply to these species.

Brush-tailed Phascogale	Phascogale tapoatafa
Bush Stone-curlew	Burhinus grallarius
Little Lorikeet	Glossopsitta pusilla
Little Pied Bat	Chalinolobus picatus
Painted Snipe	Rostratula benghalensis
Regent Honeyeater	Xanthomyza phrygia
Squirrel Glider	Petaurus norfolcensis
Superb Parrot	Polytelis swainsonii
Swift Parrot	Lathamus discolor

Threatened Species Requiring Survey

Assessor Name:

Assessor Accreditation Number: 0050

Tool Version: 1.2

Report Created: 25-Sep-2012 09:56

Proposed Survey Time(s):

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

List of species requiring survey

Common Name	Scientific Name
Small Scurf-pea	Cullen parvum

Herbs and Forbs

Small Scurf-pea

Cullen parvum

Vegetation Types	Condition	Patch Size (ha)
River Red Gum - Silver Wattle - grassy very tall open forest of the inner floodplains of the lower NSW South West Slopes and Riverina Bioregions (Benson 5)	Moderate/Good	50

This species is likely to occur on:

Habitat:

Geographic: land within and to the east of Hay Plains in Murrumbidgee CMA subregion

Does the species have an identified population on the site?

Suitable Survey Time for this Species: JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes

Threatened Species Requiring Expert Report (or are assumed to be present):

Cullen parvum;





Home » Fishing and aquaculture » Species protection » Records

Records viewer

Records for this map are from I&I NSW research surveys, they do not indicate the entire distribution of the species and there may be errors and omissions.
To view the records using Google Earth you must download and install the Google Earth Plugin.



Records search

Step 1
Select an area type to search by:
[Statewide](#)
[Catchment Management Authority](#)
[Local Government Area](#)

LGA:

Step 2
Select a species:

Step 3
Select a time period:
 pre 1980
 post 1980
 all records



NOTE: The map depicts the expected distribution of this species in NSW. The records indicate locations where the species has been found.

Records

Trout cod
Waterbody: MURRUMBIDGEE RIVER Year: 2004 Datasource: Research
Trout cod
Waterbody: MURRUMBIDGEE RIVER Year: 2004 Datasource: Research
Trout cod
Waterbody: MURRUMBIDGEE RIVER Year: 2004 Datasource: Research
Trout cod
Waterbody: Murrumbidgee River Year: 2005 Datasource: Research
Trout cod
Waterbody: Murrumbidgee River Year: 2005 Datasource: Research
Trout cod

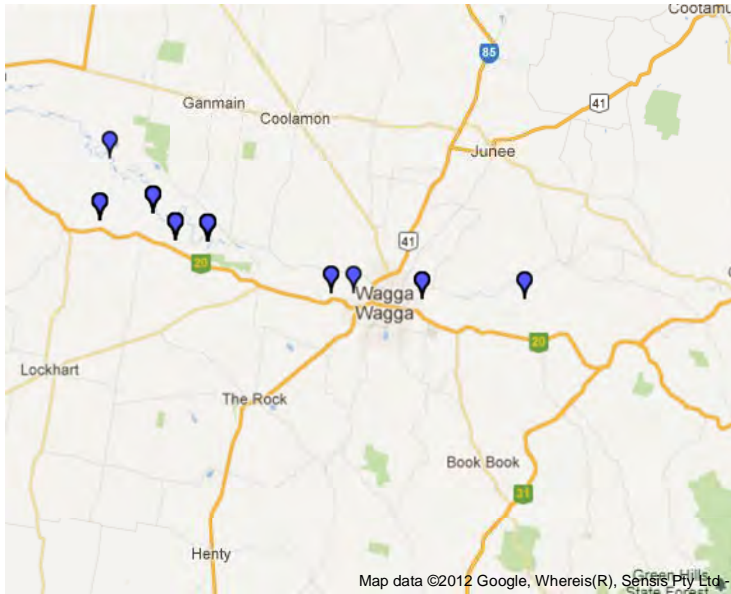




Home » Fishing and aquaculture » Species protection » Records

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Records search

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LGA:

Step 2
Select a species:

Step 3
Select a time period:
 pre 1980
 post 1980
 all records



NOTE: The map depicts the expected distribution of this species in NSW. The records indicate locations where the species has been found.

Records

Murray cod

Waterbody: MURRUMBIDGEE RIVER Year: 2004 Datasource: Research

Murray cod

Waterbody: MURRUMBIDGEE RIVER Year: 2004 Datasource: Research

Murray cod

Waterbody: MURRUMBIDGEE RIVER Year: 2004 Datasource: Research

Murray cod

Waterbody: MURRUMBIDGEE RIVER Year: 2004 Datasource: Research

Murray cod

Waterbody: MURRUMBIDGEE RIVER Year: 2004 Datasource: Research

Murray cod





EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 20/09/12 09:22:44

[Summary](#)

[Details](#)

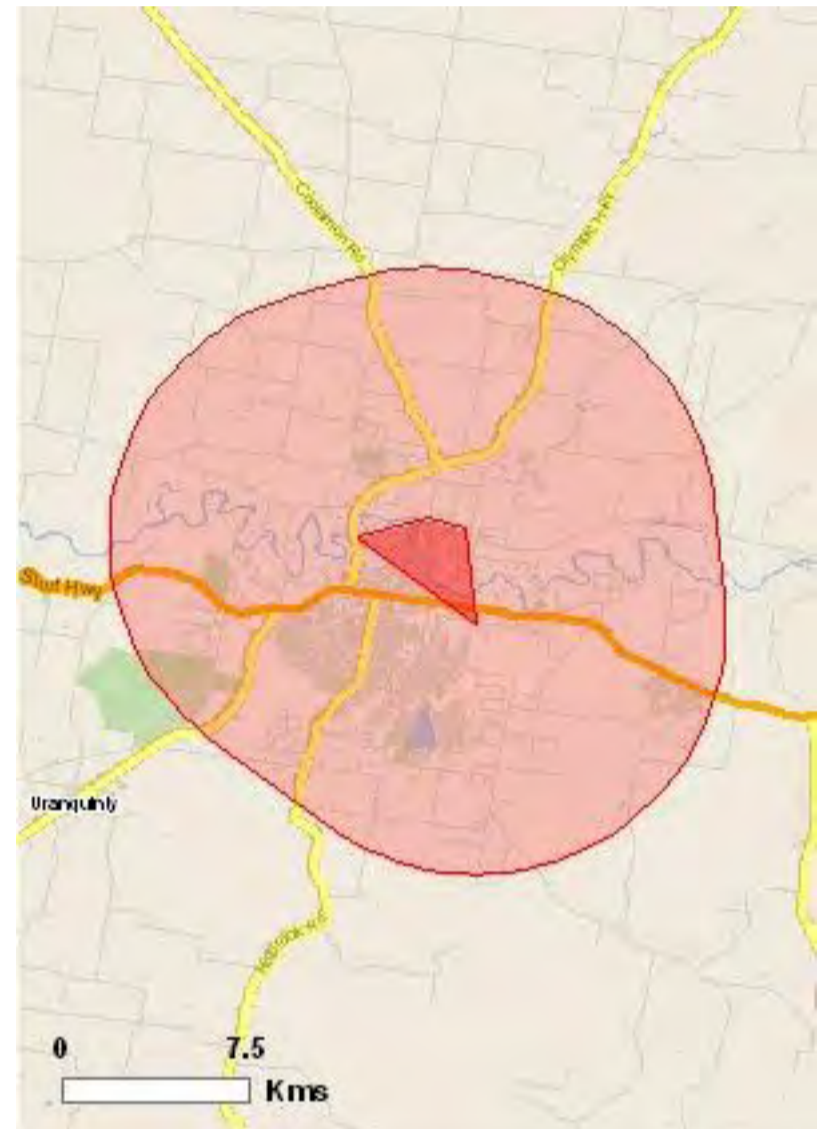
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

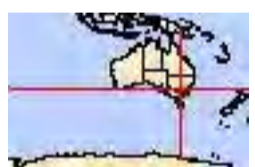
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

[Buffer: 10.0Km](#)



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	14
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As [heritage values](#) of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	13
Commonwealth Heritage Places:	None
Listed Marine Species:	9
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	17
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	11
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (RAMSAR)	[Resource Information]
Name	Proximity
Banrock station wetland complex	Upstream from Ramsar
Coorong and lakes alexandrina and albert	Upstream from Ramsar
Riverland	Upstream from Ramsar

Listed Threatened Ecological Communities [\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Breeding likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species

Name	Status	Type of Presence
Fish		
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat likely to occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Nyctophilus corbeni South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Plants		
Swainsona murrayana Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Xanthomyza phrygia Regent Honeyeater [430]	Endangered*	Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Broadcasting Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Commonwealth Bank of Australia
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Director of War Service Homes
Defence - BLAMEY BARRACKS - KAPOOKA
Defence - RAAF BASE WAGGA
Defence - WAGGA ARES DEPOT ; BLAMEY BKS -WAGGA WAGGA TRG DEP
Defence - WAGGA - WATER BORE SITE AP1
Defence - WAGGA - WATER BORE SITE AP2
Defence - WAGGA - WATER BORE SITE AP3

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area

Extra Information

Places on the RNE [\[Resource Information \]](#)

Note that not all Indigenous sites may be listed.

Name	State	Status
Historic		
Estella Homestead, Outbuildings and Barn House	NSW	Indicative Place
St Johns Anglican Church	NSW	Indicative Place
CBC Bank (former)	NSW	Registered
Church and Cathedral Group	NSW	Registered
Civic Group	NSW	Registered
Hampden Bridge	NSW	Registered
Murrumbidgee River Rail Bridge	NSW	Registered
Police Station	NSW	Registered
Railway Station	NSW	Registered
St Andrews Manse	NSW	Registered
St Andrews Presbyterian Church	NSW	Registered
St Michaels Cathedral	NSW	Registered
St Michaels Presbytery (The Bishops House)	NSW	Registered
Wagga South Public School	NSW	Registered
Wagga Wagga Courthouse	NSW	Registered
Wagga Wagga Post Office (former)	NSW	Registered

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species

Name	Status	Type of Presence
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat may occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area

Coordinates

-35.096363 147.349936,-35.089358 147.374758,-35.092555 147.388312,-35.127733
147.391967,-35.096515 147.350088,-35.096363 147.349936

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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Appendix G Habitat pruning techniques



PRUNING FOR HABITAT WORKSHOP



HABITAT CREATION

13 September 2010

1. Habitat Trees

Approximately 300+ species of wildlife use tree hollows throughout Australia. Tree hollows are of great importance as they are used as nesting sites, shelters and safe refuges. Hollows can present as a small crack or split to very a large cavity in the tree. (Gibbons & Lindenmayer, 2002).

The Arboricultural Industry has gradually become aware of the importance of a habitat trees as part of an active ecosystem. The creation of artificial habitat hollows in dead, dying or living trees is developing rapidly within our Industry.

This workshop is aimed at habitat awareness and to further develop methods and ideas to create artificial habitat in trees whilst maintaining the trees basic integrity.

When managing large dead trees in the landscape, a current management practice is to reduce the tree to a point where it is unlikely to present a risk to people and infrastructure. These trees are usually dead, dying or declining and are left as habitat stumps. The habitat stump has a high proportion of sound wood (very little decay) which has very little value to wildlife, as there are very few usable hollows.

Natural hollows are formed by the process of failure and decay within a tree. It can take up to 120 -150 years in many tree species for natural hollows to develop (Mackauski 1984, Stoneman et al.1097, Warrington and Lamb1999 in Gibbons & Lindenmayer, 2002).

By developing a range of strategies it is possible to shorten this long term decay process and provide natural looking habitat by creating artificial wildlife hollows.

We have so much to learn about the habitat requirements for many species of birds, reptiles, amphibians, mammals, and insects that utilise habitat in trees. It is hoped that this workshop will stimulate some research to further develop the level of knowledge and methods being used. There is a strong school of thought that trees that can develop habitat hollows are able to sustain better survival in some environments.

Without doubt habitat is a vital factor in the health of the overall urban forest.

List of points that may need to be considered (Some need further research)

- Entrance size. Vital (see attached chart.)
- Aspect. Openings faced away from worst weather.
- Temperature. Warm and ventilated.
- Drainage. Waste drains out of nest.
- Landing platforms. Required by some hollow users.
- Escape ladder for young.
- How many habitat sites in each tree.
- How close can each site be situated.
- Discouraging feral and predator animals.
- Light exclusion for owls and some bats.
- Height of lip in the hollow.(Kookaburra chickens point their rear over the edge during toilet training)
- Complimentary planting to provide, food, cover and aesthetic screening.
- Retain any natural habitat if possible.
- Can habitat be created in live branches without compromising safety.
- Can a branch collar be developed by constricting sap flow at the collar site?
- Methods of removing branches and leaving 'natural' habitat ends.

2. Methods of creating habitat hollows and cavities in standing trees and branches.

2.1 Method 1: Trunk Hollows

This is a procedure to make artificial hollows in habitat stumps on vertical sections.

Identify a tree that can be retained as a habitat stump rather than complete removal. Remove the canopy back to a level that is acceptable to reduce the target area or risk of limb failure. Retain any existing hollows if possible. (See Figure 1 and Figure 2).



Figure 1: Prune tree



Figure 2: Habitat tree

Identify suitable locations for new hollows.

Remove a faceplate approximately 30mm to 50mm thick and lower it to the ground. See Figure 3 and Figure 4.

The size of the face plate removed will determine the size of the artificial hollow.



Figure 3: Cut faceplate



Figure 4: Remove faceplate

Choose the desired entrance hole and carefully drill through the faceplate. Pre drill two holes to attach the faceplate back on to the tree with screws. See Figure 5 and Figure 6



Figure 5: Drill entrance hole



Figure 6: Pre Drill screw holes

Mark out the size of desired cavity with boring cuts. Once you know the desired depth of the cavity, draw a line on the chainsaw bar with a marker pen, so that each boring cut is similar in depth. Carefully use a small chainsaw to carry out a series of horizontal boring cuts. (Rollomatic E Mini with picco micro chain is very good for boring cuts). See Figure 7 and Figure 8



Figure 7: Cavity boring cuts



Figure 8: Horizontal boring cuts

Use a small crow bar and hammer to break out sections and form the cavity. Once this has been done, carefully tidy up the rough interior with the chainsaw. See Figure 9 and Figure 10



Figure 9: Break out cavity sections



Figure 10: Cavity interior

Retrieve the face plate and screw into position.



Figure 11: Place faceplate in position



Figure 12: Secure faceplate to trunk

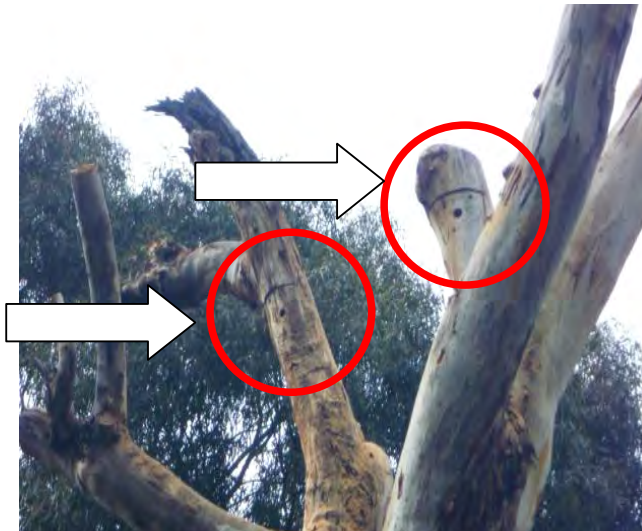


Figure 13: Completed habitat tree with hollows.



Figure 14: Various hole and cavity sizes will determine the different types of wildlife

2.2 Method 2: Branch Hollows

First a suitable branch or stub is selected. Ensure the branch diameter is no less than 150 mm for this method



Figure 15: Select a suitable branch or stub.



Figure 16: Branch diameter no less than 150mm.

Remove the excess length of the branch safely, leaving a stub of at least 300mm in length.



Figure 17: Angled cut then a face plate cut



Figure 18: Create the desired cavity

Cut a sloping section off the end of the stub. Angle the cut at approximately 30 degrees. Cut a face plate off the stub following the same angle. The face plate should be approximately 20mm minimum depth. The face plate should be angled to shed water.

Use a small chainsaw to very CAREFULLY bore into the sloping cut end of the stub. This boring cut should only be undertaken by experienced operators.



Figure 19: Creating the desired cavity



Figure 20: Artificial hollow in use

Remove the core to create a hollow. The hollow can be left open or the face plate re-attached and an entrance hole drilled.

Select a spot for the entrance and use a suitable drill to bore an entrance hole. Entrance holes can be through the face plate, in the side or from the underside. Boring large holes is a little difficult. Reattach the face plate with screws or nails. Drainage holes may also be required.



Figure 20: Drill entrance, and or drainage hole.



Figure 21: Attached faceplate.



Figure 22: Final hollow in use

3. References

Gibbons, P. & Boak, M., 2000, *The Importance of Paddock Trees for Regional Conservation in Agricultural Landscapes*, New South Wales National Parks and Wildlife Service.

Gibbons, P. & Lindemayer, D., 2002, *Tree Hollows and Wildlife Conservation in Australia*, CSIRO Publishing, Collingwood.

Victorian Tree Industry Organisation (VTIO), 2010, Tree habitat sizes, www.vtio.org.au/Content/?s=habitat

Grant J. 1997. *The Nestbox Book*, Gould League Of Victoria Inc.



TREE HABITAT SIZES

Entrance size:

Nest size approx. within tree trunk:

Name of bird / possum	Hole size	above ground	Nest size approx. within tree trunk:		
			Width cm	Depth cm	Height cm

Cockatoos / Kookaburras	18cm	5m ↑	30	30	100
Pacific Black Duck	12cm	1.5-2m	35	45	35
Galah	12cm	6m	20	20	75
Teal	10cm	1.5-2m	35	35	45
Crimson rosella / Rainbow Lorikeet / Brush Tail Possum	10cm	5m ↑	20	20	55
Barn Owl	10x30cm recta	5m	40	90	40
Grey shrike-thrush	9cm square	2-5m	18	18	25
Yellow-bellied Glider / Great Glider	8cm	8m ↑	30	30	50
Red-rumped parrot / Eastern rosella / Owlet nightjar / Common Ringtail Possum	7cm	5m ↑	15	15	15
Tree-creepers	6cm	5m	15	15	15
Tuan (Brush tail phascogale)	4cm	4m	18	18	50
Eastern & Western Pygmy possum / Feathertail Glider	3cm	1.5m ↑	15	15	45
Sugar Glider / Padalotes	3cm	5m ↑	20	20	50

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