

Appendix D

Terrestrial and aquatic ecological assessment



Murray River Council
Gee Gee Bridge replacement
Terrestrial and aquatic ecological assessment

June 2017

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Terms and acronyms

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

Anaerobic – Denoting an absence of free oxygen

AUSRIVAS – Australian River Assessment System

CEMP – Construction Environmental Management Plan

DBH – diameter at breast height

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).

DO – dissolved oxygen

DotEE – Department of the Environment and Energy

EC – electrical conductivity

EPBC Act – *Environment Protection and Biodiversity Conservation Act 1999*

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).

LGA – Local Government Area

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

Local occurrence of ecological community – the ecological community that occurs within the study area. However, the local occurrence may include adjacent areas if the ecological community on the study area forms part of a larger contiguous area of that ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.

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.

Movement habitat – Any form of habitat that may be used by fauna species to aid movement through an area. This may include, for example, remnant native vegetation corridors or permanent and ephemeral streams.

NES – National Environmental Significance

NTU – Nephelometric Turbidity Units

OEH – Office of Environment and Heritage

Proposal – the action proposed to be undertaken. In this case the replacement of the existing Gee Gee Bridge, including the approach bridge and approach roads.

RCE – riparian channel and environmental inventory

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 Eastern Highlands Bioregion.

Risk of extinction – the likelihood that the local population will become extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the viability of that species, population or ecological community.

SIGNAL - Stream Invertebrate Grade Number – Average Level. A biotic index based on pollution sensitivity values (grade numbers) assigned to aquatic macroinvertebrate families that have been derived from published and unpublished information on their tolerance to pollutants.

SIS – Species Impact Statement

Subject site – the area to be directly affected by the proposal (DEC 2004), in this case the portion of land within which the bridge would be constructed and the existing bridge would be demolished, including the site compound (see Figure 1-1).

Substrate – the material that exists at the bottom of an aquatic habitat, for example silt, rocks, sand, or gravel.

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 NSW *Threatened Species Conservation Act 1995* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* 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 NSW *Threatened Species Conservation Act 1995* or listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

TSC Act – *Threatened Species Conservation Act 1995*

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

1. Introduction

1.1 Background

Murray River Council (Council) proposes to replace the existing Gee Gee Bridge at the Noorong Road crossing of the Wakool River. The bridge is located between the towns of Deniliquin in New South Wales and Swan Hill in Victoria (see Figure 1-1 and Figure 1-2). A new concrete bridge would be constructed downstream of the existing timber truss bridge. The replacement and demolition of the bridge is included in the NSW Government “Bridges for the Bush” initiative and as part of this initiative, Roads and Maritime would build a new bridge that would allow the road network to provide improved freight capacity and improved traffic safety.

The strategic objectives of the proposal are to:

- Provide for higher mass limits transport and meet the current and future traffic demands in the area
- Provide additional road capacity from the single lane bridge
- Improve road safety.

1.2 Report author

This report has been prepared by GHD Pty Ltd (GHD).

1.3 Report commissioner

This report was commissioned by Council.

1.4 Purpose of this report

GHD has been engaged by Council to undertake an ecological assessment for the replacement of Gee Gee Bridge (the proposal). The terrestrial and aquatic ecological assessment has been prepared to provide specialist input to a Review of Environmental Factors (REF) for the proposal. The demolition of the existing timber truss bridge and approach bridge is considered in the specialist studies.. The ecological assessment addresses relevant legislation (see section 1.8) including:

- 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)
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The primary objectives of the ecological assessment are to:

- Identify potential ecological constraints and opportunities, including the known or likely presence of species, populations and ecological communities and their habitats listed under the TSC Act, FM Act and EPBC Act
- Identify the potential for any matters of National Environmental Significance (NES) listed under the EPBC Act
- Identify the potential impacts of the proposal on threatened biota and their habitats and advise on potential development design constraints and specific mitigation/management actions to avoid or minimise impacts on biodiversity values

- Identify, describe and map ecological communities present within the subject site and study area
- Assess the significance of impacts on threatened biota and matters of NES and identify the likely requirement or otherwise for further approvals under the EP&A Act and/or the EPBC Act
- Recommend mitigation and environmental management measures to avoid, minimise or offset potential impacts on threatened biota and biodiversity values
- Consider the principles of ecologically sustainable development (ESD) in relation to the proposal's potential impacts on ecology.

1.5 Disclaimer

This report has been prepared by GHD for Murray River Council on behalf of Roads and Maritime Services and may only be used and relied on by Murray River Council and Roads and Maritime Services for the purpose agreed between GHD and the Murray River Council as set out in section 1.4 of this report.

GHD otherwise disclaims responsibility to any person other than Murray River Council and Roads and Maritime Services arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.6 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Murray River Council and Roads and Maritime Services and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.6 Assumptions

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

- Were limited to those specifically detailed in section 1.4 of this report
- Did not include preparation of a Species Impact Statement or Commonwealth referral.

1.7 Subject site and existing environment

The subject site (see Figure 1-2) is about 7.6 hectares, including the area in which the new bridge would be constructed and the approach roads. The site compound and stockpile sites would be located at sites that have previously been cleared and/or are currently used as stockpile sites. The subject site is located between the towns of Deniliquin in NSW and Swan Hill in Victoria, in the NSW Riverina in the Murray River Local Government Area (LGA).

The study area (see Figure 1-2) includes the subject site and any additional areas that would be affected by the proposal whether directly or indirectly. The study area for the purpose of this report is defined as the area within 500 metres of the subject site.

The landscape in the study area is dominated by a mix of agricultural land and national park. The Murray Valley National Park (formerly Noorong State Forest) is located in and directly surrounding most of the subject site, with agricultural land located to the north and east of the study area.

The terrain of the study area is generally flat due to its location on the floodplain of the Wakool River.

The Wakool River is the only major permanent watercourse in the study area. A confluence with the ephemeral Wyam Creek occurs in the south-east of the study area (see Figure 1-2).

The locality is defined as the area within a 10 kilometre radius of the subject site.

1.8 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.

1.8.1 NSW Environmental Planning and Assessment Act 1979

The proposal would be assessed under Part 5 of EP&A Act. Roads and Maritime Services is the determining authority.

Section 5A of the EP&A Act includes an assessment of significance that uses seven factors to assist in determining if the proposed activity '*is likely to have a significant effect on the threatened species, populations or ecological communities, or their habitats*'. These seven factors must be taken into account by the determining authority when considering a proposed activity. 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 is required.

1.8.2 NSW Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) lists a number of threatened species, populations and ecological communities to be considered when 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 Species Impact Statement (SIS) must be completed and consultation with the NSW Office of Environment and Heritage (OEH) is required.

1.8.3 NSW Fisheries Management Act 1994

Overview

The *Fisheries Management Act 1994* (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 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 the NSW Department of Primary Industries (Fisheries and Aquaculture) (referred to as Fisheries NSW) is required.

Key fish habitats

One of the objectives of the FM Act is to conserve key fish habitats. These are defined as aquatic habitats that are important to the sustainability of recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.

In freshwater systems, most permanent and semi-permanent rivers, creeks, lakes, lagoons, billabongs, weir impoundments and impoundments up to the top of the bank are considered key fish habitats. Small headwater creeks and gullies (known as first and second order streams) that flow for a short period after rain and farm dams on such systems are excluded, as are artificial waterbodies except for those that support populations of threatened fish or invertebrates.

NSW Department of Primary Industries maps showing the distribution of key fish habitats within the Wakool local government area indicate that the Wakool River is considered key fish habitat.

Approvals

The FM Act requires a permit for certain work including dredging, reclamation or work that blocks fish passage.

Dredging is defined under the FM Act as any work that involves excavating water land, or any work that involves the removal of material from water land and includes the removal of woody debris, snags, gravel beds, cobbles, rocks, boulders, rock bars or aquatic vegetation from water land.

Reclamation refers to using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, or depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge), or draining water from water land for the purpose of its reclamation.

The proposal would involve dredging and reclamation work. Public authorities are exempt from obtaining a permit for dredging or reclamation work under Part 7 of the FM Act (refer Section 199). Section 199 of the FM Act requires a public authority to give written notification of the work to the Minister and any matters raised by the Minister within 21 days after the giving of the notice would be considered.

1.8.4 Noxious Weeds Act 1993

The objectives of the *Noxious Weeds Act 1993* include:

- Identify noxious weeds in respect of which particular control measures need to be taken
- Specify those control measures
- Specify the duties of public and private landholders as to the control of those noxious weeds
- Provide a framework for the State-wide control of those noxious weeds by the Minister and local control authorities.

Under this Act, noxious weeds have been identified for Local Government Areas and assigned control categories (such as W1, W2, W3 and W4). Part 3 provides that occupiers of land (including owners of land) have responsibility for controlling noxious weeds on the land they occupy.

One noxious weed was identified in the study area, identified in section 3.5.1. The potential impacts of the proposal relating to noxious weeds, and site specific safeguards, are included in section 6 .

1.8.5 Water Management Act 2000

Approval is required under *the Water Management Act 2000* (WM Act) for certain types of developments and controlled activities that are carried out in or near a river, lake or estuary. Four types of controlled activities are recognised:

- Erection of a building or the carrying out of a work (within the meaning of the EP&A Act)
- Removal of material or vegetation from land, by way of excavation or other means
- Deposition of material on land as a result of landfill operations or other means
- Carrying out any other activity that affects the quantity or flow of water in a water source.

Approvals

Clause 38 of the *Water Management (General) Regulation 2011* provides an exemption for public authorities from the requirement to obtain licensing for controlled activities on 'waterfront land'. Therefore, Council is not required to obtain a controlled activity permit for the proposal.

Relevant guidelines

The NSW Department of Primary Industries - Office of Water, the agency responsible for administering the WM Act, has developed guidelines to assist applicants carrying out controlled activities on waterfront land (ie the land within 40 metres of the highest bank of the river, lake or estuary). These guidelines provide information on the design and construction of a controlled activity, and other mechanisms for the protection of waterfront land. The following guidelines are relevant to the potential effects of the proposed works on aquatic ecology:

- In-stream works (NSW Office of Water 2012a)
- Riparian corridors (NSW Office of Water 2012b)
- Watercourse crossings (NSW Office of Water 2012c).

1.8.6 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 ecological assessment considers the intent of the SEPP.

SEPP 44 applies to each local government area (LGA) listed in Schedule 1, which includes the Wakool LGA. Schedule 2 of SEPP 44 lists preferred feed tree species of the Koala.

River Red Gum (*Eucalyptus camaldulensis*) trees occur in the study area and are a preferred feed tree species; therefore potential Koala habitat is present. Field surveys and habitat assessment for the Koala indicate that the study area does not contain known habitat for the species.

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.*'

1.8.7 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (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. Ultimately the environmental assessment and approval process required by the Australian Government will be delegated to individual states through the development of bilateral agreements. If the proposal is likely to have a significant impact on a matter of national environmental significance it must be referred to the Australian Minister for the Environment. After the Referral is completed and assessed, the Australian Minister can then refer the proposal back to the NSW Government in accordance with the bilateral agreement.

Matters of national environmental significance 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 national environmental significance or the environment of Commonwealth land.

1.8.8 Wakool Local Environmental Plan 2013

Under the *Wakool Local Environmental Plan 2013*, the subject site is located in the following land use zones:

- E1 – National Parks and Nature Reserves
- W1 – Natural Waterways
- RU1 – Primary Production.

1.9 The proposal

1.9.1 Description of the proposal

Council propose to construct a new concrete bridge over the Wakool River to replace the existing timber truss Gee Gee Bridge and the flood relief bridge on Noorong Road. The proposal would also include a change in road alignment for the bridge approaches. An overview of the proposal is shown in Figure 1-1 and Figure 1-2.

The proposal includes:

- A new two-lane concrete bridge across the Wakool River and floodplain, 15 to 20 metres downstream (north) of the existing Gee Gee Bridge and flood relief bridge. The bridge would have a length of about 245 metres
- Realignment of about 1.4 kilometres of Noorong Road
- Demolition and removal of the existing Gee Gee Bridge and flood relief bridge
- A new rest area near the southern abutment of the existing bridge
- Establishing hard stand areas for crane and piling activities next to the new bridge
- Landscaping treatments, including vegetation planting on road batters and in the road reserve.

Temporary stockpile/compound sites would be provided at the following locations:

- At an existing stockpile site on a private property about one kilometre east of the subject site, on the southern side of Noorong Road
- At an existing stockpile site west of, and adjacent to, the Noorong Road/Nacurrie Road intersection (see Figure 1-1)
- On agricultural land between the proposed approach road and the existing road, about 300 metres west of the Noorong Road/Nacurrie Road intersection (see Figure 1-1).

Other smaller stockpile sites may also be located within the subject site.

1.9.2 Work methodology

An indicative work methodology is provided below. The final construction methodology would be developed by the contractor.

Timing

Construction of the proposal is expected to occur over two years.

Pre-construction activities

Pre-construction activities would include:

- Adjusting utilities as required
- Installing permanent boundary fencing
- Establishing the temporary site compound(s)
- Installing temporary fencing to identify the proposal boundary and prevent access to environmentally sensitive areas where necessary
- Progressively installing temporary and permanent erosion, sedimentation and drainage controls
- Establishing stockpile sites.

Road construction activities

Road construction activities would include:

- Clearing and grubbing vegetation
- Establishing environmental controls
- Constructing stormwater drainage
- Constructing bridge abutments
- Constructing the bridge (see following section for description)
- Progressively stripping, stockpiling and managing topsoil across the site
- Cut and fill earthworks to construct the road formation
- Importing road base materials, compacting and preparing the final road surface
- Applying bitumen sealing and line marking
- Preparing the roadside batters to the final shape
- Constructing roadside drainage

- Progressively landscaping and revegetating the proposal site, including placing topsoil, seeding, planting trees and shrubs, installing weed mats and placing mulch
- Installing safety barriers, line marking, signs and guide posts
- Installing permanent fencing on both sides of the new road on the national park boundary
- Cleaning up the site, including removing temporary site compound(s) and disposing of all surplus and waste materials.

Construction of new bridge

Activities associated with bridge construction may include:

- Establishing a hardstand area on the northern river bank for cranes used to build the bridge
- Cutting and providing ramps in the river banks to allow access for building piers 11 and 12
- Installing temporary coffer dams around piers 11 and 12 on the northern edge of the Wakool River. The coffer dams would have dimensions of about 20 metres by 20 metres. Cofferdams may be constructed by using clean rock or metal sheet piles. These would be removed after the piers have been built. The river bed would be excavated inside the coffer dams. Water inside the coffer dams would likely be extracted for use in the existing road reserve for dust suppression and road construction. A work method statement would be developed for treating the water as required. The work method statement would meet the requirements of Roads and Maritime's 'EMS-TG-011 Environmental Management of Construction Site Dewatering'
- Minor cutting and ground levelling, and building crane platforms at several locations on the downstream side of the new bridge
- Installing a temporary work platform adjacent to the downstream side of the proposed bridge. The temporary platform may be constructed across the entire length of the Wakool River (about 40 metres) and may have a width of about seven metres. The temporary platform may be constructed with piers in the bed of the river or could be on floating barges with supports placed on the bed of the river. For a platform constructed on piers, up to five piers may be constructed across the river, with up to five piles in the river bed for each pier. Upon completion, it is likely that the piles would be cut off at river bed level
- Installing temporary clean rock work platforms (about 10 metres in length) from each bank, adjacent to the downstream side of the proposed bridge
- Driving precast concrete piles
- Building piers and abutments up to the underside of the deck (poured concrete)
- Casting bridge headstocks, placing precast beams, building the deck, installing precast parapets and rails and building kerb infill/deck connection. Bitumen seal would be applied to the completed bridge deck, and line marking and associated infrastructure would be installed.

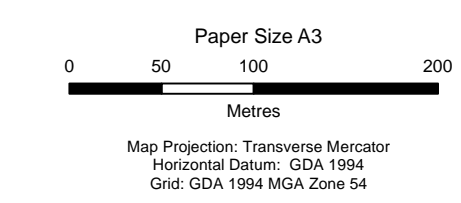
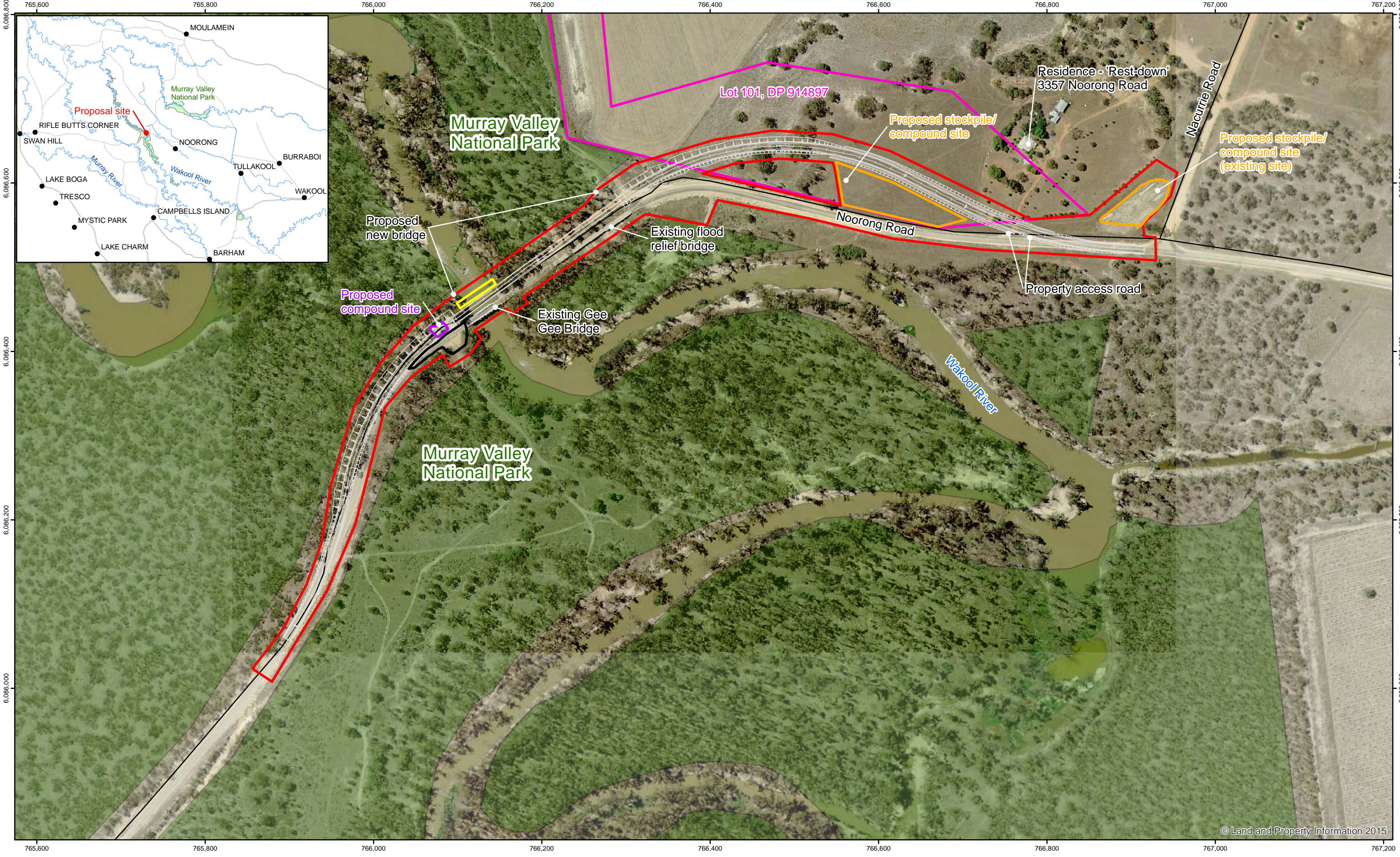
Demolition and removal of existing bridges

The existing Gee Gee Bridge and flood relief bridge would be demolished and removed in sections before being taken off-site for recycling or disposal at an appropriately licensed landfill.

Activities associated with demolishing and removing the bridges may include:

- Cutting or trimming trees on the upstream side of the existing bridge

- Establishing site access, a compound site, stockpiling area and environmental controls including protecting the river from demolition debris
- Establishing an on-site area to stockpile and dismantle timber and steel bridge components before removing them from site
- Managing lead paint in line with a contamination management plan (see REF)
- Establishing a temporary work area including a hardstand for a crane to lift and manoeuvre existing bridge sections as they are progressively dismantled
- Installing temporary clean rock work platforms (about 10 metres in length) from each bank, next to the existing bridge
- Removing decking timbers and girders, then removing the truss spans with a crane
- Salvaging reusable timbers and disposing of poor timbers
- Removing the timber piers by cutting through the piers and moving these sections to the temporary stockpiling area. Piers would be removed to approximately river bed level. Removing the piers below river bed level may require establishing coffer dams around the piers, where possible
- Disposing of contaminated soils from piers and abutments
- Salvaging road material from the approach road, reshaping and capping with topsoil and revegetating the site for stability
- Reshaping and revegetating the batters.



LEGEND	
	Road design
	Existing road
	Subject site
	Proposed rest area
	Proposed compound site
	Proposed stockpile/compound site
	Proposed temporary work platform
	Lot 101, DP 914897 (indicative only)
	Murray Valley National Park (indicative only)

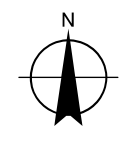
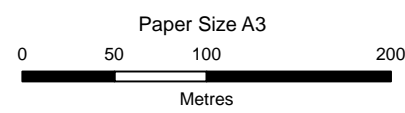


Murray River Shire Council
Gee Gee Bridge replacement

Job Number	23 15324
Revision	0
Date	30 May 2017

Subject site

Figure 1-1



LEGEND					
	Aquatic fauna survey		Anabat walking survey		Road design
	Flora plot		Bird transect		Road
	Harp trap		Spotlighting survey		Subject site
	Anabat detector				



Wakool Shire Council
Gee Gee Bridge replacement

Job Number	23 15324
Revision	0
Date	19 May 2017

Flora and fauna surveys **Figure 1-2**

2. Methods

2.1 Desktop review

2.1.1 Landscape analysis

A brief landscape analysis was conducted 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 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.

2.1.2 Database review

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

The assessment included a review of:

- OEH (2015a) Wildlife Database Atlas – licensed data for Wakool local government area. Search of all terrestrial threatened flora and fauna species (within a 20 kilometre radius of subject site) (searched 12 June 2015)
- OEH (2015b) NSW threatened species, online profiles
- DotE (2015a) EPBC Act Protected Matters Search Tool – for a 10 kilometre radius around the subject site (searched 12 June 2015)
- DotE (2015b) Species profile and threats database, online profiles
- NSW Department of Primary Industries – Fishing and Aquaculture records viewer (DPI 2014a) (searched 11 May 2015)
- NSW Department of Primary Industries - Fishing and Aquaculture unofficial records from fish surveys at Gee Gee Bridge
- NSW Department of Primary Industries – noxious weed declarations – Wakool local government area control area (DPI 2015b) (searched 15 June 2015).

2.2 Field survey

Terrestrial flora and fauna field surveys were conducted by two ecologists between 1 and 3 June 2015. Where appropriate, field surveys were conducted in accordance with *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (DEC 2004).

Targeted threatened flora surveys were conducted on 28 and 29 September 2015.

Aquatic fauna and habitat surveys were completed on 13 May 2015. Field surveys and data collection were completed in accordance with the *NSW Australian River Assessment System (AUSRIVAS) sampling and processing manual* (Turak and Waddell 2004).

The primary objectives of the field surveys were to:

- Determine the presence and/or potential for threatened flora and fauna species, populations, ecological communities, listed under the NSW TSC Act, NSW FM 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 proposal
- 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 ground-truthing and reference to satellite imagery
- Determine the condition and extent of vegetation removal required for the proposal.

Survey effort for the proposal is summarised in Table 2.1.

Table 2.1: Survey effort for aquatic and terrestrial ecological assessment

Survey method	Effort
TERRESTRIAL	
Flora plot and transect surveys (see Figure 1-2)	Three 20 metre by 50 metre plots and two random meander transects to record incidental species in the subject site and study area
Hollow-bearing tree surveys (see Figure 3-1)	GPS of all hollow-bearing trees with the potential to be impacted by the proposal
Threatened flora (<i>Austrostipa wakoolica</i> , <i>Maireana cheelii</i> , <i>Swainsona murrayana</i> , <i>Lepidium monoplocoides</i>)	Random meander survey of all proposal and ten metres either side of the proposal alignment for threatened flora species (16 person hours)
Fauna habitat assessment	Potential fauna habitat identified within areas of potential vegetation clearing, the bridge structure and adjacent areas
Diurnal bird surveys	Three 30 minute transects throughout the subject site by two people (2.5 person hours)
Bridge/roost watches	Bridge/roost watches were completed at dusk over two nights (1.5 person hours)
Anabat echolocation surveys (see Figure 1-2)	Anabat all night echolocation detection using one Anabat detector for two full nights in two locations (24 recording hours)
Anabat walking transects (see Figure 1-2)	Bridge transects walking with Anabat detector at bridge deck to detect departing bats at dusk over two nights (1 person hour)
Harp trapping (see Figure 1-2)	One harp trap for two consecutive nights
Spotlighting for nocturnal birds, bats, amphibians and mammals (see Figure 1-2)	Traverse on foot throughout the study area and parts of the locality over two nights after dusk (4 person hours)
Reptile and amphibian searches	Daytime searches of water habitats and other potential habitat including logs, rocks etc for amphibians and reptiles.

Survey method	Effort
Opportunistic fauna observations	Opportunistic fauna observations for all fauna species encountered during flora surveys and habitat assessment.
AQUATIC	
Aquatic habitat cross sections	River depth and width were recorded along four cross sections and used for the calculation of width / depth ratios at each site.
AUSRIVAS aquatic macroinvertebrate collection	Three replicate samples were collected at each site, with each sample representing a 10 metre continuous or semi-continuous section of the edge habitat.
AUSRIVAS aquatic habitat assessment	Assessments of the in-stream physical habitat were conducted at all three sites using AUSRIVAS protocols. This included detailed assessments of the substrata and water channel.
Velocity readings	Velocity readings were made at each depth measurement along each transect and are reported as averages.
Riparian surveys	Riparian quality assessments were conducted at each site.
Water quality assessments	At each site physico-chemical water quality parameters were recorded and logged using a water quality multi-probe and field turbidimeter. Alkalinity was analysed using field titration analysis kits.

2.2.1 Weather conditions

Weather conditions during the aquatic assessment on the morning and afternoon of 13 May 2015 were fine with variable cloud cover throughout the day. Wind increased in the mid to late afternoon and there was no recorded rainfall at the time of the survey.

Weather conditions during the spotlight and Anabat surveys on the evenings of 1 and 2 June 2015 were cold and calm.

Weather conditions during the time of the diurnal bird survey on the morning of 2 June 2015 were cold, clear and calm. Conditions on the morning of 3 June 2015 were cool, cloudy and calm.

Weather conditions during the targeted flora surveys on 28 and 29 September 2015 were warm and sunny.

Weather conditions at the time of the field surveys are summarised in Table 2.2.

Table 2.2: Weather conditions at the time of field surveys

Day	Weather conditions
Wednesday 13 May 2015	Minimum temperature 3.6°C Maximum temperature 14.5°C Maximum wind gust 54 km/h (at 3.49pm)
Monday 1 June 2015	Minimum temperature 2.5°C Maximum temperature 12.7°C Maximum wind gust 33 km/h (at 1.20pm)
Tuesday 2 June 2015	Minimum temperature 0.6°C Maximum temperature 13.7°C Maximum wind gust 22 km/h (at 10.52am)
Wednesday 3 June 2015	Minimum temperature 6.0 °C Maximum temperature 11.5°C Maximum wind gust 13 km/h (at 3.02am)
Monday 28 September 2015	Minimum temperature 4.0 °C Maximum temperature 25.9°C Maximum wind gust 46 km/h (at 12.47pm)
Tuesday 29 September 2015	Minimum temperature 3.1 °C Maximum temperature 21.2°C Maximum wind gust 37 km/h (at 12.23pm)

2.2.2 Flora

Flora surveys were conducted in the subject site and study area using transects and plot surveys (Figure 1-2 and Table 2.1).

For the transect survey, the random meander technique (Cropper 1993) was conducted to search likely habitat for threatened 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 plots of dimensions 50 metres by 20 metres were surveyed in the study area. Within each plot the vegetation and habitat characteristics were recorded.

The following information was recorded:

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

Plot and random meander data in conjunction with the database review were used to determine the potential for threatened flora species to occur.

Threatened flora

Targeted flora surveys were conducted for threatened flora likely to occur in the study area. The entire proposal alignment and a ten metre buffer either side of the alignment were walked on foot and surveyed. Target flora species were:

- A Speargrass (*Austrostipa wakoolica*)
- Slender Darling-pea (*Swainsona murrayana*)
- Chariot Wheels (*Maireana cheelii*)
- Winged Peppergrass (*Lepidium monoplocoides*).

Any plants of the same genus as any of the targeted flora species listed above were collected and identified using Harden (1990-1993). Timing of surveys was ideal and all species were either flowering and or fruiting at the time of survey.

All specimens were positively identified and no specimens were sent to the Royal Botanic Gardens for clarification.

2.2.3 Vegetation communities

Surveys of vegetation communities in the study area were undertaken to characterise vegetation formation, class, structure and condition. Plant community composition is especially important for 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 Vegetation condition

Vegetation types within the subject site and the surrounding study area were identified according to the vegetation classes of Keith (2004) and the NSW Plant Community Types database. Vegetation condition classes will be assigned according to the BioBanking definition of low condition vegetation (OEH 2014):

- Woody native vegetation with native overstorey per cent foliage cover less than 25 per cent of the lower benchmark of over storey per cent foliage cover for that vegetation type, and where either:
 - Less than 50 percent of groundcover vegetation is indigenous species, or
 - Greater than 90 percent of vegetation is cleared.

OR

- Native grassland, wetland or herbfield where either:

- Less than 50 percent of groundcover vegetation is indigenous species, or
- More than 90 percent of groundcover vegetation is cleared.

Any native vegetation community not in low condition is in moderate/good condition

2.2.5 Hollow-bearing tree survey

Surveys of hollow-bearing trees with the potential to be impacted by the proposal were undertaken in the subject site.

Hollow-bearing trees were surveyed by collecting a GPS position at the location of the tree. For each hollow-bearing tree the following characteristics were recorded:

- Species
- Diameter at breast height (DBH)
- Number of hollows
- Size of hollows.

2.2.6 Terrestrial fauna

Fauna surveys comprised morning and evening diurnal bird surveys, bat surveys using an Anabat call detector and harp trapping, habitat assessment for all fauna groups, observations of fauna signs and spotlighting (mammals, amphibians and nocturnal birds). 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.

Habitat assessment

Habitat details recorded included presence or absence of:

- Hollow-bearing trees (arboreal mammals, hollow-nesting birds and microchiropteran bats)
- Feed trees (e.g. *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 in the study area during the mornings of 2 and 3 June 2015 and evening of 2 June 2015 (see Figure 1-2). Bird surveys 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.

Bats – surveys, call analysis and harp trapping

Searches of the bridge deck and girders were conducted during field surveys for evidence of bats roosting in the bridge structure, such as presence of guano (bat faeces). Searches were conducted by visual inspection with torches.

A targeted survey was conducted for threatened bats with the potential to occur in the study area, including:

- Little Pied Bat (*Chalinolobus picatus*) (vulnerable – TSC Act)
- South-eastern Long-eared Bat (*Nyctophilus corbeni*) (vulnerable – TSC Act and EPBC Act)
- Southern Myotis (*Myotis macropus*) (vulnerable – TSC Act)
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) (vulnerable – TSC Act and EPBC Act).

It should be noted that this survey was only conducted over two nights and does not provide conclusive evidence of the presence or absence of these species in the study area.

Anabat surveys

An Anabat detector (Titley Scientific Brisbane) was placed in a potential bat fly-way adjacent to the Wakool River and underneath the existing main bridge (see Figure 1-2). Surveys were conducted over a period of two nights with the detector placed in each location for one night.

The Anabat data were analysed for identification of bat species by Senior Ecologist Craig Grabham. Calls were identified using zero-crossing analysis and AnalookW software (version 3.8s, Chris Corben 2011). The sonogram and call characteristics (eg characteristic frequency and call shape) were visually compared 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) 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 2015a).

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 2.3.

Due to the absence of reference calls from the study area, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls. Species names follow Pennay et al (2011), then van Dyck and Strahan (2008).

Table 2.3: Confidence rating 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.

Identification	Description
Species group	<p>Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species eg</p> <p><i>Chalinolobus gouldii</i> / <i>M. Mormopterus</i> sp.</p> <p><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 lumped together.</p>

Harp trapping

A harp trap was placed in a potential bat fly-way adjacent to the Wakool River and the existing bridge for a period of two nights.

The harp trap was erected within a gap between two bridge piers on the northern side of the main bridge. Branches were used on either side of the trap to deter bats from flying around the trap. The trap consists of a metal frame with numerous strands of fishing line tied vertically between the frame and pulled taut. A calico bag is connected to the frame underneath the fishing lines, with a plastic flap attached to each side of the bag to prevent any bats caught from escaping the bag.

Bats captured were identified then released at their capture location. Reference calls were collected for each bat as they were released with the Anabat detector. Bats were followed with the spotlight when released to determine if they entered the bridge on release.

Spotlighting for nocturnal fauna

Spotlighting was conducted over a period of two consecutive nights around the southern and northern approaches of the existing bridge and surrounding areas for frogs, mammals, nocturnal birds and bats (see Figure 1-2). Spotlighting was conducted on foot.

Observations of fauna signs

Any indirect evidence of fauna (eg scats, feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash) was recorded and/or photographed.

2.2.7 Aquatic fauna

Site selection

Aquatic fauna sampling sites were established by first determining the reach of the study area. Sampling sites were selected at either extent of the study area, and at the existing bridge. Three sampling sites were surveyed (see Figure 1-2) including one site upstream of the bridge, one site downstream of the bridge and one site spanning the width of the bridge on the northern bank.

Macroinvertebrates

The slow-flowing river edge habitat was sampled in accordance with the NSW AUSRIVAS (Australian River Assessment System) protocols (Turak *et al.*, 2004). At each site, three samples were collected and composited from the edge habitat using a framed net (350 millimetres wide) with 250 micrometre mesh size. The nets and all other associated equipment were washed thoroughly between sampling sites to remove any retained macroinvertebrates. Samples were collected by sweeping the collection net along the edge habitat at the sampling site. The operator worked systematically over three 10-metre sections covering overhanging vegetation, submerged snags, macrophyte beds, overhanging banks and areas with trailing vegetation.

The collected material from each 10 metre section was placed into a sorting tray and the macroinvertebrates were picked for a minimum of 40 minutes. If new taxa were found between 30 and 40 minutes, sorting was continued for a further 10 minutes. If no new taxa were found, after an additional 10 minute period, then this process ceased. If new taxa were found, this process continued up to a maximum of one hour.

The AUSRIVAS model uses site-specific information to predict the macroinvertebrate fauna expected (E) to be present in the absence of environmental stressors. The expected fauna from sites with similar sets of predictor variables (physical and chemical characteristics which cannot be influenced due to human activities, eg. altitude) are then compared to the observed fauna (O). A ratio between the expected and observed fauna values is derived to indicate the extent of any impact (referred to below as the 'O/E ratio').

The ratio derived from this analysis is compiled into bandwidths (ie X, A-D) which are used to indicate the overall health of a particular site using the following classification:

- **Band X** – Richer invertebrate assemblage than reference condition (O/E ratio > 1.17).
- **Band A** – Reference condition (O/E ratio upper limit = 1.17).
- **Band B** – Significantly impaired (O/E ratio upper limit = 0.81).
- **Band C** – Severely impaired (O/E ratio upper limit = 0.46).
- **Band D** – Impoverished (O/E ratio upper limit = 0.11).

The data were run through the AUSRIVAS NSW Autumn Edge model for this assessment.

The Stream Invertebrate Grade Number – Average Level (SIGNAL) biotic index (Chessman, 2003) was also used to determine the ecological quality of sampling sites. This method assigns a grade between 1 (most tolerant) and 10 (most sensitive) to each macroinvertebrate family.

The SIGNAL index is then calculated as the average grade number for all families present in the sample.

The resulting index score can then be interpreted using the following guidelines (Gooderham and Tsyrlin 2005):

- **SIGNAL > 6** = Healthy habitat
- **SIGNAL 5-6** = Mild pollution
- **SIGNAL 4-5** = Moderate pollution
- **SIGNAL < 4** = Severe pollution

Fish

The reaches upstream and downstream of Gee Gee Bridge on the Wakool River are known habitat for a number of fish species. NSW Fisheries (2015) identified 14 species of fish that have been recorded in the Wakool River at Gee Gee Bridge including two threatened fish species, Murray Cod (*Maccullochella peelii peelii*) and Silver Perch (*Bidyanus bidyanus*). Targeted fish surveys were not undertaken as part of this ecological assessment as the effort required was unlikely to provide additional information relating to the study area.

Fish habitat in the study area was classified according to policies and guidelines for fish friendly road crossings (Appendix B) (Fairfull and Witheridge 2003).

Permits and Licences

GHD holds a current NSW Department of Primary Industries Scientific Collection Permit (P07/0142-4.0, expiry 27 August 2018) to conduct aquatic ecology surveys including macroinvertebrate sampling in NSW rivers and streams. Sampling conducted for this project

was conducted in accordance with this scientific collection permit and the requirements of the GHD Animal Ethics Committee.

2.2.7 Aquatic plants

The presence of emergent and submerged aquatic plants was recorded at each survey site. The survey method included the recording of presence / absence data and notes on the extent of plants along the Wakool River in the study area. This survey was conducted in conjunction with the AUSRIVAS habitat assessment. Transect surveys were not possible at the time of the site visit due to the depth and turbidity of the Wakool River at each survey site. Aquatic flora surveys were restricted to records of surface macrophytes, emergent macrophytes and those identified in the littoral zone and above the current water level.

2.2.8 Water quality

Water quality parameters were measured using a YSI 556 water quality multi-probe. Physicochemical parameters measured included:

- pH
- Dissolved oxygen (milligrams per litre and percent saturation)
- Electrical conductivity (microsiemens per centimetre)
- Temperature (degrees Celsius)
- Turbidity (Nephelometric Turbidity Units)

Turbidity was measured using a portable HACH 2100p turbidity meter. Alkalinity was also measured using field Titrets® for titrimetric analysis. Alkalinity (total in milligrams per litre) was included because it is a required variable for the AUSRIVAS NSW Autumn Edge model. The results were used to assess water quality in the study reach in relation to the health of aquatic ecosystems, determined by the Australian and New Zealand Environmental Conservation Council guidelines for upland streams in south-east Australia (ANZECC, 2000).

2.2.9 Habitat characteristics

The condition of the surrounding land, river channel and riparian vegetation was determined using the riparian, channel and environmental inventory scorecard developed by the NSW Environment Protection Authority. This method was originally developed by Peterson (1992) but was modified for Australian conditions by Chessman *et al.* (1997). There are 13 descriptors on the score card with a classification rating of one to four (Appendix C). The highest score (52) is assigned to streams with little or no physical disturbance. The lowest score (13) would be assigned to a stream with little or no riparian vegetation and one which is strongly channelled. Width depth ratios were calculated for each site using the data collected from the cross sections (Gordon *et al.*, 2004).

2.2.8 Survey timing and potential technical limitations

Field surveys were conducted outside the optimal survey period for many species. Terrestrial field surveys were undertaken in early June when many plant species have finished flowering in the area and may be difficult to detect. The cool conditions at the time of the fauna surveys may have affected the activity of some fauna such as frogs and bats.

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

This survey was not designed to enable all species, either resident or transitory to the study area, to be detected. Instead it was aimed at providing an overall assessment of the ecological values of the study area with particular emphasis on threatened and migratory species to allow an assessment of the potential impacts of the proposal. For those species of conservation significance that were not detected but likely to occur in the study area, an assessment of the likelihood of their occurrence was made based on known habitat requirements.

2.3 Likelihood of occurrence and assessment of impact significance

An assessment of the likelihood of occurrence and possibility of impact was completed for listed species, populations and ecological communities with the potential to occur in the study area.

In assessing which of these species, populations and ecological communities are 'likely' to occur within the study area (as described in *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft*) (DEC 2004) 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).

The criteria used for the assessment of the likelihood of occurrence (Appendix D), and their meanings are as follows (DEC 2004):

- Unlikely – species, population or ecological community is not likely to occur. Lack of previous recent (<25 years) records and suitable potential habitat limited or not available in the study area
- Likely (taken to be a real chance or possibility) – 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 current or previous field investigations.

In addition, the possibility of impact by the proposal on threatened biota likely to occur, or present 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.

Assessments of significance were completed for any species identified as being likely to be impacted by the proposal.

Potential impacts on species listed under the TSC Act were assessed in accordance with the Assessment of Significance included in section 5A of the EP&A Act, with reference to DECC (2007) (see Appendix E).

Potential impacts on species listed under the EPBC Act were assessed in accordance with the EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DEWHA 2013) (see Appendix E).

2.4 Key threatening processes

A key threatening process is defined in the TSC Act as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

There are currently 38 key threatening processes listed under the TSC Act, eight listed under the FM Act and 21 under the EPBC Act. A number of key threatening processes are listed under more than one Act.

Those key threatening processes potentially relevant to the proposal and specific mitigation measures to limit the impacts of these key threatening processes are discussed in section 5.3.

2.5 Key personnel

Four key people have been involved in writing this report (Table 2.4):

Table 2.4: Key personnel and their role in writing this report

Name	Title	Qualifications	Role
Melissa Cotterill	Ecologist	BSc (Biology)	Ecologist and report writing
Leigh Maloney	Senior Ecologist	BAppSc (Environmental Science) (Hons)	Senior ecologist and technical review
Phil Taylor	Senior Aquatic Ecologist	BSc (Ecology and Biodiversity), MSc (Ecology and Evolution)	Senior aquatic ecologist and report writing
Carlie McClung	Senior Ecologist	BEnvSc (Environmental Management and Ecology) MEnvMgt (Aquatic Ecology)	Aquatic ecology technical review
Craig Grabham	Senior Ecologist	BAppSc (Parks, Recreation and Heritage) (Hons)	Microchiropteran bat survey (Anabat) data analysis

3. Existing environment

3.1 Landscape context

3.1.1 Bioregion

The study area occurs within the Riverina Bioregion. This bioregion extends from Ivanhoe in the Murray Darling Depression Bioregion south to Bendigo in Victoria, and from Narrandera in the east to Balranald in the west. It includes outlying remnants of the Murray Darling Depression Bioregion in its western boundary, and the Victorian Midlands Bioregion in the south.

3.1.2 Vegetation connectivity

The study area occurs within the boundary of the Murray Channels and Floodplains Mitchell Landscape in the Murray Local Land Services (LLS) area. Fifty-six per cent of this Mitchell Landscape has been cleared within the Murray catchment area. Murray Channels and Floodplains are therefore not considered to be an over-cleared landscape (ie less than 70 per cent cleared) (DEC 2005).

Native woodland vegetation exists in Murray Valley National Park and along the Wakool River in the study area and subject site.

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 3.1).

Table 3.1: Assessment of the landscape value of vegetation in the study area

Landscape value	Subject site and study area
Size/Shape	The subject site covers an area of 4.6 hectares and is relatively linear in shape.
Location in landscape	The study area occurs between the towns of Swan Hill and Deniliquin in the Riverina and is surrounded by agricultural land and national park.
Per cent cover native vegetation within a two kilometre radius of site	31-70 per cent.
Connectivity value	<p>The proposal includes vegetation that:</p> <ul style="list-style-type: none"> • Is not in low condition • Has an average width >100 metres • Links to surrounding native vegetation on three compass quarters of the proposal. <p>The connectivity value is therefore high.</p>
Next nearest remnants, distance, size and connectivity	The nearest remnant is Murray Valley National Park - Noorong, which is located within the study area and subject site and the connected vegetation is about 1713 hectares in size.
Distance to nearest large remnant > 1000 hectares	Murray Valley National Park - Noorong is made up of numerous patches of woodland. Another patch of the park is located about eight kilometres north-east of the study area. This section of the park has an area of about 1614 hectares.

3.1.3 Corridors and connectivity

Remnant vegetation along the Wakool River in the study area forms a corridor of riparian vegetation that facilitates the movement of fauna across the landscape. This vegetation is connected to the vegetation in Murray Valley National Park that extends outside of the study area and further facilitates fauna movement across the landscape. The vegetation in the study area provides an important fauna corridor in the locality for woodland birds, mammals and other fauna. Woodland in the study area also provides connectivity to remnant vegetation outside the locality, including Koondrook and Perricoota State Forests and the riparian corridor of the Murray River to the south.

3.1.1 Surrounding landuse

The landscape in the study area is dominated by native forest and woodland in the Murray Valley National Park, with agricultural land use outside the national park to the north. Murray Valley National Park was created in 2011. Before this, the forest and woodland in the study area were part of Noorong State Forest, which was historically logged.

The study area and locality have been disturbed through development for agriculture, which has resulted in a large amount of clearing for activities such as grazing and dryland cropping. There is no commercial land use in the study area and limited rural holdings in the locality.

Three residences are located within 1.3 kilometres of the subject site. One of these, the 'Rest-down' residence, is located about 100 metres north of the subject site.

3.1.1 Terrain, drainage and geology

The Murray Channels and Floodplains Mitchell Landscape comprises active channels and seasonally inundated floodplains in Quaternary alluvium with associated billabongs, swamps, channels levees and source bordering dunes. It includes scalded alluvial flats, broad elevated floodplains and associated relict channels and isolated sandy rises. Local relief is about five to 10 metres (Mitchell 2002).

The geology of the study area is comprised of the Coonambidgal Formation. The geology of this formation is Quaternary, comprising unconsolidated grey brown micaceous silty clay, silt, polymictic sand and gravel (NSW Department of Mineral Resources 2002).

The terrain of the study area is generally flat due to its location on the floodplain of the Wakool River. The floodplain becomes slightly undulating further from the river.

The Wakool River is the only major permanent watercourse in the study area.

3.1.2 Soils

The Murray Channels and Floodplains Mitchell Landscape contain channel banks of grey and brown clays and flats of silty or cracking grey clays. Highest flooded terraces contain brown clays or red-brown texture contrast soils with dune and sandplains of deep sandy brown soils or texture-contrast soils that are locally calcareous (Mitchell 2002).

3.1.3 Climate

The area is classified as semi-arid with a mean annual rainfall of 303.5 millimetres for Swan Hill. Summers are generally hot and dry while winters are cold. The mean maximum temperature occurs in January at 33.0 degrees Celsius, while the mean minimum temperature occurs in July with 3.6 degrees Celsius. Average rainfall is generally highest in November with an average of 44.6 millimetres (Bureau of Meteorology 2015).

3.2 Vegetation communities

Three native vegetation communities were identified in the study area during field surveys. Table 3.2 outlines the vegetation communities present in the study area and their corresponding vegetation types as listed in the NSW plant community type's database.

3.2.1 River Red Gum forest

Forest in the immediate vicinity of the Wakool River is dominated by River Red Gum (*Eucalyptus camaldulensis*). This predominantly occurs along the riparian zone and inner floodplain of the Wakool River and meets the classification criteria for the NSW plant community type (PCT) *River Red Gum – Warrego Grass – herbaceous riparian tall open forest wetland mainly in the Riverina bioregion* (PCTID 7) (Figure 3-1 and Photo 1). The mid storey contains a small amount of River Cooba (*Acacia salicina*) and Pale-fruit Ballart (*Exocarpos strictus*).

The community contains a patchy shrub cover of Lignum (*Duma florulenta*) and Nitre Goosefoot (*Chenopodium nitrariaceum*).

The understorey is dominated by a mixture of both native and introduced species. Native grasses and forbs that occur include Warrego Grass (*Paspalidium jubiflorum*), Climbing Saltbush (*Einadia nutans*), Curly Mitchell Grass (*Astrelba lappacea*) and Ruby Saltbush (*Enchylaena tomentosa*). Woody debris and leaf litter are common.

3.2.2 Black Box woodland

Woodland dominated by Black Box (*E. largiflorens*) occurs on the outer floodplain of the Wakool River where it grades from the River Red Gum community. The Black Box woodland community meets the classification criteria for the NSW PCT *Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly the Riverina and Murray Darling Depression bioregions)* (PCTID 13) (Figure 3-1 and Photo 2).

The midstorey includes Pale-fruit Ballarat which in some locations forms locally dens stands. There are dense patches of shrub cover in parts of the community, dominated by Lignum and including other native species such as Nitre Goosefoot and Spiny Saltbush (*Rhagodia spinescens*).

Leaf litter and bare ground form a high percentage of the groundlayer. Groundcover plants are common but not dense in this community and include Black Rolyoly (*Sclerolaena muricata*) Black Cotton Bush (*Maireana decalvans*), Creeping Saltbush (*Atriplex semibaccata*) Climbing Saltbush and Ringed Wallaby Grass (*Rytidosperma caespitosum*).

3.2.3 Black Roly Poly shrubland

This community is a low shrubland that occurs past the limits of the immediate floodplain on the northern side of the Wakool River. This community meets the classification criteria for the NSW PCT *Black Roly Poly low open shrubland of the Riverina bioregion and Murray Darling Depression bioregions* (PCTID 216) (Figure 3-1 and Photo 3). The upper and mid stratum are generally absent with a few scattered Black Box occurring.

The shrub layer is dominated by chenopods including Black Roly Poly (*Sclerolaena muricata*), Creeping Saltbush (*Atriplex semibaccata*) and Black Cotton Bush (*Maireana decalvans*). This community possibly did not exist when intensive stock grazing would have eliminated saltbushes from large areas. There was evidence of past and current grazing in this community. It is likely that the community has regenerated since the grazing intensity in the study area was reduced.

3.2.4 Non-native vegetation

Areas of non-native vegetation are located throughout the subject site and study area and occur mostly as introduced grassland dominated by pasture species such as Wild Oats (*Avena fatua*), Soft Brome (*Bromus hordeaceus*) and Barley Grass (*Hordeum leporinum*). These areas occur mostly outside patches of woodland in agricultural land. Introduced tree species occur in the study area including Pepper Tree (*Schinus areira*).

Table 3.2: Native vegetation communities and NSW plant community type (PCT)

Mapped vegetation community	Plant community types
River Red Gum forest	<i>Formation:</i> Forested Wetlands (Keith 2004) <i>Class:</i> Inland Riverina Forests (Keith 2004) <i>PCT:</i> River Red Gum – Warrego Grass – herbaceous riparian tall open forest wetland mainly in the Riverina bioregion (PCTID 7)
Black Box woodland	<i>Formation:</i> Semi-arid woodland (Grassy sub-formation) (Keith 2004) <i>Class:</i> Inland Floodplain Woodland (Keith 2004) <i>PCT:</i> Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly the Riverina and Murray Darling Depression bioregions (PCTID 13)
Black Roly Poly shrubland	<i>Formation:</i> Arid shrublands (Chenopod sub-formation) (Keith 2004) <i>Class:</i> Riverine Chenopod Shrublands (Keith 2004) <i>PCT:</i> Black Roly Poly low open shrubland of the Riverina bioregion and Murray Darling Depression bioregions (PCTID 216).



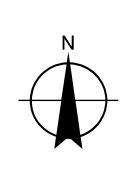
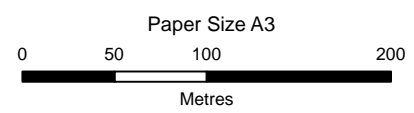
Photo 1: River Red Gum forest in the study area



Photo 2: Black Box woodland in the study area



Photo 3: Black Roly Poly shrubland in the study area



LEGEND

- | | | |
|---------------------|---------------|---------------------------------------|
| Hollow-bearing tree | — Road design | Vegetation community |
| Remove | — Road | Introduced grass and tree plantings |
| Retain | Subject site | PCTID 13 - Black Box woodland |
| | | PCTID 216 - Black Roly Poly shrubland |
| | | PCTID 7 - River Red Gum forest |



Wakool Shire Council
Gee Gee Bridge replacement

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Revision	0
Date	19 May 2017

Vegetation communities and hollow-bearing trees

Figure 3-1

3.3 Terrestrial fauna habitat

3.3.1 Forest and woodland

Fauna habitat within the study area occurs predominantly in areas of River Red Gum forest and Black Box woodland. The remainder of the study area has previously been cleared for agriculture, is dominated by introduced groundcover species and contains little habitat value for fauna.

Remnant vegetation in the subject site and study area provides foraging, movement and potential breeding habitat for a variety of bird species. This includes threatened species that were recorded during current surveys, such as the Brown Treecreeper (*Climacteris picumnus victoriae*) (Figure 3-1). It may also provide habitat for other threatened species not recorded in the study area, but considered likely to occur, such as the Barking Owl (*Ninox connivens*), Diamond Firetail (*Stagonopleura guttata*) and Gilbert's Whistler (*Pachycephala inornata*).

Mature eucalypt trees exist throughout the study area predominantly in patches of woodland. Patchy regeneration of canopy and shrub species is occurring throughout the subject site and study area. Regeneration in the Black Box Woodland is more common than the River Red Gum Woodland. The trees in the study area would be used for nesting and foraging by a range of woodland birds, arboreal mammals and microchiropteran bats.

Although the species was not observed during surveys, it is considered likely that the trees in the study area would provide habitat for the threatened Squirrel Glider due to the presence of hollows and the connections between woodland patches in the landscape. Squirrel Gliders would use trees in the study area to forage for sap and nectar. Other arboreal mammals such as the Common Brushtail Possum (*Trichosurus vulpecula*), which was recorded during surveys, also use trees in the study area for foraging.

Hollow-bearing trees occur throughout the subject site and study area. Hollow-bearing trees located in or near the subject site are shown in Figure 3-1. 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 – *Tadarida australis*), arboreal mammals (such as the Squirrel Glider and Common Brushtail Possum) and a range of woodland birds. Owls such as the Barn Owl (*Tyto alba*) and Southern Boobook (*Ninox novaeseelandiae*) may use hollow-bearing trees for nesting. Both these species were observed in the study area. Barn Owls were observed leaving hollows in River Red Gum trees during surveys. The threatened Barking Owl may also use them.

Forest and woodland areas with woody debris and leaf litter would provide habitat for reptiles such as snakes and skinks, as well as foraging habitat for threatened woodland birds such as the Brown Treecreeper and Grey-crowned Babbler (*Pomatostomus temporalis temporalis*).

3.3.2 Bridges

Gee Gee Bridge and the flood relief bridge contain potential roosting habitat for microchiropteran bats in the timber framework underneath the bridge deck. There was evidence of bat guano in the bridge during surveys. Crevices in the bridge underneath the deck contain potential habitat. It is possible bats could have been roosting in parts of the bridge that were inaccessible during surveys, such as directly above the water. Bats were seen flying in the vicinity of the bridge during surveys and captured bats that were released were observed looking for entry points into the bridge. One captured bat appeared to enter the bridge over the river after release.

The framework of the bridge also provides roosting and potential nesting habitat for birds.

3.3.3 Grassland

Grassy areas in the study area provide feeding habitat for common mammals such as the Eastern Grey Kangaroo (*Macropus giganteus*) and Swamp Wallaby (*Wallabia bicolor*), which were both recorded during surveys. Grassy areas also provide foraging habitat for birds.

3.3.4 Wakool River

The Wakool River is a major permanent waterway and provides potential breeding habitat for frogs and waterbirds. It also provides foraging and drinking habitat for a range of terrestrial fauna.

3.4 Aquatic fauna and flora habitat

The Wakool River is a major permanent waterway and provides habitat for a variety of aquatic fauna and flora.

The study area for the aquatic surveys was defined within a 1000 metre reach of the Wakool River (~500 m upstream and downstream of the existing bridge). Within this study area, there are several significant log jams within the river; both up and downstream of the existing bridge (see Photo 4, Photo 5, Photo 6 and Photo 8). There is limited trailing bank vegetation on either side of the macro channel, however large semi-continuous stands of emergent macrophytes provide likely habitat for macroinvertebrates and small and/or juvenile fish.

The existing bridge itself may be utilised by fish as an artificial shelter and woody debris in the vicinity of the bridge also provides habitat.



Photo 4: Large woody debris mid-stream (downstream of Gee Gee Bridge)



Photo 5: Woody debris – mid stream (approximately 50 m downstream of the bridge)



Photo 6: Woody debris under the bridge

3.4.1 Fish

The Wakool River at Gee Gee Bridge is known to provide habitat for a number of native fish species including the threatened fish species, Murray cod (*Maccullochella peelii*) and Silver perch (*Bidyanus bidyanus*) (NSW DPI 2015).

Based on the presence of these known threatened fish species the Wakool River is classified as Class 1 (Major fish habitat) according to the NSW Fisheries Habitat Classification Scheme (Fairfull and Witheridge (2003); AppendixB).

There are an additional twelve species known to occur in the Wakool River at Gee Gee Bridge (NSW DPI Fisheries, 2015) including the native species: Australian smelt (*Retropinna semoi*), Bony herring (*Nematalosa erebi*); Murray-Darling rainbow fish (*Melanotaenia fluviatilis*); Carp-gudgeon (*Hypseleotris sp.*); Flat-headed gudgeon (*Phylipnodon grandiceps*); Un-specked hardyhead (*Craterocephalus fulvus*); Golden perch (*Macquaria ambigua*).

Trout cod (*Maccullochella macquatiensis*) also has the potential to be present given the nature of the River and the suitable habitat (logs and deep pools) (Morris *et al.*, 2001) for this species. While there are no current records of this species within the Wakool River (NSW DPI Fisheries, 2015), NSW DPI Fisheries have indicated that this species may occur in the study area.

The introduced Plague Minnow (*Gambusia holbrooki*) has been recorded in the study area as have the following introduced species: Goldfish (*Carassius auratus*); Oriental weatherloach (*Misgurnus anguillicaudatus*); Common carp – goldfish hybrid and the Common carp (*Cyprinus carpio*) (NSW DPI Fisheries, 2015).

The Redfin Perch (*Perca fluviatilis*), a Class 1 Noxious fish (FM Act), has been recorded within the Wakool River but not within the study area to date (NSW DPI Fisheries, 2015).

3.4.2 Platypus

The Platypus (*Ornithorhynchus anatinus*) has been recorded in the Niemer River about 30 kilometres from Gee Gee Bridge. During the field survey there were no sightings of Platypus or burrows. This may be, in part, due to the lack of bank vegetation.

Bank vegetation provides shelter and habitat for macroinvertebrates, which make up a considerable component of the species' diet. The banks at the subject site tended to be appropriate for Platypus requirements in that they were steep and mostly greater than one metre in height. The absence of notable riffle/pool sequences may also explain their absence in the study area, even though the pool habitats themselves provide suitable depth profiles for the species (Williams and Serena 1999).

The Platypus is unlikely to be resident in the study area but the species may use the study area for foraging.

3.4.3 Macroinvertebrates

There was some habitat for macroinvertebrates at each of the sampling sites in the form of emerging macrophytes, woody debris, detritus and some artificial habitat at the bridge site.

A total of 19 macroinvertebrate taxa were collected in this survey. AUSRIVAS results indicate that the ecological health was below reference condition and resulted in BAND B assessments ("significantly impaired") at each sampling location. Site 1 (upstream of the bridge) had approximately 57 percent of the taxa that would be expected to occur compared to the reference condition, while sites 2 (at the bridge) and site 3 (downstream of the bridge) approximately 64 percent of the expected taxa were collected.

The majority of the taxa collected in this study were either tolerant or moderately tolerant to Pollution, with the exception of the mayfly: Leptophlebiidae which has a SIGNAL rating of 8.

3.4.4 Aquatic plants

The banks of the Wakool River in the study area showed signs of recent inundation due to some fresh deposits of sediment and the largely denuded understorey. There were however several stands of the giant sedge (*Cyperus exultatus*) and *Bolboschoenus* sp. occurring along the channel margins of both banks.

This area of the basin is known habitat for a number of aquatic and semi aquatic plants depending on their associated woodland (ie River Red Gum or Black Box) (Margules and Partners et al., 1990). Many of these species were not picked up in the aquatic ecology survey, which may have been a limitation brought about by the timing of the field assessment.

While there is potential for the study area to provide habitat for Western Water-starwort, which is listed as vulnerable under the EPBC Act and TSC Act, the presence of this species at the subject site is considered unlikely based on no observations during the surveys and a lack of records in the study area.

3.4.5 Aquatic ecology site assessments

The Wakool River in the study area was assessed as Class 1 (Major fish habitat) according to the NSW Fisheries Habitat Classification Scheme, which is defined as:

"Major permanently or intermittently flowing waterway (e.g. river or major creek), habitat of a threatened fish species"

The general features of the river and the aquatic environment at the study sites where the low diversity of geomorphic units at the study, with deep pools and runs being the dominant types at the survey sites in the study area. The river bed substrate is dominated by materials with

small particle sizes, including sand and fine silt and clay. There was a relatively high organic load on the river bed largely from the surrounding Eucalyptus species.

Materials with larger particle sizes, including cobbles, gravel and pebbles, accounted for less than 10 percent of the bed substrate and are moderately embedded in finer sediments, suggesting that vertical connectivity is restricted. This pattern was consistent throughout the study reach.

The river bank was predominately concave in shape and steep in gradient with several large areas of bare ground. Small sections of either bank flattened out at Site 1 and Site 3 where the gradient was less than 5°. Even in these flattened sections there were also considerably large areas of bare ground and minimal trailing bank vegetation.

River riparian channel and environmental (RCE) inventory scores were approximately 60 percent of the maximum score at each site indicating a moderately disturbed channel and modified riparian zone. Observations from the site visit suggest that the key disturbance factors along the riparian zone are from human and stock access, runoff and vegetation clearing. Overall habitat scores from the AUSRIVAS scoring sheet suggests that habitat quality is slightly better at Site 1 compared to the other two upstream sites (Table 3.3).

All of the water quality parameters were within ANZECC (2000) guidelines with the exception of electrical conductivity, which was below the lower limit for lowland rivers (Table 3.4).

Table 3.3: Site details and assessment results from the aquatic survey.

Site	Latitude	Longitude	RCE score (maximum score =52)	AUSRIVAS Habitat quality score (max. score=200)	O/E ratio	AUSRIVAS BAND	SIGNAL 2 Score	Fish habitat class
1	-35.3295	143.9312	33	108	0.57	B	4.09	1
2	-35.3298	143.9277	33	104	0.64	B	3.77	1
3	-35.3276	143.9263	34	125	0.64	B	3.46	1

Table 3.4: Water quality data recorded during the aquatic ecology survey.

Site	Date (time)	Temp.	pH	EC	Turbidity (NTU)	DO% Saturation	DO (mg/L)	Alkalinity (mg/L)
ANZECC guideline range ¹		NA	6.5-8.0	125- 2200	6-50	85-110	NA	NA
1	13/05/2015 13:45	14.9	7.13	63.3	44.7	99.9	9.36	21
2	13/05/2015 11.25	12.9	7.15	109.3	44.6	97.2	9.46	22
3	13/05/2015 09.10	10.8	6.72	64.8	49.8	95.9	9.56	22

¹ Guideline values are for the protection of lowland river aquatic ecosystems

Site 1 – Approximately 300 metres upstream of Gee Gee Bridge

Site 1 is located approximately 300 metres upstream of Gee Gee Bridge. The area surveyed is approximately 200 metres upstream of the first major bend upstream of Gee Gee Bridge. The river at this location has a mode stream width of 29 metres and had a mid-stream depth of 1.35 metres. Mean velocity was 0.31 metres per second. Log jams were present throughout the channel (Photo 7) at a frequency of one log per 30-40 metres.

The aquatic macrophytes *Bolboschoenus* spp. dominated the littoral zone on both banks at Site 1. There were also occasional clumps of *Eleocharis acuta* and scattered individuals of *Juncus usitatus*. There were two floating macrophyte species recorded at this site, *Potamogeton sulcatus* (floating pondweed) and *Ludwigia* sp. (water primrose). Shading at midday covered less than five percent of the channel. The flood plain was well forested on both banks and there were flood runners present. The understory is poorly established and on the right hand side there are extensive sections of exposed riparian tree roots.

Land use in the proximity of the site is recreation on the left hand side and agriculture on the right hand side. Irrigation pipes were evident immediately upstream. This site is a popular recreational fishing destination. Steep bare embankments on the right hand side are suggestive of high erosion potential (Photo 7).

Habitat at this site includes a number of log jams and long sections of semi-continuous emergent sedges on both banks. River contours are also likely to provide some microhabitat within the channel itself.



Photo 7: Site 1 looking upstream

Site 2 – At Gee Gee Bridge (right hand side)

Site 2 is in the proximity of and including the bridge itself. The area surveyed included a distance of approximately 100 metres upstream and downstream of the bridge. The river at this location has a mode stream width of 38 metres and had a mid-stream depth in the range of 1.5-3.5 metres². Mean velocity was 0.26 metres per second. Large woody debris is present throughout the channel (Photo 8).

The aquatic macrophytes *Cyperus exaltatus* (giant sedge) and *Bolboschoenus* sp. dominated the littoral zone on both banks at Site 2 (Photo 9). There were also occasional clumps of *Juncus usitatus*. Shading at midday covered less than five percent of the channel. The flood plain was well forested on both banks and there were flood runners. The understory is poorly established and macrophyte diversity was low.

Land use in the proximity of the site is recreation on both banks and agriculture on the northern and south sides of the bridge. The floodplain at this site is asymmetrical banks on the left hand side are steep (60-80°) while on the right hand side the bank is slightly convex with a shallower, moderate grade (30-60°). On both banks there are large areas (>80%) of bare ground on both banks (Photo 9), the erosion potential considered to be high, particularly on the steeper left hand embankment. This site is a popular recreational fishing destination.

Habitat at this site includes a number of log jams and long sections of semi-continuous emergent sedges on both banks. River contours are also likely to provide some microhabitat within the channel itself. The existing bridge is likely to be utilised by fish species as an artificial shelter and there is woody debris currently between the right bank and the first pier which is likely to also provide habitat.

² Exact readings from the bridge were distorted by current drag.



Photo 8: Large woody debris mid channel and along the margins upstream of Gee Gee Bridge



Photo 9: Site 2 (up and downstream of Gee Gee Bridge). Facing south west showing the extent of macrophyte stands on both banks



Photo 10: View of Gee Gee Bridge with the southern embankment in the background

Site 3 – Approximately 300 metres downstream of Gee Gee Bridge

Site 3 is located approximately 300 metres downstream of Gee Gee Bridge. The extent of the survey covered 150 metres upstream and 100 metres downstream of the site location (Photo 11). The river at this location has a mode stream width of 32 metres (range: 29-51 m) and a mid-stream depth of 1.53 metres. Mean velocity was 0.25 metres per second. Large woody debris is present throughout the channel (Photo 12) and just upstream of the large pool before the river meanders to the southwest is a vegetated mid-channel bar that forms the foundation of a complex log jam on the downstream side of the bar (Photo 13).

The aquatic macrophytes *Cyperus exaltatus* (giant sedge) dominated the littoral zone on both banks at Site 2 (Photo 12) and is likely to provide shelter for fish and habitat for various macroinvertebrate species. There were also occasional clumps of *Juncus usitatus* and additional unidentified sedge (*Cyperus* sp.). Shading at midday covered less than 10 percent of the channel. The flood plain was well forested on both banks and there were flood runners present (mainly on the left hand side). The understory, as at the other sites is poorly established and macrophyte diversity was low. Riparian vegetation formed both semi continuous and clumped distributions which was predominately native (~70%) and was dominated by large river red gums (>10 m).

Land use in the proximity of the site is recreation on both banks and agriculture on the northern and south sides of the bridge. The floodplain at this site is asymmetrical banks on the left hand side are steep (60-80°) while on the right hand side the bank is a more shallow incline with a low grade (~10°). On both banks there are large areas (>80%) of bare ground on both banks (Photo 13), the erosion potential considered to be high, particularly on the steeper left hand embankment. This site is a popular recreational fishing destination evidenced by considerable fishing line and lures found in-stream and tangled around vegetation during the survey.



Photo 11: Looking upstream to Gee Gee Bridge from Site 3 (08.30 hr.)



Photo 12: Looking downstream to large pool before the Wakool River meanders to the south-west



Photo 13: Vegetated, mid-channel bar and complex log jam at Site 3

3.5 Recorded flora and fauna species

3.5.1 Terrestrial flora

Flora survey results

GHD field surveys identified 66 flora species, of which 41 species are native and 25 species are introduced.

Canopy species in the study area are dominated by Black Box and River Red Gum. Other native tree species that occur include River Cooba. One introduced tree species was recorded in the study area; Pepper Tree (*Schinus areira*). None of the trees in the study area appear to be suffering from dieback and there is minimal regeneration of River Red Gum occurring.

Native shrubs that occur in the study area include Lignum, Nitre Goosefoot, Pale-fruit Ballart and Spiny Saltbush. The shrub layer in the study area is generally sparse; however, there are relatively dense patches of shrub cover in parts of the Black Box community, dominated by Lignum.

The groundcover vegetation in the study area is generally dominated by native species in areas with a canopy cover. In areas with an absent canopy the groundcover is generally dominated by introduced species, including annuals such as Barley Grass (*Hordeum leporinum*). Commonly occurring native species include Black Rolypoly, Climbing Saltbush, Black Cotton Bush and Ringed Wallaby Grass.

Despite targeted surveys for threatened flora species at an appropriate time of year, no threatened flora species were recorded in the study area.

Noxious weeds

One flora species listed as noxious for the Wakool Shire Council control area (DPI 2015b) was recorded during flora surveys; White Horehound (*Marrubium vulgare*). The species is generally confined to the floodplain areas closer to the river where disturbance has occurred. It was recorded in the River Red Gum forest on the northern approach to the bridge and Black Box woodland on the southern approach.

Noxious weed classes are prescribed by NSW Department of Primary Industries. White Horehound is classified as a class four weed. This means the growth of plant must be managed in a manner that reduces its numbers, spread and incidence, and continuously inhibits its reproduction.

3.5.2 Terrestrial fauna

GHD field surveys identified 40 fauna species, all of which are native (Appendix A).

The forest and woodland in the study area provide habitat for a number of bird species. Thirty-two bird species were identified during field surveys. Commonly occurring native species included the Sulphur-crested Cockatoo (*Cacatua galerita*), Superb Fairy-wren (*Malurus cyaneus*), Australian Raven (*Corvus coronoides*) and White-plumed Honeyeater (*Lichenostomus penicillatus*). Spotlight surveys recorded at least six individual Barn Owls (*Tyto alba*) and the Southern Boobook (*Ninox boobook*).

One threatened bird species was observed during current surveys; the Brown Treecreeper. The species is listed as vulnerable under the TSC Act and was observed in River Red Gum habitat in the study area.

Three species of native mammals (not including bats – see below) were recorded during field surveys; the Eastern Grey Kangaroo, Swamp Wallaby and Common Brushtail Possum. No threatened or introduced mammals were recorded during field surveys.

Bats were observed flying along the Wakool River and in the vicinity of the bridge during surveys. One species of bat was recorded during the harp trap surveys; Gould's Long-eared Bat (*Nyctophilus gouldi*). Two individuals were trapped. The species is not threatened. Four species of bats were recorded by the Anabat surveys, including the Southern Forest Bat (*Vespadelus regulus*) and the Chocolate Wattled Bat (*Chalinolobus morio*). Anabat survey results are included in Appendix F.

No amphibians were recorded during field surveys, possibly due to the cold conditions experienced at the time of field surveys. Potential habitat is present in the study area along the river and drainage lines.

No reptile species were recorded during field surveys despite active searches. The cool to cold weather experienced during the survey period was not optimal for the detection of reptiles. Given the suitable potential habitat in and around the Wakool River, reptiles are likely to occur in the study area. No rocky habitats for reptiles were observed. No threatened species of reptiles are likely to occur in the study area.

3.5.3 Aquatic fauna

The plague minnow, *Gambusia holbrooki* were collected (six in total) at two of the AUSRIVAS samples from the slow flowing edge habitat amongst *Cyperus exaltatus* (Giant Sedge) at Site 1. No other fish species were seen or collected during this sampling effort.

The number of aquatic macroinvertebrate families identified ranged from 11 at Site 1 to 14 at Site 2. These taxa are listed in (Appendix C).

No threatened aquatic fauna species listed under the FM Act were recorded onsite during GHD field surveys.

It is noted that no targeted fish surveys were conducted as NSW Fisheries (2015) records for fish species known in the Wakool River at Gee Gee Bridge were provided as a resource. A summary of the known fish species (NSW Fisheries, 2015) are provided in Table 3.5.

Table 3.5: Fish species known to occur in the Wakool River at Gee Gee Bridge

Class/Species	Common Name
<i>Retropinna semoi</i>	Australian smelt
<i>Nematalosa erebi</i>	Bony herring
<i>Cyprinus carpio</i> *	Common carp
-	Common carp – goldfish hybrid
<i>Gambusia holbrooki</i> *	Eastern gambusia / Plague minnow
<i>Phyllipnodon grandiceps</i>	Flat-headed gudgeon
<i>Macquaria ambigua</i>	Golden perch
<i>Carassius auratus</i> *	Goldfish
<i>Maccullochella peelii</i>	Murray cod
<i>Melanotaenia fluviatilis</i>	Murray-Darling rainbow fish
<i>Misgurnus anguillicaudatus</i> *	Oriental weatherloach
<i>Perca fluviatilis</i> *	Redfin perch
<i>Bidyanus bidyanus</i>	Silver perch
<i>Hypseleotris</i> sp.	Carp-gudgeon
<i>Craterocephalus fulvus</i>	Un-specked hardyhead

* indicates introduced species

3.5.4 Aquatic flora

The time of year of the survey was outside of the optimal growth and flowering periods for many aquatic flora, which may have resulted in low numbers of aquatic plants being documented during this survey and restricted the identification beyond the genus taxonomic level of three of the taxa recorded during the field survey.

Three species of floating macrophytes *Ludwigia* sp. (Water Primrose), Common Nardoo (*Marsilea drummondii*) and *Potamogeton sulcatus* (Floating Pond Weed) were recorded and four (including at least two species of Clubrush) emergent species were documented. These were:

- Giant sedge (*Cyperus exaltatus*);
- Clubrush (*Bolboschoenus* spp.);
- Rush (*Juncus usitatus*).

Specific locations of these records are shown in Appendix A.

No threatened aquatic flora species listed under the FM Act were recorded onsite during GHD field surveys.

3.6 Groundwater dependent ecosystems

River Red Gum forest and Black Box woodland (see Figure 3-1) are groundwater dependent ecosystems, relying on aquifers connected to the Wakool River.

4. Species, populations and ecological communities of conservation concern

This chapter describes the threatened biodiversity and other species of conservation concern present or likely to occur within the study area based on records within the locality and the nature of habitats within the existing environment.

4.1 Matters of national environmental significance

Matters of National Environmental Significance (MNES) are listed and protected under the EPBC Act. The act identifies three MNES relevant to this ecological assessment:

- Threatened species and ecological communities
- Migratory species
- Ramsar wetlands of international importance.

4.1.1 Listed biota

The literature review, database search and field surveys identified four flora species, four bird species, two bat species and three fish species listed under the EPBC Act, which have been recorded or are considered likely to occur in the study area.

Table 4.1 provides a summary of the biota listed under the EPBC Act that have been recorded or are considered likely to occur in the study area (see Appendix B).

Table 4.1: Matters of national environmental significance and likelihood of occurrence in study area

Species / community	Status	Likelihood of occurrence in study area
Flora		
A Speargrass <i>Austrostipa wakoolica</i>	E	Likely
Chariot Wheels <i>Maireana cheelii</i>	V	Likely
Slender Darling-pea <i>Swainsona murrayana</i>	V	Likely
Winged Peppercross <i>Lepidium monoplacoides</i>	E	Likely
Birds		
Cattle Egret <i>Ardea ibis</i>	Mi	Likely
Fork-tailed Swift <i>Apus pacificus</i>	Mi	Likely
Great Egret <i>Ardea alba</i>	Mi	Likely
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	Mi	Likely

Species / community	Status	Likelihood of occurrence in study area
Bats		
South-eastern Long-eared Bat <i>Nyctophilus corbeni</i>	V	Likely
Yellow-bellied Sheath-tail-bat <i>Saccolaimus flaviventris</i>	V	Likely
Fish		
Murray Cod <i>Maccullochella peelii</i>	V	Present
Silver Perch <i>Bidyanus bidyanus</i>	V	Present
Trout Cod <i>Maccullochella macquariensis</i>	E	Likely

V – Vulnerable, E – Endangered, Mi – Migratory

Likely: Species, population or ecological community could occur and the study area is likely to provide suitable habitat.

Present: Species, population or ecological community has been recorded during current or previous field investigations in the study area.

For those species listed in Table 4.1, which are known or likely to occur in the study area and for which an impact is likely, the EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DEWHA 2013) was used to assist in determining the significance of the potential impacts of the proposal on threatened biota (see section 6 and Appendix E).

4.1.2 Migratory species

Migratory species are protected under the international agreements to which Australia is a signatory, including the *Japan-Australia Migratory Bird Agreement* (JAMBA), the *China-Australia Migratory Bird Agreement* (CAMBA), the *Republic of Korea-Australia Migratory Bird Agreement* (RoKAMBA) and the *Bonn Convention on the Conservation of Migratory Species of Wild Animals*. Migratory species are considered MNES and are protected under the EPBC Act.

Four bird species currently recognised under the provisions of the EPBC Act are likely to occur within the study area (Table 4.1). Under the EPBC Act, an action is likely to have a significant effect on a migratory species if it substantially modifies, destroys or isolates an area of important habitat for the species (DEWHA 2013).

The study area is not considered to comprise important habitat for these species as it does not contain:

- Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- Habitat that is of critical importance to the species at particular life-cycle stages
- Habitat used by a migratory species that is at the limit of the species' range
- Habitat within an area where the species is declining (DEWHA 2013).

As such, impacts of the proposal on migratory species are not considered further for these species.

4.1.3 Ramsar wetlands of international importance

Four nationally important wetlands were identified during the EPBC database search of MNES associated with the Murray/Darling Drainage Division.

- NSW Central Murray State Forest, NSW: This site is the closest Ramsar wetland to the Proposal and is made up of five separate wetland areas. The closest extent is located 20 kilometres from the proposal on the Murray River within Campbell Island State Forest.
- The other three sites are located more than 100 kilometres from the proposal on the Murray River in South Australia and include:
 - Banrock station wetland complex
 - The Coorong and Lakes Alexandrina and Albert Wetland
 - Riverland.

No wetlands of international importance occur in the locality (within 10 km) of the study area and the proposal is not likely to have an adverse effect on any Ramsar Wetland either directly or indirectly.

4.2 State-listed species, communities and populations

The literature review, database search and field surveys identified five flora species, 12 bird species, five mammal species (including four bat species), two fish species, and one endangered ecological community listed under the TSC Act and FM Act, which are known or likely to occur in the study area.

Table 4.2 provides a summary of the biota listed under the TSC Act and FM Act that are known or likely to occur in the study area (see Appendix B).

Table 4.2: Species and communities listed under the TSC Act and likelihood of occurrence in the study area

Species / community	Status	Likelihood of occurrence in study area
Ecological communities		
Murray River Endangered Ecological Community	E	Present
Flora		
A Speargrass <i>Austrostipa wakoolica</i>	E	Likely
Chariot Wheels <i>Maireana cheelii</i>	V	Likely
Slender Darling-pea <i>Swainsona murrayana</i>	V	Likely
Western Water-starwort <i>Callitriche cyclocarpa</i>	V	Likely
Winged Peppercross <i>Lepidium monoplacoides</i>	E	Likely
Birds		
Barking Owl <i>Ninox connivens</i>	V	Likely

Species / community	Status	Likelihood of occurrence in study area
Blue-billed Duck <i>Oxyura australis</i>	V	Likely
Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	V	Present
Diamond Firetail <i>Stagonopleura guttata</i>	V	Likely
Dusky Woodswallow <i>Artamus cyanopterus</i>	V	Likely
Freckled Duck <i>Stictonetta naevosa</i>	V	Likely
Gilbert's Whistler <i>Pachycephala inornata</i>	V	Likely
Grey-crowned Babbler (eastern subspecies) <i>Pomatostomus temporalis temporalis</i>	V	Likely
Hooded Robin <i>Melanodryas cucullata cucullata</i>	V	Likely
Major Mitchell's Cockatoo <i>Lophochroa leadbeateri</i>	V	Likely
Spotted Harrier <i>Circus assimilis</i>	V	Likely
Varied Sittella <i>Daphoenositta chrysoptera</i>	V	Likely
White-fronted Chat <i>Epthianura albifrons</i>	V	Likely
Mammals		
Squirrel Glider <i>Petaurus norfolcensis</i>	V	Likely
Bats		
Little Pied Bat <i>Chalinolobus picatus</i>	V	Likely
South-eastern Long-eared Bat <i>Nyctophilus corbeni</i>	V	Likely
Southern Myotis <i>Myotis macropus</i>	V	Likely
Yellow-bellied Sheath-tail-bat <i>Saccolaimus flaviventris</i>	V	Likely
Aquatic fauna		
Silver Perch <i>Bidyanus bidyanus</i>	V	Present
Trout Cod <i>Maccullochella macquariensis</i>	E	Likely

V – Vulnerable, E – Endangered

Likely: Species, population or ecological community could occur and study area is likely to provide suitable habitat.

Present: Species, population or ecological community has been recorded during current or previous field investigations in the study area.

For those species listed in Table 4.2, which are known or likely to occur in the study area and for which an impact is likely, an assessment of significance (7 part test) was applied under

Section 5A of the EP&A Act to assist in determining the significance of the potential impacts of the proposal on threatened biota with reference to DECC (2007) (section 6 and Appendix E).

4.2.1 State Environmental Planning Policy No 44 – Koala Habitat Protection

This policy applies to each LGA listed in Schedule 1 of the SEPP, which includes the Wakool LGA. Schedule 2 of this policy lists preferred feed tree species of the Koala, including River Red Gum. Because 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, the habitat in the study area comprises *potential koala habitat* as defined under SEPP 44. However, the habitat assessment found that the Koala is unlikely to inhabit the study area due to a paucity of recent local sightings and due to the species not being recorded in the study area.

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.*'

While SEPP 44 does not apply to projects being assessed under Part 5 of the EP&A Act, the proposal recognises the intent of SEPP 44 and it has been considered in this assessment.

5. Potential impacts of the proposal

5.1 Potential direct impacts

5.1.1 Loss of vegetation/habitat

The proposal would remove 2.1 hectares of native vegetation. The area of each vegetation type proposed to be removed is provided in Table 5.1. No vegetation would be removed from a threatened ecological community.

Table 5.1: Vegetation removal

Vegetation type	Area (ha)
PCTID 7 – River Red Gum forest	0.78
PCTID 13 – Black Box woodland	0.65
PCTID 216 – Black Roly Poly shrubland	0.68
Total	2.1

The study area contains 126 hectares of River Red Gum forest and Black Box woodland. The proposal would remove up to two per cent of the woodland habitat in the study area.

Vegetation to be removed on the northern side of the river is predominately River Red Gum. Vegetation to be removed on the southern side of the river is mostly Black Box with the exception of the first ten metres of the riparian zone of the river which is dominated by River Red Gum. North of the flood relief bridge, vegetation to be removed is a mixture of native and introduced groundcovers.

The vegetation types to be cleared are groundwater dependent ecosystems, as identified in section 3.6. The proposal would therefore impact on groundwater dependent ecosystems through removal of vegetation. This impact is unlikely to be significant, given the extent of the groundwater dependent ecosystems in the study area and locality.

Hollow-bearing trees

Surveys identified 13 hollow-bearing trees in or near the subject site, all of which are likely to be removed by the proposal (Figure 3-1). The characteristics of the trees to be removed are listed in Table 5.2, including tree diameter at breast height (dbh) and number and diameter of hollows. The 13 hollow-bearing trees likely to be removed contain a total of 55 hollows, including nine greater than 20 centimetres diameter.

Table 5.2: Hollow-bearing trees to be removed by the proposal

Species	DBH (cm)	No. of hollows/diameter (cm)				
		<5	5-10	10-20	20-30	>30
<i>Eucalyptus camaldulensis</i>	200	2	3	2	-	-
<i>Eucalyptus camaldulensis</i>	130	3	1	-	-	-
<i>Eucalyptus camaldulensis</i>	120	-	3	-	1	4
<i>Eucalyptus camaldulensis</i>	160	2	-	1	-	1
<i>Eucalyptus camaldulensis</i>	90	2	1	-	-	-
<i>Eucalyptus camaldulensis</i>	100	-	2	-	-	-
<i>Eucalyptus camaldulensis</i>	120	3	3	3	2	-

Species	DBH (cm)	No. of hollows/diameter (cm)				
		<5	5-10	10-20	20-30	>30
<i>Eucalyptus camaldulensis</i>	50	-	-	1	-	-
<i>Eucalyptus largiflorens</i>	80	-	1	-	-	-
Stag	80	3	2	1	-	-
<i>Eucalyptus largiflorens</i>	60	2	1	-	-	-
<i>Eucalyptus largiflorens</i>	70	2	1	-	-	-
<i>Eucalyptus largiflorens</i>	160	2	-	-	1	-
Total		21	17	8	4	5

Hollow-bearing trees are a vital habitat component for many fauna species in the study area. They are likely to provide roosting and nesting habitat for microchiropteran bats, arboreal mammals and woodland birds, including threatened species such as the Yellow-bellied Sheath-tail-bat, Squirrel Glider and Brown Treecreeper. Non-threatened fauna including the nocturnal Barn Owl and Common Brushtail Possum were observed using hollows in River Red Gums in the study area during field surveys.

Squirrel Gliders are dependent on hollows in trees for diurnal denning. Some of the hollow-bearing trees proposed to be removed may provide habitat for the species. All these hollow-bearing trees are likely to provide potential denning sites as they are adequately connected to woodland patches the species may use as habitat. Hollows that are less than five centimetres in diameter are unlikely to be used by the species. About 34 hollows to be removed by the proposal may be suitable denning habitat for the species.

Although not threatened, Common Brushtail Possums were recorded in the study area during surveys, and one was recorded leaving a tree hollow in the alignment route that is likely to be removed.

The hollow-bearing trees proposed to be removed may also provide habitat for Brown Treecreepers recorded during current surveys. Brown Treecreepers use hollows for breeding, and have small home ranges of 1.1 hectares to 10.7 hectares. Hollows in standing dead or live trees and tree stumps are essential for nesting (OEH 2015b). Hollows less than six centimetres in diameter are unlikely to be used by the species. About 35 hollows to be removed by the proposal may be suitable nesting habitat for the species. The loss of these hollows is likely to substantially impact the breeding habitat of the Brown Treecreeper.

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 these hollows represents a long-term reduction in habitat resources for fauna within the study area. There are, however, a large number of hollow-bearing trees in the study area and the locality, and the hollows proposed to be removed are unlikely to represent a significant reduction in habitat for these species.

5.1.2 Habitat fragmentation and connectivity

Vegetation along the Wakool River in the study area forms part of a corridor of riparian vegetation in the Murray Valley National Park that facilitates the movement of fauna across the landscape. The vegetation in the study area provides an important fauna corridor for woodland birds, mammals and other fauna. The vegetation along the Wakool River is also connected to large areas of forest in the Koondrook, Perricoota and Campbell's Island State Forests to the south-east and the riparian corridor of the Murray River to the south.

Fragmentation of the vegetation in the locality has previously occurred through construction of the Noorong Road and other local roads and clearing for agriculture. These developments

have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities and habitat preferences.

Due to the relatively limited amount of vegetation proposed to be removed, it is unlikely that the proposal would significantly fragment woodland habitat in the study area. The existing gap in the vegetation immediately north of Gee Gee Bridge is about 25 metres. The gap to be created in the vegetation for construction of the proposal would generally be 40 to 60 metres. The increased width of the gap in the vegetation is unlikely to constrain the movement of threatened birds known or likely to occur in the study area, such as Diamond Firetails, Brown Treecreepers and Grey-crowned Babblers. The height of the bridge deck above ground level would generally be about three metres, allowing fauna to move underneath the bridge. The construction corridor would be allowed to regenerate after construction completion.

The removal of woodland, including hollow-bearing trees, may increase the gaps across which Squirrel Gliders would need to glide to move between denning and foraging trees. The species is limited in its gliding ability and trees are less likely to be used by the species if they are separated from other trees by more than its preferred gliding distance (about 40 metres). The maximum gliding distance of Squirrel Gliders is about 70 to 80 metres (van der Ree *et al* 2003).

Given that the gap in the woodland vegetation after construction would generally be 50 metres or less, and that the connectivity of vegetation along both sides of the approach road and bridge would be retained, Squirrel Gliders would still be capable of traversing the gaps in the canopy created by the proposal.

The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

5.1.3 Removal of potential bat habitat

The existing main bridge and approach bridge contains potential bat habitat in the timber framework underneath the deck of the bridge. There was evidence of bat guano in the bridge during surveys and one captured bat appeared to enter the bridge over the river after release. Mature native trees along the Wakool River and on the floodplain provide alternative bat roosting habitat.

The demolition of the bridge may cause death or injury to any bats that may be roosting in the bridge at the time of demolition. To minimise potential impacts on bats, a fauna management plan would be prepared with specific attention to the potential presence of bats roosting in the bridge. Potential impacts on fauna during construction would be managed by implementing safeguards identified in section 6.

5.1.4 Injury and mortality

Death or injury may occur to any fauna present during the clearing of trees. If birds are present but not nesting during construction they will generally move away to escape the disturbance. Clearing of hollow-bearing trees carries the risk of injury to hollow dependent fauna that may be using hollows at the time of clearing including Common Brushtail Possums.

5.1.5 Soil surface and changed hydrology

The proposal would cause surface soil disturbance due to the earthworks that would be required for the construction of the new bridge and road alignment. The earthworks have the potential to cause soil erosion in the subject site, particularly in sloping areas. Without appropriate erosion controls during construction and operation, the proposal has the potential to cause sedimentation of the river and drainage lines in the study area.

Following construction it is expected revegetation with locally native species would occur in disturbed areas to minimise surface soil exposure and therefore erosion potential.

Provided an erosion and sediment control plan is developed and implemented during construction, the proposal should not cause significant soil erosion or sedimentation.

Drainage patterns of the area are expected to be temporarily impacted during the construction phase. Runoff from the proposal would be directed away from the river. The operation of the proposal is therefore not expected to cause any significant soil surface or drainage disturbance.

5.1.6 Removal and disturbance of aquatic habitat

The bridge itself may provide shelter for a number of fish species and two large snags were observed between pier 1 and the right embankment during field surveys. This habitat and the habitat provided by the bridge itself will be removed during construction. The potential impacts may be minimised by removing snags beneath the bridge prior to demolition as a precautionary approach, so fish have an opportunity to re-establish in suitable habitat available away from the bridge. Removal of these snags is unlikely to impact on resident fish populations as there high frequencies (per kilometre) of instream snags in the study area as alternative habitat. Any large woody debris removed during construction would be relocated back into the river at completion of construction and demolition.

The construction of piers and temporary work platforms in the river would possibly result in the disturbance, removal or destruction of emergent and/or submerged (in-stream) vegetation within the Wakool River. Removal of instream vegetation (floating, emergent or submerged) is unlikely to result in a significant impact to fish, or macroinvertebrate populations due to the relatively small area which will likely be impacted and the relative abundance occurring in the study area. The construction of piers and temporary work platforms in the river may result in the disturbance of the river bed, which may impact some species that utilise bed contours as foraging habitat.

5.2 Potential indirect impacts

5.2.1 Weeds

The proposal has the potential to introduce and spread weeds (including noxious weeds such as White Horehound). The most likely causes of weed dispersal are associated with vegetation clearing, stockpiling of soils and transport of weed propagules by construction vehicles and machinery.

The spread of weeds is of particular concern in areas where the groundcover vegetation is dominated by native species, generally within forest and woodland areas. The spread of weeds would be managed by implementing safeguards identified in section 6.

5.2.2 Noise and vibration

Traffic noise is associated with the existing bridge and approach roads, including braking by large trucks as they slow down before crossing the one lane bridges. The proposed new bridge would have two lanes, with no requirement to give way to oncoming traffic. Operational noise generated by the braking and accelerating of trucks is likely to decrease. Operational noise associated with the proposal is not expected to be any higher than is currently experienced by fauna in the study area.

5.2.3 Sedimentation and bank erosion

The proposal may cause sedimentation of the Wakool River through construction of bridge piers and temporary work platforms in the river and removal of the existing bridge piers, as

well as vegetation removal and machinery works adjacent to the river. There is the potential that works could destabilise the river banks, leading to erosion of the channel and deposition of sediment, impacting on water quality.

Disturbance to the river bed caused by construction (and removal) of the temporary clean rock work platform and installation of the coffer dam would result in localised increases in turbidity in the Wakool River. Turbidity caused by these activities is expected to be low due to the relatively minor disturbance to the river bed.

Piling work in the Wakool River would be undertaken using driven piles. The use of coffer dams around new piers would reduce the potential for impacts on water quality through sedimentation.

The existing bridge piers located in the bed of the Wakool River would be cut off at bed level. By retaining the piers the potential for the proposal to cause soil erosion and sedimentation of the river would be reduced.

Sedimentation has the potential to affect flora and fauna, including fish, frogs, turtles and macroinvertebrates. Fish normally move away from highly turbid water; however, sedimentation may block fish passage, having detrimental impacts during times of migration. More extreme impacts on fish species resulting from 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.

An erosion and sediment control plan would be prepared as part of the CEMP to manage potential erosion and sedimentation issues during construction. Potential impacts from sedimentation would also be managed by implementing safeguards identified in section 7 of the REF.

5.2.4 Water quality

Potential accidental spills of contaminants such as fuel or chemicals could impact on aquatic fauna and flora in the Wakool River. The use of coffer dams around new piers would reduce the potential for impacts on water quality through spills. Contaminants present in the timbers and deck of the existing bridge (eg lead paint) could also have water quality impacts on flora and fauna when the existing bridge is demolished. Provided safeguards detailed in section 6 to manage fuels, chemicals and contaminated bridge materials are implemented, the proposed demolition of the existing bridge would be unlikely to cause substantial water quality impacts.

5.2.5 Changes to fish passage

Fish passage is important for several reasons, including:

- Access to habitat, food and shelter
- The avoidance of predators
- Seasonal movement associated with breeding cycles (Fairfull and Witheridge 2003).

Fish passage may be blocked by sedimentation within the Wakool River, as described in the section titled 'Sedimentation and bank erosion' above.

Any construction activities that involve entering the Wakool River (eg the construction of piers, temporary work platforms and use of coffer dams) has the potential to encounter and possibly injure or kill aquatic fauna and flora species, possibly by stranding aquatic species within the coffer dams when they are installed in aquatic habitat.

The use of silt curtains, partial or otherwise, within the river may also temporarily impede fish passage.

The potential deposition of debris from construction and demolition, including sediment, in the waterway could also impact on fish passage in the area by creating blockages. Construction activities would aim to avoid any deposition of debris in the waterway.

The construction of temporary work platforms and new piers would partially block fish passage in the river. The new piers would each occupy about two metres of the river channel cross section. The channel width is about 40 metres. The proposal would be unlikely to substantially affect fish passage due to the relatively small proportion of the river cross section that the new piers would occupy. The piers would be unlikely to substantially change the hydrology of the river.

Potential water quality impacts would also be managed by implementing safeguards identified in section 7 of the REF.

5.2.6 Shading

The proposed new bridge would cause shading of the Wakool River. This may change habitat characteristics for aquatic biota, such as plant growth, water temperature and visual characteristics. Some fish species will not enter an intensely shaded section of river during daylight (Fairfull and Witheridge 2003). The extent of impact is likely to be small in relation to the extent of river and floodplain habitat in the vicinity of the proposal. The extent of shading would be similar to that of the existing bridge, which would be removed.

5.2.7 Disturbance of fauna

The proposal has the potential to temporarily affect fauna using the study area due to increased disturbance during construction. The use of machinery during construction may temporarily deter some fauna species from using potential habitat in the study area.

Noise can cause change in behaviours such as foraging, requiring additional energy expenditure if fauna need to forage further afield. Construction impacts would be short-term and temporary, and would be unlikely to deter fauna from using the study area in the long term.

5.2.8 Pathogens

The proposal has the potential to spread pathogens. Of particular concern is infection of native plant species by Cinnamon Fungus (*Phytophthora cinnamomi*), which causes root-rot disease and subsequent vegetation dieback. Cinnamon Fungus is spread into new areas by contaminated soil on construction machinery, vehicles and footwear.

Chytrid fungus (*Batrachomyxium dendrobatidis*) is a water-borne fungus which causes the disease chytridiomycosis in frogs, and is lethal to a wide variety of Australian frogs. It is spread through cross contamination of water bodies by vehicles and personnel. There is a risk that the proposal may cause spread of Chytrid fungus during construction.

5.2.9 Bushfire

The proposal has the potential to result in increased risks of bushfire during construction (eg welding and other hot works). Impacts of bushfires may include death and injury to fauna, loss of woodland habitat including hollow bearing trees and loss of feed resources. In addition,

bushfires may result in changes to structure and function of woodland communities including changes to groundcover composition.

5.3 Key threatening processes

The proposal would result in the following key threatening processes listed under the TSC Act, FM Act and/or EPBC Act:

- Clearing of native vegetation (TSC Act and EPBC Act) – the proposal would remove about 2.1 hectares of native vegetation from the subject site
- Loss of hollow-bearing trees (TSC Act) – the proposal would remove 13 hollow-bearing trees from the subject site
- Removal of dead wood and dead trees (TSC Act) – the proposal would relocate woody debris and remove one dead tree
- Removal of large woody debris from NSW rivers and streams (FM Act) – the proposal would remove woody debris from the bed of the Wakool River for the construction of the new bridge and for the demolition of the existing bridge. This woody debris would be relocated to a downstream section of the river
- Degradation of native riparian vegetation along New South Wales water courses (FM Act) – the proposal would remove native riparian vegetation adjacent to the Wakool River, and could further damage vegetation through movement of construction vehicles and machinery. The proposal could also cause degradation of native vegetation by causing sedimentation of the waterway, affecting plant photosynthesis, increasing nutrient concentrations and smothering habitat.

The impacts of these key threatening processes would be minimised through the implementation of safeguards detailed in section 6.

5.4 Groundwater dependent ecosystems

The proposal would remove up to two per cent of the River Red Gum and Black Box vegetation types, which are groundwater dependent ecosystems, from the study area. This impact is unlikely to be significant, given the small percentage, and given the much greater extent of these vegetation types along the Wakool River in the locality.

The proposal is unlikely to substantially alter the local groundwater system and is unlikely to significantly affect the groundwater dependent ecosystems located in the study area.

5.5 Cumulative impacts

The proposal would remove about 2.1 hectares of River Red Gum and Black Box vegetation from the subject site. The proposal would cause impacts additional to those that have occurred due to previous land use activities in the study area; including agricultural activities. Other works that may contribute to cumulative ecological impacts in the study area include vegetation maintenance for other linear infrastructure such as roads and powerlines.

A large portion of the study area is protected as part of the Murray Valley National Park and it is unlikely that there would be significant future developments in the study area.

6. Assessment of significance of impacts

6.1 Commonwealth legislation

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.

The assessment of likelihood of occurrence found that the proposal may impact two bat species, three fish species and four bird species listed under the EPBC Act (Table 6.1 and Appendix B). Significance assessments (with reference to the EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1*) were completed for these biota (Appendix E).

The significance assessments concluded that the proposal is unlikely to have a significant impact on any fauna species or threatened ecological community listed under the EPBC Act that occur, or have the potential to occur in the study area. Therefore the preparation of a referral to the Australian Minister for the Environment is not required.

Table 6.1: Summary of Commonwealth significance assessment outcomes

Species	Important population ¹	Important habitat ²	Likely significant impact?
South-eastern Long-eared Bat	Yes	N/A	No
Yellow-bellied Sheath-tail-bat	Yes	N/A	No
Murray Cod	Yes	N/A	No
Trout Cod	N/A	N/A	No
Silver Perch	N/A	N/A	No
Cattle Egret	N/A	No	No
Fork-tailed Swift	N/A	No	No
Great Egret	N/A	No	No
White-bellied Sea-Eagle	N/A	No	No

Notes: Y= Yes (negative impact), N= No (no or positive impact), X= not applicable, ? = unknown impact.

- Important Population as determined by the Environment Protection and Biodiversity Conservation Act 1999, is one that for a vulnerable species:
 - is likely to be key source populations either for breeding or dispersal
 - is likely to be necessary for maintaining genetic diversity
 - is at or near the limit of the species range.
- Important habitat as defined in EPBC Act significance assessment in Appendix E.

6.2 NSW legislation

The *Threatened species assessment guidelines: the assessment of significance* (DECC 2007) was reviewed when determining if a significant impact is likely on state-listed threatened species, populations or ecological communities.

The assessment of likelihood of occurrence found that the proposal may impact 12 bird species, four mammal species (including three bat species), two fish species and one ecological community listed under the TSC Act and/or FM Act (Table 6.2 and Appendix B). Assessments of significance under Section 5A of the EP&A Act were completed (Appendix E). The assessments concluded that the proposal is unlikely to have a significant impact on these biota. Therefore the preparation of a Species Impact Statement is not required.

Table 6.2: Summary of NSW assessment of significance outcomes

Threatened species or community	Significance assessment question ¹							Likely significant impact?
	a	b	c	d	e	f	g	
Barking Owl	No	X	X	No	No	Yes	Yes	No
Blue-billed Duck	No	X	X	No	No	Yes	Yes	No
Brown Treecreeper	No	X	X	No	No	Yes	Yes	No
Diamond Firetail	No	X	X	No	No	Yes	Yes	No
Dusky Woodswallow	No	X	X	No	No	Yes	Yes	No
Freckled Duck	No	X	X	No	No	Yes	Yes	No
Gilbert's Whistler	No	X	X	No	No	Yes	Yes	No
Grey-crowned Babbler	No	X	X	No	No	Yes	Yes	No
Hooded Robin	No	X	X	No	No	Yes	Yes	No
Murray River EEC	X	X	No	No	X	X	Yes	No
Silver Perch	No	X	X	No	No	Yes	Yes	No
South-eastern Long-eared Bat	No	X	X	No	No	Yes	Yes	No
Southern Myotis	No	X	X	No	No	Yes	Yes	No
Spotted Harrier	No	X	X	No	No	Yes	Yes	No
Squirrel Glider	No	X	X	No	No	Yes	Yes	No
Trout Cod	No	X	X	No	No	Yes	Yes	No
Varied Sittella	No	X	X	No	No	Yes	Yes	No
White-fronted Chat	No	X	X	No	No	Yes	Yes	No
Yellow-bellied Sheath-tail-bat	No	X	X	No	No	Yes	Yes	No

Notes: Y= Yes (negative impact), N= No (no or positive impact), X= not applicable, ? = unknown impact.

3. Significance Assessment Questions as set out in the *Threatened Species Conservation Act 1995/ Environmental Planning and Assessment Act 1979*.
 - 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,
 - 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,
 - 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,
- 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
 - (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
 - (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,
- e whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),
- f whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
- 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.

7. Proposed safeguards and management measures

The safeguards and management measures detailed in Table 7.1 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) and fauna management plan to be implemented during construction.

Table 7.1: Safeguards and management measures

Impact	Environmental safeguards	Timing
Loss of native vegetation habitat	<ul style="list-style-type: none"> • Native vegetation removal will be minimised during detailed design • A flora and fauna management plan will be prepared as part of the construction environmental management plan (CEMP) to minimise the ecological impacts of the proposal. The CEMP will incorporate measure outlined in the relevant guidelines of Roads and Maritime’s <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i>. As a minimum this will include: <ul style="list-style-type: none"> – Pre-clearing surveys will be undertaken in accordance with ‘<i>Guide 1: Pre-clearing process</i>’ – An exclusion zone plan will be implemented in line with ‘<i>Guide 2: Exclusion zones</i>’ and ‘<i>Guide 10: Aquatic habitats and riparian zones</i>’. Exclusion zones will be established to prevent unnecessary clearing or disturbance of native vegetation and aquatic and terrestrial habitats – Native vegetation will be re-established in accordance with ‘<i>Guide 3: Re-establishment of native vegetation</i>’ – Vegetation removal will be undertaken in accordance with ‘<i>Guide 4: Clearing of vegetation and removal of bushrock</i>’ • The flora and fauna management plan will address terrestrial and aquatic matters and include, but not necessarily be limited to: <ul style="list-style-type: none"> – Plans for the construction site and adjoining area showing native vegetation, flora and fauna habitat, threatened species and endangered ecological communities – Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features (eg hollow bearing trees to be retained and removed) and areas for rehabilitation or re-establishment of native vegetation. 	Pre-construction
Impacts to native fauna	<ul style="list-style-type: none"> • The flora and fauna management plan will incorporate fauna protection measures outlined in the relevant guidelines of Roads and Maritime’s <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i>; including: <ul style="list-style-type: none"> – Fauna will be managed in accordance with ‘<i>Guide 9: Fauna handling</i>’ 	Pre-construction

Impact	Environmental safeguards	Timing
	<ul style="list-style-type: none"> – If threatened ecological communities, not assessed in the biodiversity assessment, are identified in the subject site the unexpected species find procedure in ‘<i>Guide 1: Pre-clearing process</i>’ of the Biodiversity Guidelines will be implemented. • The flora and fauna management plan will identify the potential presence of bats roosting in the existing bridge, water birds that may occur in the study area and terrestrial birds that may be present in the bridge or surrounding vegetation. The plan would include: <ul style="list-style-type: none"> – Timing of the works (with particular reference to the breeding season of any bats that may be using the bridge as breeding habitat) – Where practicable, vegetation removal will occur outside the main fauna breeding season (August to January) to avoid potential breeding disturbance to fauna – Method for pre-clearance surveys on the bridge – Measures to be taken if evidence of bats is found (eg exclusion of bats from the bridge and techniques for demolishing the bridge that minimise harm) – Measures to be taken if birds are found nesting in the bridge or trees during construction – Additional management measures not identified in the Guidelines; including protocols before, during and after works (eg engagement of experienced bat handler to remove bats during the demolition of the bridge and notification of WIRES and/or veterinarian to care for injured bats collected by the bat handler). 	
Spread of weeds	<ul style="list-style-type: none"> • A weed management plan will be prepared before construction, for implementation before, during and after the work, as detailed in <i>Guide 6: Weed management</i> of the Biodiversity Guidelines. This will include management of Horehound in the subject site. 	Pre-construction
Disturbance of aquatic habitat	<ul style="list-style-type: none"> • Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design • Changes to existing surface water flows will be minimised through detailed design. 	Pre-construction
Loss of native vegetation habitat	<ul style="list-style-type: none"> • Native vegetation removal will be minimised during construction • All staff will be inducted and informed of the requirements of the CEMP including the limits of vegetation clearing and the areas of vegetation to be retained. 	Construction

Impact	Environmental safeguards	Timing
Loss of woody debris habitat	<ul style="list-style-type: none"> Woody debris will be re-used as detailed in the Biodiversity Guidelines '<i>Guide 5: Re-use of woody debris and bushrock</i>' and '<i>Guide 10: Aquatic habitats and riparian zones</i>' Root boles from large felled trees will be placed in the Wakool River as habitat for aquatic fauna, where practicable. 	Construction
Disturbance of aquatic habitat	<ul style="list-style-type: none"> Aquatic habitat will be protected in accordance with '<i>Guide 10: Aquatic habitats and riparian zones</i>' of the Biodiversity Guidelines' and Section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013 (DPI (Fisheries NSW) 2013) Disturbed areas adjacent to the river will be revegetated with native semi-aquatic flora species. 	Construction
Blockage of fish passage	<ul style="list-style-type: none"> A hydrocarbon boom or silt curtain will be installed only where necessary, and will not be left within the waterway for any longer than necessary, to minimise impacts to fish moving through the study area To maintain connectivity to the upstream reaches, where a hydrocarbon boom or silt curtain is used, it will not extend across the full channel width. A suitable path will be provided for fish passage. 	Construction
Impacts to threatened species	<ul style="list-style-type: none"> If unexpected threatened fauna or flora species are discovered, work near the find will stop immediately and follow Roads and Maritime's 'Unexpected Threatened Species Find Procedure' in RTA (2011) – 'Biodiversity Guidelines Guide 1: Pre-clearing process'. 	Construction
Pathogen spread and establishment	<ul style="list-style-type: none"> Pathogens will be managed in accordance with '<i>Guide 7: Pathogen management</i>' of the Biodiversity Guidelines. 	Construction
Impacts to native fauna	<ul style="list-style-type: none"> From the Nacurrie Road intersection, the redundant section of Noorong Road north of the bridge would be removed and rehabilitated Connectivity measures will be implemented in accordance with the '<i>Wildlife Connectivity Guidelines for Road Projects</i>' (RTA 2011). 	Post-construction

8. Conclusion

The study area of the proposal is located partly in the Murray Valley National Park on the floodplain of the Wakool River and as such has high biodiversity values. Remnant woodland occurs throughout much of the study area. The woodland and study area is known or likely to provide habitat for a range of fauna species and an ecological community listed under the TSC Act, FM Act and/or the EPBC Act.

The proposal has the potential to affect 16 bird species, four mammal species (including three bat species), three fish species and one ecological community listed under the TSC Act, FM Act and/or the EPBC Act.

The proposal would remove 2.1 hectares of native vegetation. Thirteen hollow-bearing trees, containing 56 hollows, are also likely to be removed by the proposal.

A number of safeguards and management measures are proposed to minimise the impacts of the proposal on native flora and fauna, particularly species listed under the TSC Act, FM Act and EPBC Act. A fauna management plan would be developed prior to the commencement of the proposal and include measures for the protection of fauna during construction, particularly during the demolition of the bridges.

The proposal is unlikely to have a significant impact on biota listed under the EPBC Act due to the relatively small amount of native vegetation to be removed, the proposal being unlikely to significantly fragment habitat and the low number of hollow-bearing trees proposed to be removed. Therefore a referral to the Australian Government Minister for the Environment is not required.

The proposal is unlikely to have a significant impact on biota listed under the TSC Act, due to the relatively small amount of native vegetation to be removed, the proposal being unlikely to significantly fragment habitat and the low number of hollow-bearing trees proposed to be removed. Therefore a Species Impact Statement would not be required.

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Appendices

Appendix A – Species lists

FLORA LIST

* Introduced species

✓ Species present

All numbers are per cent cover

r Less than one per cent cover, few individuals

+ Less than one per cent cover, numerous individuals

Scientific Name	Common Name	P1	P2	P3	T1
<i>Acacia pendula</i>	Weeping Myall				✓
<i>Acacia salicina</i>	Cooba	1	✓		
<i>Arctotheca calendula</i> *	Capeweed				✓
<i>Astrebula lappacea</i>	Curly Mitchell Grass	<1			
<i>Atriplex lindleyi</i>				<1	
<i>Atriplex nummularia</i>	Old Man Saltbush				✓
<i>Atriplex semibaccata</i>	Creeping Saltbush		✓	5	
<i>Austrostipa scabra</i>	Speargrass				✓
<i>Austrostipa scabra</i> subsp. <i>falcata</i>	Speargrass			1	
<i>Avena fatua</i> *	Wild Oats				✓
<i>Boerhavia dominii</i>	Tarvine				✓
<i>Bromus</i> sp.*	Brome	2			
<i>Bromus hordeaceus</i> *	Soft Brome				✓
<i>Centipeda cunninghamii</i>	Common Sneezeweed		✓		
<i>Chenopodium nitriaceum</i>	Nitre Goosefoot	2	✓		
<i>Chloris divaricata</i>	Slender Chloris			1	
<i>Chloris truncata</i>	Windmill Grass			<1	
<i>Cirsium vulgare</i> *	Spear Thistle	<1			
<i>Cyperus difformis</i>	Dirty Dora				✓
<i>Cyperus exaltatus</i>	A Sedge				✓
<i>Duma florulenta</i>	Lignum	4	✓		
<i>Echium plantagineum</i> *	Patterson's Curse	1	✓		
<i>Einadia hastata</i>	Berry Saltbush			<1	
<i>Einadia nutans</i>	Climbing Saltbush	1	✓	3	
<i>Enchylaena tomentosa</i>	Ruby Saltbush	<1		<1	
<i>Enneapogon nigricans</i>	Niggerheads				✓
<i>Eragrostis cilianensis</i> *	Stinkgrass				✓
<i>Erodium botrys</i> *	Long Storksbill				✓
<i>Eucalyptus camaldulensis</i>	River Red Gum	3			
<i>Eucalyptus largiflorens</i>	Black Box		✓	2	
<i>Exocarpos strictus</i>	Pale-fruit Ballart	2			✓
<i>Heliotropium europaeum</i> *	Potato Weed				✓
<i>Hordeum leporinum</i> *	Barley Grass			5	

Scientific Name	Common Name	P1	P2	P3	T1
<i>Lepidium africanum</i> *					✓
<i>Lolium perenne</i> *	Perennial Ryegrass			<1	
<i>Maireana decalvans</i>	Black Cotton Bush		✓	5	
<i>Maireana pentagona</i>	Hairy Bluebush				✓
<i>Malva parviflora</i> *	Small-flowered Mallow				✓
<i>Marrubium vulgare</i> *	White Horehound	1			
<i>Marsilea drummondii</i>	Common Nardoo				✓
<i>Medicago praecox</i> *	Small-leaved Burr Medic		✓	<1	
<i>Olea europaea</i> *	Common Olive				✓
<i>Paspalidium jubiflorum</i>	Warrego Grass	✓	✓		✓
<i>Paspalum distichum</i>	Water Couch				✓
<i>Phragmites australis</i>	Common Reed				✓
<i>Phyla canescens</i> *			✓		
<i>Phyla nodiflora</i> *	Lippia	1			
<i>Polycarpon tetraphyllum</i> *	Four-leaf Allseed	<1			
<i>Rhagodia spinescens</i>	Spiny Saltbush		✓		
<i>Rumex brownii</i>	Swamp Dock	<1			
<i>Rytidosperma</i> sp.	A Wallaby Grass		✓		
<i>Rytidosperma caespitosum</i>	Ringed Wallaby Grass			2	
<i>Rytidosperma setaceum</i>	Smallflower Wallaby Grass				✓
<i>Salsola australis</i>			✓	1	
<i>Salvia verbenaca</i> *	Vervain				✓
<i>Schinus areira</i> *	Pepper Tree	<1			
<i>Sclerolaena muricata</i>	Black Rolypoly		✓	30	
<i>Senecio quadridentatus</i>	Cotton Fireweed				✓
<i>Sida corrugata</i>	Corrugated Sida	<1			
<i>Sisymbrium irio</i> *	London Rocket				✓
<i>Solanum esuriale</i>	Quena	<1		<1	
<i>Sonchus oleraceus</i> *	Common Sowthistle	<1	✓		
<i>Tribulus terrestris</i> *	Cat-head				✓
<i>Trifolium</i> sp.*	A Clover	<1	✓		
<i>Wahlenbergia gracilenta</i>	Annual Bluebell				✓
<i>Walwhalleya</i> sp.			✓		

AQUATIC MACROPHYTE LIST

✓ = species present

CS= cross section

Scientific name	Common name	Site 1	Site 2	Site 3	CS 1	CS 2	CS 3
<i>Cyperus exaltatus</i>	Giant Sedge	✓	✓	✓	✓	✓	✓
<i>Scirpus</i> sp.	Clubrush	✓					✓
<i>Potamogeton sulcatus</i>	Floating Pond weed	✓		✓	✓		✓
<i>Juncus usitatus</i>	Rush	✓		✓			✓
<i>Marsilea drummondii</i>	Common Nardoo	✓					✓
<i>Bolboschoenus</i> spp.	Clubrushes	✓	✓	✓	✓	✓	✓
<i>Ludwigia</i> sp.	Water Primrose	✓		✓	✓		✓

FAUNA LIST

* Introduced species

Bold denotes threatened species

Class/Species	Common Name
BIRDS	
<i>Gymnorhina tibicen</i>	Australian Magpie
<i>Corvus coronoides</i>	Australian Raven
<i>Tyto alba</i>	Barn Owl
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater
<i>Acanthiza pusilla</i>	Brown Thornbill
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper
<i>Falcunculus frontatus</i>	Crested Shrike-tit
<i>Eolophus roseicapillus</i>	Galah
<i>Rhipidura albiscapa</i>	Grey Fantail
<i>Colluricincla harmonica</i>	Grey Shrike-thrush
<i>Dacelo novaeguineae</i>	Laughing Kookaburra
<i>Corvus mellori</i>	Little Raven
<i>Grallina cyanoleuca</i>	Magpie-lark
<i>Geopelia placida</i>	Peaceful Dove
<i>Cracticus nigrogularis</i>	Pied Butcherbird
<i>Neochmia temporalis</i>	Red-browed Finch
<i>Petroica goodenovii</i>	Red-capped Robin
<i>Myiagra inquieta</i>	Restless Flycatcher
<i>Pachycephala rufiventris</i>	Rufous Whistler
<i>Ninox boobook</i>	Southern Boobook
<i>Pardalotus striatus</i>	Striated Pardalote
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
<i>Malurus cyaneus</i>	Superb Fairy-wren
<i>Hirundo neoxena</i>	Welcome Swallow
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater
<i>Cormobates leucophaea</i>	White-throated Treecreeper
<i>Corcorax melanorhamphos</i>	White-winged Chough
<i>Haliastur sphenurus</i>	Whistling Kite
<i>Rhipidura leucophrys</i>	Willie Wagtail
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
<i>Platycercus elegans flaveolus</i>	Yellow Rosella
<i>Acanthiza nana</i>	Yellow Thornbill
MAMMALS	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat

Class/Species	Common Name
<i>Macropus giganteus</i>	Eastern Grey Kangaroo
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat
<i>Tadarida australis</i>	White-striped Freetail Bat
<i>Trichosurus vulpecula</i>	Common Brushtail Possum
<i>Vespadelus regulus</i>	Southern Forest Bat
<i>Vespadelus vulturnus</i>	Little Forest Bat
<i>Wallabia bicolor</i>	Swamp Wallaby
Macroinvertebrate taxa identified from sample collection	
Acarina ³	Water Mite
[Crustacea] Cladocera	Water Flea
[Crustacea] Copepoda	
[Decapoda] Atyidae	Freshwater Shrimp
[Decapoda] Palaemonidae	Freshwater Prawn
[Diptera] Ceratopogonidae	Biting midges / sand flies
[Diptera] Chironomidae	Non-biting Midges
[Diptera] Orthoclaadiinae ⁴	Non-biting Midges
[Diptera] Tanypodinae ²	Non-biting Midges
[Ephemeroptera] Baetidae	Baetids
[Ephemeroptera] Caenidae	Caenids
[Ephemeroptera] Leptophlebiidae	Leptophlebs
[Hemiptera] Corixidae	Waterboatman
[Hemiptera] Notonectidae	Back-swimmer
[Hemiptera] Veliidae	Small water striders
[Odonata] Coenagrionidae	Pond damselflies
[Trichoptera] Hydroptilidae	Microcaddis
[Trichoptera] Leptoceridae	Stick caddis
FISH⁵	
<i>Gambusia holbrooki</i> ⁶	Eastern gambusia / Plague minnow

³Order

⁴ Sub-family

⁵ List of know fish species to occur in the Wakool River at Gee Gee bridge courtesy of the Department of Primary Industries Fisheries

⁶ Collected while sampling Macroinvertebrates for the AUSRIVAS assessment

Appendix B Fish habitat classification criteria for watercourses and recommended crossing types.

Classification	Characteristics of waterway type	Minimum [1] recommended crossing type
Class 1 Major fish habitat	Major permanently or intermittently flowing waterway (e.g. river or major creek), habitat of a threatened fish species.	Bridge, arch structure or tunnel.
Class 2 Moderate fish habitat	Named permanent or intermittent stream, creek or waterway with clearly defined bed and banks with semi – permanent to permanent waters in pools or in connected wetland areas. Marine or freshwater aquatic vegetation is present, Known fish habitat and/or fish observed inhabiting the area.	Bridge, arch structure, culvert [2] or ford.
Class 3 Minimal fish habitat	Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi – permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or recognised aquatic habitats.	Culvert [3] or ford.
Class 4 Unlikely fish habitat	Named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free standing water or pools after rain events (e.g. dry gullies of shallow floodplain depressions with no permanent aquatic flora present).	Culvert [4]. Causeway or ford.

[1] In all cases bridges are preferred to arch structures, culvers, fords and causeways (in that order).

[2] High priority given to the “High Flow Design” procedures presented for the design of these culverts – refer to Design Considerations section of this document, or engineering guidelines (Witheridge, 2002)

[3] Minimum culvert design using the “Low Flow Design” procedures; however, “High Flow Design” and “Medium Flow Design” should be given priority where affordable (refer to Witheridge (2002)).

[4] Fish friendly waterway crossing designs possibly unwarranted. Fish passage requirements should be confirmed with the local fisheries department/authority.

Source: Fairfull and Witheridge (2003)

Appendix C River descriptors, associated categories and values used in the modified riparian, channel and environmental inventory.

Descriptor and category	Value	Descriptor and category	Value
1. Land-use pattern beyond immediate riparian zone		2. Riffle/pool sequence	
Undisturbed native vegetation	4	Frequent alternation of riffles and pools	4
Mixed native vegetation and pasture/exotics	3	Long pools with infrequent short riffles	3
Mainly pasture, crops or pine plantation	2	Natural channel without riffle/pool sequence	2
Urban	1	Artificial channel; no riffle/pool sequence	1
3. Width of riparian strip of woody vegetation		4. Retention devices in stream	
More than 30 m	4	Many large boulders and/or debris dams	4
Between 5 and 30 m	3	Rocks/logs present; limited damming effect	3
Less than 5 m	2	Rocks/logs present but unstable; no damming	2
No woody vegetation	1	Stream with few or no rocks/logs	1
5. Completeness of riparian strip of woody vegetation		6. Channel sediment accumulations	
Riparian strip without breaks in vegetation	4	Little or no accumulation of loose sediments	4
Breaks at intervals or more than 50 m	3	Some gravel bars but little sand or silt	3
Breaks at intervals of 10-50 m	2	Bars of sand and silt common	2
Breaks at intervals of less than 10 m	1	Braiding by loose sediment	1
7. Vegetation of riparian zone within 10 m of channel		8. Stream bottom	
Native tree and shrub species	4	Mainly clean stones with obvious interstices	4
Mixed native and exotic trees and shrubs	3	Mainly stones with some cover of algae/silt	3
Exotic trees and shrubs	2	Bottom heavily silted but stable	2

Descriptor and category	Value	Descriptor and category	Value
Exotic grasses/weeds	1	Bottom mainly loose and mobile sediment	1
9. Stream bank structure		10. Stream detritus	
Banks fully stabilized by trees, shrubs, etc.	4	Mainly unsilted wood, bark, leaves	4
Banks firm but held mainly by grass and herbs	3	Some wood, leaves, etc. with much fine detritus	3
Banks loose, partly held by sparse grass, etc.	2	Mainly fine detritus mixed with sediment	2
Banks unstable, mainly loose sand or soil	1	Little or no organic detritus	1
11. Bank undercutting		12. Aquatic vegetation	
None, or restricted by tree roots	4	Little or no macrophyte or algal growth	4
Only on curves and at constrictions	3	Substantial algal growth; few macrophytes	3
Frequent along all parts of stream	2	Substantial macrophyte growth; little algal growth	2
Severe; bank collapses common	1	Substantial macrophyte and algal growth	1
13. Channel form			
Deep; width:depth ratio less than 8:1	4		
Medium; width:depth ratio 8:1 to 15:1	3		
Shallow; width:depth ratio greater than 15:1	2		
Artificial; concrete or excavated channel	1		

Appendix D Assessment of likelihood of occurrence

An evaluation of the likelihood and extent of impact to threatened and migratory fauna recorded from within the Wakool 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, and the EPBC Environmental Reporting Tool available from the Department of the Environment and Energy (DotEE) website. Ecology information has been obtained from the Threatened Species Profiles on the NSW OEH website (<http://www.environment.nsw.gov.au/threatenedspecies/>), the NSW Fisheries Scientific Committee final determinations (<http://www.dpi.nsw.gov.au/fisheries/species-protection/fsc/final>) and from the Species Profiles and Threats Database on the Commonwealth DotEE 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 recent (<25 years) 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 and Fisheries Management Act 1994.

E: Endangered.

CE: Critically Endangered.

V: Vulnerable.

Mi: Migratory.

M: Marine.

Common name Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Ecological communities					
Buloke (<i>Allocasuarina luehmannii</i>) Woodlands of the Riverina and Murray-Darling Depressions Bioregions	E	E	<i>Allocasuarina luehmannii</i> Woodland has been recorded in the southern part of the Riverina bioregion from near Urana and Mulwala in the east to the Barham district, and may extend as far west as Euston in the southern part of the Murray-Darling Depression bioregion. The community typically comprises an open tree canopy with a sparse and highly variable ground layer dominated by grasses and herbs, sometimes with scattered shrubs and/or small trees. The community typically occupies patches of red-brown loamy sands with alkaline sub-soils on the alluvial plain of the Murray River and its tributaries in south-western NSW.	Unlikely. The ecological community does not occur in the study area due to the absence of Buloke.	Unlikely. The ecological community does not occur within the study area.
Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	E	E	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.	Unlikely. The ecological community does not occur in the study area due to the absence of Grey Box.	Unlikely. The ecological community does not occur within the study area.

Common name Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Murray River Endangered Ecological Community (Aquatic ecological community in the natural drainage system of the lower Murray River catchment)	E	-	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 downstream of Hume Weir, the Murrumbidgee River downstream of Burrinjuck Dam, the Tumut River downstream of Blowering Dam and all their tributaries anabranches and effluents including Billabong Creek, Yanco Creek, Colombo Creek, and their tributaries, the Edward River and the Wakool River and their tributaries, anabranches and effluents, Frenchmans Creek, the Rufus River and Lake Victoria. Excluded from this recommendation are the Lachlan River and the Darling River and their tributaries, and artificial canals, water distribution and drainage works, farm dams and off-stream reservoirs.	Present. The Wakool River is located within the subject site, therefore the community occurs.	Likely. The proposal would involve impacts within the Wakool River and its floodplain, which would impact on the community.
Natural Grasslands of the Murray Valley Plains	-	CE	The Natural Grasslands of the Murray Valley Plains is a type of naturally treeless grassland occurring on the plains of western and northern Victoria (including the Victorian Riverina), extending into the southern parts of the Riverina in New South Wales. Although occurring near the Murray River and other major tributaries, it is a dryland ecological community occurring above the floodplains.	Unlikely. The ecological community does not occur in the study area due as it is dominated by woodland vegetation.	Unlikely. The ecological community does not occur within the study area.

Common name Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Weeping Myall Woodlands / Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions'	E	E	The structure of the 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.	Unlikely. The ecological community does not occur in the study area due to the absence of Weeping Myall.	Unlikely. The ecological community does not occur within the study area.
Flora					
A Speargrass <i>Austrostipa metatoris</i>	V	V	Most records occur in the Murray Valley with sites including Cunninyeuk Station, Stony Crossing, Kyalite State Forest (now part of Murrumbidgee Valley Regional Park) and Lake Benanee. Grows in sandy areas of the Murray Valley. Habitats include sandhills, sandridges, undulating plains and flat open mallee country, with red to red-brown clay-loam to sandy-loam soils. Associated species include <i>Eucalyptus populnea</i> , <i>E. intertexta</i> , <i>Callitris glaucophylla</i> , <i>Casuarina cristata</i> , <i>Santalum acuminatum</i> and <i>Dodonaea viscosa</i> .	Unlikely. The species was recorded in the locality most recently in 2008, about 16 kilometres north-west of the study area. The study area does not contain suitable sandy or mallee habitat preferred by the species and absence of associated species.	Unlikely. The species is unlikely to be present in the study area.

Common name Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
A Speargrass <i>Austrostipa wakoolica</i>	E	E	Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW. Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils. Habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. Associated species include <i>Callitris glaucophylla</i> , <i>Eucalyptus microcarpa</i> , <i>E. populnea</i> , <i>Austrostipa eremophila</i> , <i>A. drummondii</i> , <i>Austrodanthonia eriantha</i> and <i>Einadia nutans</i> .	Likely. The species was recorded in the locality most recently in 1980, about 17.6 kilometres north-west of the study area. However, suitable potential habitat is present as the study area is on the floodplain of the Wakool River, a tributary of the Murray River.	Unlikely. Despite targeted surveys at an appropriate time of year, this species was not recorded in the study area.
Chariot Wheels <i>Maireana cheelii</i>	V	V	Restricted to the southern Riverina region of NSW, mainly in the area between Deniliquin and Hay. Usually found on heavier, grey clay soils with <i>Atriplex vesicaria</i> (Bladder Saltbush). Recorded on the Hay Plain in <i>Atriplex vesicaria</i> , <i>Maireana aphylla</i> and <i>Acacia homalophylla</i> shrublands. Soils include heavy brown to red-brown clay-loams, hard cracking red clay, other heavy texture-contrast soils. Tends to grow in shallow depressions, often on eroded or scalded surfaces, and does not extend to the higher soils in the habitat. It has been found on the edges of bare, windswept claypans, in shallow depressions of eroded surfaces where rainwater collects and on a "shelf" in the crabhole complex of heavy grey soils. Associated species include <i>Atriplex vesicaria</i> , <i>Maireana pentagona</i> , <i>M. excavata</i> , <i>M. ciliata</i> , <i>Cressa cretica</i> , <i>Avena fatua</i> and <i>Acacia homalophylla</i> .	Likely. The species was recorded in the locality most recently in 2006, about 24 kilometres west of the study area. The study area contains suitable clay soil habitat and associated species it is likely to be found with.	Unlikely. Despite targeted surveys at an appropriate time of year, this species was not recorded in the study area.

Common name Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Greencomb Spider-orchid, Rigid-orchid <i>Caladenia tensa</i>	-	E	Historically, this species was widespread on aeolian sand deposits surrounding and including, the Little Desert in western Victoria and south-east South Australia. In the early 1990s the species was considered confined to western Victoria (Todd 2000). Grows on red-brown sandy loams on rises in open woodland dominated by Yellow Gum (<i>Eucalyptus leucoxylon</i> sens. lat.) and Rottnest Island Pine (<i>Callitris preissi</i>). This species has also been recorded from Black Box (<i>Eucalyptus largiflorens</i>)/ Yellow Gum woodland and mallee/heathland. Recently, the various habitats for the species has been described, including dry Cypress-pine (family Cupressaceae)/Yellow Gum Woodland, Pine/Box woodland, mallee-heath sites, heathy woodland and mallee woodland, generally with rock outcrops (Bates 2009; Todd 2000).	Unlikely. The species has not been recorded in the locality. Although the study area contains Black Box woodland there are no rock outcrops to provide preferred habitat and the species is unlikely to occur.	Unlikely. The species is unlikely to be present in the study area.
Slender Darling-pea <i>Swainsona murrayana</i>	V	V	The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with Maireana species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated.	Likely. The species has not been recorded in the locality, however, the study area contains suitable habitat for the species in the form of Black Box woodland on a floodplain.	Unlikely. Despite targeted surveys at an appropriate time of year, this species was not recorded in the study area.

Common name Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Winged Peppergrass <i>Lepidium monoplacoides</i>	E	E	Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300 to 500 millimetres. Predominant vegetation is usually an open woodland dominated by <i>Allocasuarina luehmannii</i> (Bulloak) and/or eucalypts, particularly <i>Eucalyptus largiflorens</i> (Black Box) or <i>Eucalyptus populnea</i> (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses. Recorded in a wetland-grassland community comprising <i>Eragrostis australasicus</i> , <i>Agrostis avenacea</i> , <i>Austrodanthonia duttoniana</i> , <i>Homopholis proluta</i> , <i>Myriophyllum crispatum</i> , <i>Utricularia dichotoma</i> and <i>Pycnosorus globosus</i> , on waterlogged grey-brown clay. Also recorded from a <i>Maireana pyramidata</i> shrubland.	Likely. The species has not been recorded in the locality, however, the study area contains suitable habitat for the species in the form of Black Box woodland	Unlikely. Despite targeted surveys at an appropriate time of year, this species was not recorded in the study area.
Western Water-starwort <i>Callitriche cyclocarpa</i>	V	-	In NSW only recorded at "The Gut" near Koraleigh, on the floodway from the Murray River to the Wakool River, about 26 km NNW of Swan Hill. The species is associated with River Red Gum (<i>Eucalyptus camaldulensis</i>) open woodlands. Aquatic forms are submerged. Terrestrial forms are prostrate or shortly erect.	Likely. Species has been recorded in the Wakool river and is predicted to occur in the study area, although current records are outside of the current study area. Not recorded during field survey within the study area.	Unlikely. The presence of this species at the subject site is considered unlikely based on no occurrences recorded during the surveys and no records in the study area in the past 25 years.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Birds					
Australasian Bittern <i>Botaurus poiciloptilus</i>	E	E	Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly <i>Typha</i> spp. and <i>Eleocharis</i> spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Unlikely. The species has been recorded once in the wider locality, about 28.5 kilometres east of the subject site. The study area does not contain suitable shallow aquatic habitat preferred by the species and it is unlikely to occur due to a lack of records.	Unlikely. The species is unlikely to inhabit the study area due to lack of records in the locality and suitable shallow aquatic habitat.
Australian Painted Snipe <i>Rostratula australis</i>	E	E	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	Unlikely. The species has not been recorded in the locality. The study area does not contain suitable shallow aquatic habitat preferred by the species and it is unlikely to occur due to a lack of records.	Unlikely. The species is unlikely to inhabit the study area due to lack of records in the locality and suitable shallow aquatic habitat.
Barking Owl <i>Ninox connivens</i>	V	-	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 understory trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts. Nests in hollows of large, old eucalypts including River Red Gum (<i>Eucalyptus camaldulensis</i>).	Likely. The species has been recorded once in the wider locality, about 21 kilometres south of the subject site. The study area contains eucalypt woodland the species may use as habitat, with large tree hollows in large, old eucalypts available for nesting.	Likely. The removal of trees from the study area may reduce roosting, nesting and foraging habitat for the species.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Black-tailed Godwit <i>Limosa limosa</i>	V	Mi	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland. Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps.	Unlikely. The species was recorded most recently in the locality about 23 kilometres east of the subject site, in 1985. The species is unlikely to occur due to lack of records and suitable shallow aquatic habitat.	Unlikely. The species is unlikely to inhabit the study area due to a lack of records in the locality and suitable shallow aquatic habitat.
Blue-billed Duck <i>Oxyura australis</i>	V	-	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. Blue-billed Ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland. They feed on the bottom of swamps eating seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies. Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Blue-billed Ducks usually nest solitarily in Cumbungi over deep water between September and February. They will also nest in trampled vegetation in Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed.	Likely. The species has been recorded about 23 kilometres east of the subject site. Suitable aquatic habitat is present in the Wakool River for the species to be likely to occur.	Likely. The construction of the proposal may cause siltation of the river and impact on the aquatic foraging resources of the species.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	V	-	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.	Present. The species was recorded during current surveys and the study area contains River Red Gum Woodland with sufficient woody debris, which the species requires as habitat components	Likely. The removal of trees from the study area may reduce roosting, nesting and foraging habitat for the species.
Bush Stone-curlew <i>Burhinus grallarius</i>	E	-	Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber.	Unlikely. The species has been recorded about five kilometres north of the subject site. The study area does not contain open woodland with a grassy understorey, for the	Unlikely. The species is unlikely to inhabit the study area due to a lack of open grassy woodland habitat.
Cattle Egret <i>Ardea ibis</i>	-	Mi	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.	Likely. The species was recorded most recently in the wider locality in 1984, about 24 kilometres south of the subject site. However, the study area contains wetland and woodland habitats the species may use.	Unlikely. Due to the species high mobility the proposed removal of trees and groundcover is unlikely to impact on the species.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Curlew Sandpiper <i>Calidris ferruginea</i>	E	Mi	It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. It 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 inland.	Unlikely. The species has been recorded about 23 kilometres east of the subject site. The species generally occurs on the coast and is unlikely to inhabit the study area.	Unlikely. The species is generally coastal and unlikely to inhabit the study area.
Diamond Firetail <i>Stagonopleura guttata</i>	V	-	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora 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 exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects.	Likely. The species has not been recorded in the locality; however, the study area contains riparian woodland with a sufficient grassy understorey for the foraging requirements of the species.	Likely. The removal of trees and groundcover from the study area may reduce roosting, nesting and foraging habitat for the species.
Dusky Woodswallow <i>Artamus cyanopterus</i>	V	-	Occurs in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath. ground cover may consist of grasses, sedges or open ground, often with coarse woody debris.	Likely. The species has not been recorded in the locality; however, the study area contains River Red Gum forest and Black Box woodland that would provide habitat for the species.	Likely. The removal of trees and groundcover from the study area may reduce roosting, nesting and foraging habitat for the species.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Flame Robin <i>Petroica phoenicea</i>	V	-	Prefer forests and woodlands up to about 1800 metres above sea level but are often recorded in fragmented landscapes foraging in open farmland adjoining box-gum woodlands.	Unlikely. The species has not been recorded in the locality. The study area does not contain woodland with a sufficiently grassy understorey for the species to be likely to occur.	Unlikely. The species is unlikely to inhabit the study area due to a lack of preferred grassy woodland habitat.
Fork-tailed Swift <i>Apus pacificus</i>	-	Mi	Migratory marine visitor to eastern Australia. It is a highly nomadic and dispersive species which feeds on insects in the air.	Likely. The species has not been recorded in the locality, however, may forage above the study area.	Unlikely. The proposal is unlikely to impact on the aerial resources of the species.
Freckled Duck <i>Stictonetta naevosa</i>	V	-	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.	Likely. The species has been recorded about 23 kilometres east of the subject site. Suitable aquatic habitat is present in the Wakool River for the species to be likely to occur.	Likely. The construction of the proposal may cause siltation of the river and impact on the aquatic foraging resources of the species.
Gilbert's Whistler <i>Pachycephala inornata</i>	V	-	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.	Likely. The species has been recorded about 26 kilometres south-east of the subject site. The study area contains River Red Gum woodland with a sufficient shrubby understorey for the foraging requirements of the species.	Likely. The removal of trees and shrubs from the study area may reduce roosting, nesting and foraging habitat for the species.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Great Egret <i>Ardea alba</i>	-	Mi	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 drainage channels.	Likely. The study area contains wetland habitat in the form of a river to provide suitable habitat for the species.	Unlikely. Due to the species high mobility the proposed removal of trees and groundcover is unlikely to impact on the species.
Grey-crowned Babbler (eastern subspecies) <i>Pomatostomus temporalis temporalis</i>	V	-	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. Feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses.	Likely. The species has been recorded about eight kilometres east of the subject site. The study area contains eucalypt woodland with areas of open understorey for the species habitat requirements.	Likely. The removal of trees and groundcover from the study area may reduce roosting, nesting and foraging habitat for the species.
Hooded Robin <i>Melanodryas cucullata cucullata</i>	V	-	Considered a sedentary species, but local seasonal movements are possible. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Nests on low, live or dead forks or branches of trees or stumps, or occasionally on fallen trees or limbs.	Likely. The species has been recorded about 17 kilometres north-east of the subject site. The study area contains the required habitat structure for the species, consisting of eucalypt woodland containing shrubs, grasses and woody debris needed for nesting, roosting and foraging.	Likely. The removal of trees and groundcover from the study area may reduce roosting, nesting and foraging habitat for the species.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Latham's Snipe <i>Gallinago hardwickii</i>	-	Mi	Occurs in permanent and ephemeral wetlands. The species usually inhabits open, freshwater wetlands with low, dense vegetation.	Unlikely. The species was recorded about 22 kilometres south-east of the subject site, most recently in 1975. The study area does not contain suitable shallow aquatic habitat preferred by the species and it is unlikely to occur due to a lack of records.	Unlikely. The species is unlikely to inhabit the study area due to lack of records in the locality and suitable shallow aquatic habitat.
Major Mitchell's Cockatoo <i>Lophochroa leadbeateri</i>	V	-	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.	Likely. The species has been recorded about 17 kilometres north-east of the subject site. study area contains woodland within easy reach of water to provide suitable habitat for the species.	Unlikely. The proposed removal of vegetation is unlikely to impact on the preferred habitat of the species.
Satin Flycatcher <i>Myiagra cyanoleuca</i>	-	Mi	Satin Flycatchers are mainly recorded in eucalypt forests, especially wet sclerophyll forest, often dominated by eucalypts such as Brown Barrel, <i>Eucalypt fastigata</i> , Mountain Gum, <i>E. dalrympleana</i> , Mountain Grey Gum, Narrow-leaved Peppermint, Messmate or Manna Gum, or occasionally Mountain Ash, <i>E. regnans</i> . Such forests usually have a tall shrubby understorey of tall acacias, for example Blackwood, <i>Acacia melanoxylon</i> . The species may also occur in woodlands such as Box-Gum Woodland.	Unlikely. The species has not been recorded in the locality. The study area does not contain suitable forest habitat or associated species for the species to be likely to occur.	Unlikely. The species is unlikely to inhabit the study area due to a lack of suitable forest habitat.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	-	Mi	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage (Cramp 1985; Higgins & Davies 1996). They are widespread in most regions of New South Wales (NSW) and Victoria, especially in coastal areas, but they are sparse in the south-central Western Plain and east Lower Western Regions of NSW, and north-east and north-central Victoria (Higgins & Davies 1996).	Unlikely. The species has been recorded about 23 kilometres east of the subject site. The species generally occurs on the coast and is unlikely to inhabit the study area.	Unlikely. The species is generally coastal and unlikely to inhabit the study area.
Spotted Harrier <i>Circus assimilis</i>	V	-	Occurs throughout Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Inhabits grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods). Most commonly in native grassland, but also in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn).	Likely. The species has been recorded about 17 kilometres north-east of the subject site. The study area contains riparian woodland to provide suitable habitat for the species.	Likely. The removal of trees from the study area may reduce roosting, nesting and foraging habitat for the species.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Superb Parrot <i>Polytelis swainsonii</i>	V	V	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.	Unlikely. The species was recorded about 21 kilometres east of the subject site in 1984. Although the study area contains River Red Gum Woodland the species generally occurs further to the east and is unlikely to occur in the study area.	Unlikely. The species generally occurs further east and unlikely to inhabit the study area.
Swift Parrot <i>Lathamus discolor</i>	E	E, Mi	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> .	Unlikely. The species has not been recorded in the locality. The study area does not contain the preferred feed trees of the species and it is unlikely to occur.	Unlikely. The study area does not contain the preferred feed trees of the species and it is unlikely to occur.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Varied Sittella <i>Daphoenositta chrysoptera</i>	V	-	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Likely. The species has been recorded about 17 kilometres north-east of the subject site. The eucalypt woodland in the study area may provide habitat for the species.	Likely. The removal of trees from the study area may reduce roosting, nesting and foraging habitat for the species.
White-fronted Chat <i>Epthianura albifrons</i>	V	-	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.	Likely. The species has been recorded about 23 kilometres east and west of the subject site. The species may utilise open areas with low vegetation in the study area as foraging, roosting and nesting habitat.	Likely. The removal of trees and shrubs from the study area may reduce roosting, nesting and foraging habitat for the species.
Mammals					
Koala <i>Phascolarctos cinereus</i>	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the western region. Inhabits eucalypt woodlands and forests.	Unlikely. The species has been recorded about 28 kilometres north of the subject site. The species is unlikely to inhabit the study area due to a lack of records in the locality and no evidence of the species was found during surveys.	Unlikely. The species is unlikely to inhabit the study area due to a lack of records in the locality.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Little Pied Bat <i>Chalinolobus picatus</i>	V	-	Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	Likely. The species has not been recorded in the locality. The species may use the woodland in the study area for foraging.	Unlikely. The proposed removal of vegetation is unlikely to impact on the preferred habitat of the species.
South-eastern Long-eared Bat <i>Nyctophilus corbeni</i>	V	V	Little is known about the biology or social structure of these bats - rarely recorded and scattered distribution (DotE 2013). Limited distribution that is restricted to the Murray-Darling Basin in south-eastern Australia. It is likely that they roost solitarily under exfoliated bark and in crevices on trees. They probably forage within one kilometre of their roost site (OEH 2013). These species are insectivorous and voracious feeders, concentrated around patches of trees in the landscape. Occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands (DotE 2013).	Likely. The species has not been recorded in the locality. The species may use the woodland in the study area for foraging and roosting.	Likely. The removal of trees from the study area, including hollow-bearing trees, may reduce roosting and foraging habitat for the species.
Southern Myotis <i>Myotis macropus</i>	V	-	Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011). Breeds November or December (Churchill 2008).	Likely. The species has not been recorded in the locality. The riparian woodland may provide suitable habitat for the species.	Likely. The removal of trees from the study area, including hollow-bearing trees, and the demolition of the timber bridge may reduce roosting and foraging habitat for the species.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Squirrel Glider <i>Petaurus norfolcensis</i>	V	-	This species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey.	Likely. The species has not been recorded in the locality. The River Red Gum Woodland of the study area may provide suitable habitat for the species and is connected to known habitat outside the locality.	Likely. The removal of trees from the study area, including hollow-bearing trees, may reduce denning, movement and foraging habitat for the species.
Yellow-bellied Sheath-tail-bat <i>Saccolaimus flaviventris</i>	V	V	In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Likely. The species has not been recorded in the locality. The species may use the woodland in the study area for foraging and roosting.	Likely. The removal of trees from the study area, including hollow-bearing trees, may reduce roosting and foraging habitat for the species.
Amphibians					
Southern Bell Frog <i>Litoria raniformis</i>	E	V	Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat (OEH 2014).	Unlikely. The species has been recorded about 21 kilometres north-east of the subject site. The species is unlikely to inhabit the study area due to a lack of records in the locality and lack of suitable swampy habitat.	Unlikely. The species is unlikely to inhabit the study area due to a lack of records in the locality and lack of suitable swampy habitat.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Fish					
Macquarie Perch <i>Macquaria australasica</i>	E	E	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.	Unlikely. The species has not been recorded in the LGA and is unlikely to occur in the study area. Distribution is now restricted to the upper reaches of the Murray basin (Allen <i>et al.</i> , 2003; Lintermans, 2007).	Unlikely. The species is unlikely to inhabit the study area due to a lack of records in the locality.
Murray Cod <i>Maccullochella peelii peelii</i>	-	V	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.	Likely. The species is known to occur in the Wakool River (NSW Fisheries, 2015), which occurs in the study area.	Likely The removal of large woody debris and potential refuge habitat around the existing bridge may have a temporary impact on habitat availability during construction. Additionally, construction of the proposal may cause siltation of the river and temporary partial blockage of river during construction.
Murray Hardyhead <i>Craterocephalus fluviatilis</i>	CE	CE	The species was once widespread and abundant in the Murray and Murrumbidgee river systems in southern NSW and northern Victoria; however, they have suffered a serious population decline, and now seem to be limited to a few sites, mainly in northern Victoria. Only one record in NSW in the last 30 years from Darling River near Wentworth.	Unlikely. The species has not been recorded in the LGA and is unlikely to occur in the study area.	Unlikely. The species is unlikely to inhabit the study area due to a lack of records in the locality.

Scientific name	TSC Act / FM Act	EPBC Act	Habitat association	Likelihood of occurrence within study area	Possibility of impact within subject site
Silver Perch <i>Bidyanus bidyanus</i>	V	V	The species was once abundant throughout the Murray-Darling river system. Silver perch 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.	Likely. The species is known to occur in the Wakool River (NSW Fisheries, 2015), which occurs in the study area.	Likely The removal of woody habitat around the bridge including the bridge itself will have minimal impact given the extent of available habitat within the study area. Construction activities in the river would possibly result in the disturbance, removal or destruction of emergent and/or submerged (in-stream) vegetation and the disturbance of the river bed within the Wakool River.
Trout Cod <i>Maccullochella macquariensis</i>	E	E	Trout Cod were formally widespread in the Murray Darling basin but now there are only three self-sustaining populations remaining in the wild (Lintermans, 2007) with the largest being a 200 km stretch of the Murray River between Yarrawonga and Barmah. There has been stocking of the Murray River and tributaries upstream. Trout cod are associated with deep pools and instream cover such as logs and boulders.	Likely. The species has not been recorded at Gee Gee bridge (NSW DPI Fisheries, 2015); however there is suitable habitat within the study area and NSW DPI Fisheries noted the potential for this species to occur within the study area.	Likely Construction activities in the river would possibly result in the disturbance, removal or destruction of emergent and/or submerged (in-stream) vegetation and the disturbance of the river bed within the Wakool River.

Appendix E – Assessments of significance

EP&A Act assessments of significance

Murray River endangered 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

Not applicable as this is an endangered community.

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

Not applicable as this is an endangered community.

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

It is unlikely that the proposal would have a significant impact on the Murray River endangered ecological community. The minor disturbances caused by the removal of the bridge piers would cause some degree of siltation and there will likely be a disturbance to the emergent macrophytes on either bank in the immediate vicinity of the bridge. The sedimentation risk associated with the Proposal is not expected to lead to adverse effects as long as the correct mitigation measures are in place.

The removal of emergent macrophytes from either bank is likely to have a negligible impact to the ecological community given the range and extent of these species in the study area.

The removal of woody debris from beneath the bridge will have a negligible impact to fish species given the range and extent of large woody debris in the study area. The potential impacts can be minimised by relocating any woody debris removed during construction back into the area after construction completion.

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

It is unlikely that the proposal would have a significant impact on the Murray River endangered ecological community. The minor disturbances caused by the removal of the bridge piers would cause some degree of siltation and there will likely be a disturbance to the emergent macrophytes on either bank in the immediate vicinity of the bridge. The sedimentation risk associated with the proposal is not expected to lead to adverse effects as long as safeguards and management measures are in place.

The removal of emergent macrophytes from either bank is likely to have a negligible impact to the ecological communities given the range and extent of this species in the study area.

The removal of woody debris from beneath the bridge will have a negligible impact to fish species given the range and extent of large woody debris in the study area. The potential impacts can be minimised by relocating any woody debris removed during construction back into the area after construction completion.

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

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

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 use of silt curtains, partial or otherwise, within the river may also temporarily impede fish passage. Cofferdams and temporary work platforms and minor alterations to flow may impede fish passage (especially small species and juveniles as they tend to move along the stream edge); however the proposal would be unlikely to substantially affect fish passage due to the relatively small proportion of the river cross section that the new piers and existing piers would occupy. The piers would be unlikely to substantially change the hydrology of the river.

The proposal will not isolate or fully fragment aquatic habitat, with fish still being able to move freely throughout the reach.

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 state recovery plan has not been established for this community.

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 proposal will involve the removal of woody habitat in the vicinity of the bridge including the bridge itself will have minimal impacts on this community given the wider extent of available habitat within the study area.

Conclusion

It is considered unlikely that the Project would have a significant adverse effect on the lower Murray Endangered Ecological Community.

Woodland birds

- Brown Treecreeper (*Climacteris picumnus victoriae*) – Vulnerable
- Diamond Firetail (*Stagonopleura guttata*) – Vulnerable
- Gilbert’s Whistler (*Pachycephala inornata*) – Vulnerable
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) – Vulnerable
- Hooded Robin (*Melanodryas cucullata cucullata*) – Vulnerable
- Varied Sittella (*Daphoenositta chrysoptera*) – Vulnerable
- White-fronted Chat (*Epthianura albifrons*) – Vulnerable
- Dusky Woodswallow (*Artamus cyanopterus*) – 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, which were recorded during surveys in the study area.

Based on resources present and records in the locality, the woodland in the study area may also provide habitat for six 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, Gilbert’s Whistler, Grey-crowned Babbler, Varied Sittella and Dusky Woodswallow.

The grassy understorey and shrubs of the woodland provide foraging resources for the Brown Treecreeper, Diamond Firetail, Gilbert’s Whistler, Grey-crowned Babbler and White-fronted Chat.

Hollow-bearing trees in the study area may be used by the Brown Treecreeper for breeding.

The Diamond Firetail, Gilbert’s Whistler, Grey-crowned Babbler, Hooded Robin, Varied Sittella, and Dusky Woodswallow may also build nests in the branches of the trees in the study area.

The woodland in the study area provides movement habitat for all of the 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 2.1 hectares of native woodland and shrubland habitat, including 13 hollow-bearing trees. This represents up to two per cent of the habitat in the study area and a minor fraction of the habitat in the locality. Murray Valley National Park, located in the study area, contains over 1600 hectares of native woodland directly connected to the subject site.

Thirteen hollow-bearing trees would be removed from the subject site. The removal of these trees is unlikely to affect the life cycle of the Brown Treecreeper due to the presence of many more habitat trees in the study area and locality. The proposal would not remove a significant proportion of the hollow-bearing tree resources within the potential home range of the Brown Treecreeper.

The proposed removal of woodland habitat would be unlikely to significantly affect the life cycle of any of these species due to the relatively small amount of habitat to be affected compared to the amount of habitat present in the study area and locality.

Good quality habitat for these species is present in other parts of the study area and the locality. Due to their mobility, it is unlikely that the proposal would have an adverse effect on the life cycle of these woodland birds 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 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 vegetation would reduce the amount of nesting, roosting, movement and foraging habitat for woodland birds in the study area. The proposal would remove 2.1 hectares of native woodland and shrubland habitat. This represents up to two per cent of the habitat in the study area and a minor fraction of the habitat in the locality. Murray Valley National Park, located in the study area, contains over 1,600 hectares of native woodland directly connected to the subject site. Due to the mobility of the woodland birds assessed, it is unlikely that the proposal would remove a significant amount of habitat for these species.

Thirteen hollow-bearing trees would be removed from the subject site. The removal of these trees is unlikely to significantly affect the life cycle of the Brown Treecreeper due to the presence of many more habitat trees in the study area and locality. The proposal would not remove a significant proportion of the hollow-bearing tree resources within the potential home range of the Brown Treecreeper.

The proposal would remove groundcover vegetation and shrubs where the approach road and bridge are constructed, which would provide foraging habitat for the Brown Treecreeper, Diamond Firetail, Gilbert's Whistler, Grey-crowned Babbler, Hooded Robin and White-fronted Chat.

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

The woodland in the study area forms part of the riparian corridor along the Wakool River and also forms part of the vegetation in Murray Valley National Park that extends outside of the study area. Woodland in the study area also provides connectivity to remnant vegetation outside the locality, including Koondrook and Perricoota State Forests and the riparian corridor of the Murray River to the south.

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for agriculture and construction of linear infrastructure, including the Swan Hill-Barham Road. These developments have not prevented the Brown Treecreeper from using the study area and are unlikely to prevent the woodland birds assessed from using the study area. A large expanse of woodland and potential habitat for the species still exists in the study area.

The proposal may result in the increased fragmentation of woodland habitat by increasing the distance between mature trees, decreasing the groundcover and reducing the overall extent of native vegetation cover. The removal of vegetation would marginally reduce vegetation connectivity along the Wakool River and in the patch of woodland. The proposal would create a gap in the vegetation of about 20-25 metres. It is unlikely that the proposal would significantly fragment woodland habitat in the study area.

Due to the small extent of vegetation removal involved, the proposal would be unlikely to result in significant additional fragmentation. 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 woodland birds assessed, the proposal is unlikely to create any substantial barriers to movement for these species or isolate them from other 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 proposal would remove 2.1 hectares of native woodland and shrubland habitat, including 13 hollow-bearing trees. The proposal would therefore remove potential nesting, roosting, movement and foraging habitat for the woodland bird species assessed.

The area of habitat for these species proposed to be removed is relatively small. Areas of high quality habitat value exist in patches connected to the study area, including Murray Valley National Park and along the floodplain of the Wakool River, where the subject site is located.

The proposed removal of vegetation does not represent habitat critical to any of the threatened bird species. It is unlikely that the relatively small area of habitat to be removed would be of significant importance 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

Specific recovery plans have not been prepared for the woodland bird species assessed. However, in the profiles for these species on the OEH (2015) Threatened Species website, a number of actions are identified that need to occur to recover these species. For all the woodland bird 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 known habitat for the Brown Treecreeper, and potential habitat for the other woodland bird species. The proposal would remove 2.1 hectares of native woodland and shrubland habitat, including 13 hollow-bearing trees.

Due to the proposed removal of habitat, the proposal is not consistent with the recovery actions identified on the OEH (2015) Threatened Species website. The proposed removal of habitat is however relatively small and unlikely to significantly affect any of the threatened woodland birds, 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 three listed key threatening processes relevant to the threatened woodland birds listed above:

- Clearing of native vegetation – the proposal would remove 2.1 hectares of native woodland and shrubland habitat. This is unlikely to represent a significant loss of habitat, as described above
- Loss of hollow-bearing trees – the proposal would remove 13 hollow-bearing trees from the subject site. The removal of these trees has the potential to affect the Brown Treecreeper which may use hollows for nesting. There is also the potential that the other hollow-bearing trees could provide future nesting habitat for the species as they grow and develop larger hollows
- Removal of dead wood and dead trees – the proposal would remove one dead tree, which represents only a minor fraction of the dead trees in the study area.

Conclusion

The proposal would be unlikely to have a significant effect on any threatened woodland bird species.

Predatory woodland birds

- Barking Owl (*Ninox connivens*) – Vulnerable.
- Spotted Harrier (*Circus assimilis*) – 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 may provide suitable foraging, nesting and roosting habitat for threatened predatory species including the Barking Owl and Spotted Harrier.

Barking Owls require large (greater than 20 centimetres diameter and greater than four metres above the ground) hollows for breeding. Hollow-bearing trees with large hollows are present in the study area.

Spotted Harriers prefer grassy open woodland, including inland riparian woodland, and build a stick nest in trees. No stick or twig nests were observed in the subject site or study area, although potential breeding habitat is present.

As the proposal would remove habitat resources for prey species (eg Common Brushtail Possum), the proposal could also reduce the abundance of prey for these predatory woodland bird species.

The woodland in the study area provides potential foraging, roosting and movement habitat for the Barking Owl and Spotted Harrier.

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 2.1 hectares of native woodland and shrubland habitat, including 13 hollow-bearing trees. This represents up to two per cent of the habitat in the study area and a minor fraction of the habitat in the locality. Murray Valley National Park, located in the study area, contains over 1,600 hectares of native woodland directly connected to the subject site.

The Barking Owl and Spotted Harrier both have large home ranges and are unlikely to rely solely on woodland in the subject site or study area for breeding and foraging. Patches of remnant woodland in the locality are likely to provide alternative habitat to that to be removed in the subject site.

The proposal would remove 13 hollow-bearing trees; three of which contain nine hollows suitable for the nesting requirements of the Barking Owl. The removal of these trees is unlikely to significantly affect the life cycle of the Barking Owl due to the presence of many more habitat trees in the study area and locality. The proposal would not remove a significant proportion of the hollow-bearing tree resources within the potential home range of the Barking Owl.

The proposed removal of woodland habitat would be unlikely to significantly affect the life cycle of either of these species due to the relatively small amount of habitat to be affected compared to the amount of habitat present in the study area and locality.

Good quality habitat for these species is present in other parts of the study area and the locality. Due to their mobility and large home ranges, it is unlikely that the proposal would have an adverse effect on the life cycle of these predatory woodland birds 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 Barking Owl or Spotted Harrier 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 nesting, roosting, movement and foraging habitat for predatory woodland birds in the study area. The proposal would remove 2.1 hectares of native woodland and shrubland habitat. This represents up to two per cent of the woodland and shrubland in the study area and a minor fraction of the habitat in the locality. Murray Valley National Park, located in the study area, contains over 1,600 hectares of native woodland directly connected to the subject site. Due to the mobility of the predatory woodland birds assessed, it is unlikely that the proposal would remove a significant amount of habitat for these species.

Thirteen hollow-bearing trees would be removed from the subject site. The removal of these trees is unlikely to affect the life cycle of the Barking Owl. Only three trees containing nine hollows suitable for the species would be removed. Many more potential habitat trees are present in the study area and locality. The proposal would not remove a significant proportion of the hollow-bearing tree resources within the potential home range of the Barking Owl.

The Barking Owl and Spotted Harrier both have large home ranges and are unlikely to rely solely on woodland in the subject site or study area for breeding and foraging. Patches of remnant woodland in the locality are likely to provide alternative habitat to that to be removed in the subject site.

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

The woodland in the study area forms part of the riparian corridor along the Wakool River and also forms part of the vegetation in Murray Valley National Park that extends outside of the study area. Woodland in the study area also provides connectivity to remnant vegetation outside the locality, including Koondrook and Perricoota State Forests and the riparian corridor of the Murray River to the south.

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for agriculture and construction of linear infrastructure, including the Swan Hill-Barham Road. These developments are unlikely to prevent the Barking Owl and Spotted Harrier from using the study area. A large expanse of woodland and potential habitat for the species still exists in the study area.

The proposal may result in the increased fragmentation of woodland habitat by increasing the distance between mature trees, decreasing the groundcover and reducing the overall extent of native vegetation cover. The removal of vegetation would marginally reduce vegetation connectivity along the Wakool River and in the patch of woodland. The proposal would create a gap in the vegetation of about 20-25 metres. It is unlikely that the proposal would significantly fragment woodland habitat in the study area.

Due to the small extent of vegetation removal involved, the proposal would be unlikely to result in significant additional fragmentation. 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 and large home ranges of the predatory woodland birds assessed, the proposal is unlikely to create any substantial barriers to movement for these species or isolate them from other 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 proposal would remove 2.1 hectares of native woodland and shrubland habitat, including 13 hollow-bearing trees. Some of the trees to be removed are mature and possess old growth characteristics favoured by the Barking Owl. The proposal would therefore remove potential nesting, roosting, movement and foraging habitat for the threatened predatory bird species assessed.

The area of habitat for these species proposed to be removed is relatively small. Areas of high quality habitat value exist in patches connected to the subject site, including Murray Valley National Park and along the floodplain of the Wakool River, where the subject site is located.

The proposed removal of vegetation does not represent habitat critical to any of the threatened predatory woodland bird species. It is unlikely that the relatively small area of habitat to be removed would be of significant importance 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 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*. The proposal would remove nine hollows the Barking Owl may potentially use as nest sites and could potentially remove trees with the potential to form nest sites in future, as well as woodland used by the species as foraging and movement habitat.

A recovery plan has not been developed for the Spotted Harrier. However, in the profile for this species on the OEH (2015) Threatened Species website, a number of actions are identified that need to occur to recover these species. An important action is the retention and protection of nesting and foraging habitat.

Due to the proposed removal of habitat, the proposal is not consistent with the recovery actions for the Barking Owl and Spotted Harrier. The proposed removal of habitat is however relatively small and unlikely to significantly affect any of the threatened predatory birds, 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 three listed key threatening processes relevant to the threatened predatory birds listed above:

- Clearing of native vegetation – the proposal would remove 2.1 hectares of native woodland and shrubland habitat. This is unlikely to represent a significant loss of habitat, as described above
- Loss of hollow-bearing trees – the proposal would remove 13 hollow-bearing trees from the subject site with three of these trees containing hollows suitable as breeding habitat for the Barking Owl. There is also the potential that the other hollow-bearing trees could provide future nesting habitat for the species as they grow and develop larger hollows
- Removal of dead wood and dead trees – the proposal would remove one dead tree, which represents only a minor fraction of the dead trees in the study area.

Conclusion

The proposal would be unlikely to have a significant effect on the Barking Owl or Spotted Harrier.

Wetland Birds

- Blue-billed Duck (*Oxyura australis*) – Vulnerable
- Freckled Duck (*Stictonetta naevosa*) – 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 Wakool River may provide habitat for the Blue-billed Duck and Freckled Duck. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The Freckled Duck prefers permanent freshwater swamps and creeks with dense vegetation and during drier times moves to more permanent waters. It is unlikely that the Blue-billed Duck would use the study area for breeding as the Murray River system is known as non-breeding habitat. The Freckled Duck may potentially use the study area as breeding habitat.

The proposal may cause disturbance during construction that would deter the species from using the Wakool River. The species would, however, be able to move to other parts of the Wakool River. Potential sedimentation and contamination of the waterway caused by the proposal could impact foraging habitat for the species, but the impacts of sedimentation would be minimised through the implementation of safeguards in section 6. The close proximity of the construction activities to the river also means there is potential for contamination of the waterway through fuel and chemical spills, which would further degrade the wetland habitat of the species. Safeguards and management measures identified in section 6 would be implemented to avoid the potential for these impacts to occur.

It is unlikely that the proposal would have an adverse effect on the life cycle of the Blue-billed Duck or Freckled Duck 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 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 proposal would be unlikely to remove habitat for the Blue-billed Duck and Freckled Duck. Potential sedimentation and contamination of the waterway caused by the proposal could impact foraging habitat for the species. Sedimentation and contamination has the potential to affect the growth and health of aquatic plants and aquatic insects, which are eaten by the species. The

impacts of sedimentation and contamination would be minimised through the implementation of safeguards in section 6.

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 agriculture and construction of linear infrastructure, including the Swan Hill-Barham Road. These developments are unlikely to prevent the threatened ducks assessed from using the study area and have not fragmented the wetland habitat the species may use.

The proposal would not obstruct Blue-billed Duck and Freckled Duck movements along the Wakool River waterway in the long term, although construction may temporarily deter local movements of the species in the waterway. The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

The proposed removal of woodland in the study area is unlikely to impact on the species as they are predominantly aquatic species.

Due to the mobility of the Blue-billed Duck and Freckled Duck, and their relatively large ranges, the proposal is unlikely to create any significant barriers to movement for the 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 Wakool River may provide habitat for the Blue-billed Duck and Freckled. The species prefer a cover of dense aquatic vegetation on the fringes of wetland habitats. While the river contains fringing vegetation it is not a dense cover and the proposal would be unlikely to remove a substantial amount. Fringing vegetation potentially provides breeding habitat for the Freckled Duck and foraging habitat for both species. It is unlikely that the Blue-billed Duck would use the study area for breeding as the Murray River system is known as non-breeding habitat.

Potential sedimentation and contamination of the waterway caused by the proposal could impact foraging habitat for the species

The proposed removal of woodland in the study area is unlikely to impact on the species as they are predominantly aquatic 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 the Blue-billed Duck or Freckled Duck. However, the OEH Threatened Species website identifies a number of actions to recover the species. None of the actions identified for the Blue-billed Duck have direct relevance to the proposal, although they are generally aimed at maintaining wetland habitats and vegetation use by the species.

An action identified for the Freckled Duck is *retain and protect wetlands and maintain a natural density of riparian and wetland vegetation*. While the proposal would remove riparian vegetation it would not alter the overall density of the vegetation in the study area and would not result in the direct loss of any wetland habitat. Therefore the proposal is not inconsistent with this action.

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 wetland birds listed above:

- Removal of large woody debris from New South Wales rivers and streams
- Degradation of native riparian vegetation along New South Wales water courses

It is unlikely that the potential impacts of these key threatening processes would significantly affect the Blue-billed Duck and Freckled.

Conclusion

The proposal would be unlikely to cause a significant ecological impact on the Blue-billed Duck or Freckled Duck.

Microchiropteran bats

- South-eastern Long-eared Bat (*Nyctophilus corbeni*) – Vulnerable
- Southern Myotis (*Myotis macropus*) – Vulnerable
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) – 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 South-eastern Long-eared Bat, Southern Myotis and Yellow-bellied Sheathtail-bat.

The woodland in the study area provides potential foraging habitat for all three bat species. The Southern Myotis is known to occur in woodland along rivers and streams.

Trees in the study area also provide potential roosting and breeding habitat for the South-eastern Long-eared Bat, Southern Myotis and Yellow-bellied Sheathtail-bat in hollows or under loose bark.

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

The proposed removal of woodland would reduce the amount of foraging, roosting, movement and breeding habitat for threatened bats in the study area. The proposal would remove 2.1 hectares of native woodland habitat, including 13 hollow-bearing trees. This represents up to two per cent of the woodland in the study area and a minor fraction of the habitat in the locality. Murray Valley National Park, located in the study area, contains over 1,600 hectares of native woodland directly connected to the subject site.

Thirteen hollow-bearing trees would be removed from the subject site. The removal of these trees is unlikely to affect the life cycle of the threatened bats due to the presence of many more habitat trees in the study area and locality. The removal of these trees would be unlikely to represent a significant loss of potential breeding habitat in the potential home ranges of these species.

The proposed removal of woodland habitat would be unlikely to significantly affect the life cycle of any of these bat species due to the relatively small amount of habitat to be affected compared to the amount of habitat present in the study area and locality.

Good quality habitat for these species is present in other parts of the study area and the locality. Due to their mobility, it is unlikely that the proposal would have an adverse effect on the life cycle of these 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 nesting, roosting, movement and foraging habitat for threatened bats in the study area. The proposal would remove 2.1 hectares of native woodland habitat. This represents up to two per cent of the woodland in the study area and a minor fraction of the habitat in the locality. Murray Valley National Park, located in the study area, contains over 1,600 hectares of native woodland directly connected to the subject site. Due to the mobility of the bats assessed, it is unlikely that the proposal would remove a significant amount of habitat for these species.

Thirteen hollow-bearing trees would be removed from the subject site. The removal of these trees is unlikely to significantly affect the life cycle of the threatened bats due to the presence of many more habitat trees in the study area and locality. The proposal would not remove a significant proportion of the hollow-bearing tree resources in the potential home ranges of the threatened bats.

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

The woodland in the study area forms part of the riparian corridor along the Wakool River and also forms part of the vegetation in Murray Valley National Park that extends outside of the study area. Woodland in the study area also provides connectivity to remnant vegetation outside the locality, including Koondrook and Perricoota State Forests and the riparian corridor of the Murray River to the south.

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for agriculture and construction of linear infrastructure, including the Swan Hill-Barham Road. These developments are unlikely to prevent the threatened bats assessed from using the study area. A large expanse of woodland and potential habitat for the species still exists in the study area.

The proposal may result in the increased fragmentation of woodland habitat by increasing the distance between mature trees, decreasing the groundcover and reducing the overall extent of native vegetation cover. The removal of vegetation would marginally reduce vegetation connectivity along the Wakool River and in the patch of woodland. The proposal would create a gap in the vegetation of about 20-25 metres. It is unlikely that the proposal would significantly fragment woodland habitat in the study area.

Due to the small extent of vegetation removal involved, the proposal would be unlikely to result in significant additional fragmentation. 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 home ranges, the proposal is unlikely to create any substantial barriers to movement for these species or isolate them from other 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 proposal would remove 2.1 hectares of native woodland habitat, including 13 hollow-bearing trees. The proposal would therefore remove potential roosting, movement and foraging habitat for the threatened bat species assessed.

The area of habitat for these species proposed to be removed is relatively small. Areas of high quality habitat value exist in patches connected to the study area, including Murray Valley National Park and along the floodplain of the Wakool River, where the subject site is located.

The proposed removal of vegetation does not represent habitat critical to any of the threatened bat species. It is unlikely that the relatively small area of habitat to be removed would be of significant importance to the long-term survival of 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 prepared for any of the threatened bat species. However, the OEH Threatened Species website (OEH 2015) identifies a number of actions relevant to the proposal that need to occur to recover these species:

- Retain remnant woodland (including along streams and rivers)
- Retain hollow-bearing trees and provide for hollow tree recruitment
- Protect roosting sites from damage or disturbance
- Retain native vegetation that is floristically and structurally diverse.

Due to the proposed removal of woodland and hollow-bearing trees, the proposal would involve removal of roosting sites and foraging habitat and is therefore not consistent with the recovery actions identified on the Threatened Species website. The proposed removal of habitat is however relatively small and 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 three listed key threatening processes relevant to the proposal:

- Clearing of native vegetation – the proposal would remove 2.1 hectares of native woodland habitat. This is unlikely to represent a significant loss of habitat, as described above
- Loss of hollow-bearing trees – the proposal would remove 13 hollow-bearing trees from the subject site. The removal of these trees has the potential to affect the threatened bats which may use them for roosting but only represent a minor fraction of the hollow-bearing trees in the study area.
- Removal of dead wood and dead trees – the proposal would remove one dead tree, which represents only a minor fraction of the dead trees in the study area.

Conclusion

The proposal would be unlikely to have a significant effect any threatened bat species.

Mammals

- Squirrel Glider (*Petaurus norfolcensis*) – 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 may provide movement and foraging habitat for the Squirrel Glider. The trees and shrubs in the study area may provide nectar and pollen during periods of flowering for the Squirrel Glider.

The Squirrel Glider requires hollows five centimetres or greater in diameter for denning. Hollow-bearing trees with hollows this size are present in the study area.

The proposed removal of woodland would reduce the amount of movement and foraging habitat for the species in the study area. The proposal would remove 2.1 hectares of native woodland habitat, including 13 hollow-bearing trees. This represents up to two per cent of the woodland in the study area and a minor fraction of the habitat in the locality. Murray Valley National Park, located in the study area, contains over 1600 hectares of native woodland directly connected to the subject site.

Thirteen hollow-bearing trees would be removed from the subject site. All of these may provide breeding habitat for the Squirrel Glider. The removal of these trees is unlikely to affect the life cycle of the Squirrel Glider due to the presence of many more habitat trees in the study area and locality. The proposal would not remove a significant proportion of the hollow-bearing tree resources within the potential home range of the Squirrel Glider. The species is known to occur along the Murray River, which is connected to the study area via the riparian corridor of the Wakool River.

The proposal would remove shrubs which may be used by the Squirrel Glider for foraging.

The proposed removal of woodland habitat would be unlikely to significantly affect habitat for the species due to the relatively small amount of habitat to be affected compared to that present in the study area and locality. Good quality habitat for these species is present in other parts of the study area and the locality. The proposal would therefore be unlikely to adversely affect the life cycle of the Squirrel Glider such that a viable 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 the Squirrel Glider 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 breeding, movement and foraging habitat for the Squirrel Glider in the study area. The proposal would remove 2.1 hectares of native woodland habitat. This represents up to two per cent of the woodland in the study area and a minor fraction of the habitat in the locality. Due to the small amount of potential habitat to be removed, it is unlikely that the proposal would remove a significant amount of habitat for the species. Murray Valley National Park, located in the study area, contains over 1,600 hectares of native woodland directly connected to the subject site.

Thirteen hollow-bearing trees would be removed from the subject site. The 13 trees to be removed contain 35 hollows suitable for the species. The removal of these trees is unlikely to significantly affect the life cycle of the Squirrel Glider due to the presence of many more habitat trees in the study area and locality. The proposal would not remove a significant proportion of the hollow-bearing tree resources within the potential home range of the Squirrel Glider.

The proposal would remove shrubs which may be used by the Squirrel Glider 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

The woodland in the study area forms part of the riparian corridor along the Wakool River and also forms part of the vegetation in Murray Valley National Park that extends outside of the study area. Woodland in the study area also provides connectivity to remnant vegetation outside the locality, including Koondrook and Perricoota State Forests and the riparian corridor of the Murray River to the south.

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for agriculture and construction of linear infrastructure, including the Swan Hill-Barham Road. These developments are considered unlikely to prevent the Squirrel Glider from using the study area. A large expanse of woodland and potential habitat for the species still exists in the study area.

The proposal may result in the increased fragmentation of woodland habitat by increasing the distance between mature trees, decreasing the groundcover and reducing the overall extent of native vegetation cover. The removal of vegetation would marginally reduce vegetation connectivity along the Wakool River and in the patch of woodland. The proposal would create a gap in the vegetation of about 20-25 metres. It is unlikely that the proposal would significantly fragment woodland habitat in the study area.

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 would not create large gaps in the canopy that would inhibit the Squirrel Glider from traversing the study area.

The proposal would cause limited additional fragmentation to vegetation in the study area. Due to the relatively small extent of habitat removal, the proposal is unlikely to create any substantial barriers to movement for the species or 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 proposal would remove 2.1 hectares of native woodland habitat, including 13 hollow-bearing trees. Some of the trees to be removed are mature and possess old growth characteristics favoured by the Squirrel Glider. The proposal would therefore remove potential

breeding habitat for the Squirrel Glider. The proposal would also remove potential movement and foraging habitat for the species.

The area of habitat for the species proposed to be removed is relatively small. Areas of high quality habitat value exist in patches connected to the subject site, including Murray Valley National Park and along the floodplain of the Wakool River, where the subject site is located.

The proposed removal of vegetation does not represent habitat critical to the Squirrel Glider. It is unlikely that the relatively small area of habitat to be removed would be of significant importance 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 state recovery plan has not been prepared for the Squirrel Glider; however the OEH (2015) Threatened Species website identifies a number of actions that need to occur to recover the species.

The following measures relevant to the proposal are identified:

- Retain den trees and recruitment trees (future hollow-bearing trees)
- Retain food resources, particularly sap-feeding trees and understorey feed species such as Acacias and banksias
- Retain and protect areas of habitat, particularly mature or old growth forest containing hollow-bearing trees and sap-feeding trees.

Due to the proposed removal of woodland and hollow-bearing trees, the proposal is not consistent with the recovery actions identified on the OEH (2015) Threatened Species website for the Squirrel Glider. The proposed removal of habitat is however unlikely to significantly affect the 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 three listed key threatening processes relevant to the Squirrel Glider:

- Clearing of native vegetation – the proposal would remove 2.1 hectares of native woodland habitat. This is unlikely to represent a significant loss of habitat, as described above
- Loss of hollow-bearing trees – the proposal would remove 13 hollow-bearing trees from the subject site with all of these trees containing hollows suitable as breeding habitat for the Squirrel Glider. The removal of these trees has the potential to affect the Squirrel Glider which may use them for denning; however these only represent a minor fraction of the hollow-bearing trees in the study area
- Removal of dead wood and dead trees – the proposal would remove one dead tree, which represents only a minor fraction of the dead trees in the study area.

Conclusion

The proposal would be unlikely to have a significant effect on the Squirrel Glider.

Freshwater fishes

- Trout Cod (*Maccullochella macquariensis*)
- Silver Perch (*Bidyanus bidyanus*)

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 study area provides known habitat for Silver Perch and Trout Cod.

Silver Perch are known to occur in the study area and are often found in similar habitats as Murray Cod (lowland, turbid and slow-flowing rivers).

Spawning occurs in spring and early summer upstream following a significant upstream migration. One of the key threats to the species is river regulation and the reduction of connectivity and removal of key habitat including riparian vegetation and large woody debris.

During the demolition of the bridge and its replacement, there will likely be increases in siltation and some removal of snags under the bridge and in the immediate vicinity. However, it is unlikely that the proposal would have a significant impact on the life cycle of either the Silver Perch or Murray Cod because during these disturbances fish passage will not be compromised in the study area. The sedimentation risk associated with the project is not expected to lead to an adverse impact if the proper mitigation measures are implemented.

In the case of Trout Cod, there are no recent records of any of these species in the study area which makes any impact to the life cycle of these species highly unlikely.

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

No known endangered populations of Silver Perch or Trout Cod 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

Minimal habitat is expected to be impacted within the waterway, with the exception of the bridge removal itself and the potential impacts created by the installation of the pylon on the northern side of the bridge. These impacts include potential disturbance to the river bed which may alter some foraging habitat. However, given the small area of impact, it is deemed unlikely that this will have a substantial impact on Silver Perch or Trout Cod.

Some woody debris and snags exist under the bridge and with particular reference to pier one and the right hand side bank. However, the foot print of the proposal would be minimal in comparison to the significant availability of similar habitat in the upstream and downstream reaches.

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

The proposal will not result in the isolation or fragmentation of key habitat. Fish will be able to move throughout the study area. The use of silt curtains and coffer dams as part of this phase of the project will also result in partial blockage of the waterway.

The proposal would be unlikely to substantially affect fish passage due to the relatively small proportion of the river cross section that the new piers, temporary work platforms and existing piers would occupy. The piers would be unlikely to substantially change the hydrology of the river.

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 large woody debris under the existing bridge and in the immediate vicinity of the bridge which is likely habitat for all of the listed fish species. The proposal would therefore remove potential shelter and breeding habitat for the threatened fish species accessed.

The area of habitat for these species proposed to be removed is relatively small. Areas of high quality habitat value exist throughout the study site at regular intervals. Therefore the removal of large woody debris from beneath the bridge or in the immediate vicinity of the bridge does not represent habitat critical to any of the threatened fish species. It is unlikely that the relatively small area of habitat to be removed would be of significant importance 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 exists for the Silver Perch (NSW DPI, 2006). The objectives of this recovery plan are to:

- Increase awareness of the current status of silver perch throughout its range.
- Increase scientific knowledge of the current distribution, ecological and habitat requirement and population genetics of silver perch.
- Protect and enhance remaining natural populations of silver perch.
- Ameliorate the impacts of known major threats to silver perch.
- Minimise any fishing impacts on natural populations through enhanced compliance with fishing regulations and involvement of recreational fishers.
- Improve management of aquaculture and stocking programs.
- improve management of aquaculture and stocking programs through enhanced compliance with fish recovery actions.
- Establish a program to monitor the status of Silver Perch and evaluate the effectiveness of recovery actions.

A recovery plan exists for the Trout Cod (NSW DPI, 2006).

The objectives of the Trout Cod recovery plan are to:

- Ensure the security of the existing trout cod population in the Murray River by maintaining and restoring, where necessary, the aquatic habitat in that locality, and through habitat

protection mechanisms

- Establish and protect a minimum of two new self-sustaining populations of Trout Cod at selected locations throughout the species' former range
- Reduce fishing related mortality of trout cod by setting appropriate regulatory controls and by maximising angler compliance
- Increase scientific knowledge of the distribution, population size, ecological requirements, and historical and existing genetic status of Trout Cod
- Improve our understanding of the threats to the survival of Trout Cod, and contribute to management actions to ameliorate identified threats
- Coordinate and initiate new community awareness and education programs relating to Trout Cod
- Coordinate and support appropriate actions by the community and government to provide a strategic, regional approach to trout cod survival and effective threat management
- Increase awareness of the status of and threats to trout cod, and enhance community support for recovery actions
- Assess the outcomes of past and current recovery actions and the species' conservation status.

Due to the proposed removal of habitat, and the potential increase in sedimentation, the proposal is not consistent with the recovery actions for the list threatened fish species. The proposed removal of habitat is however relatively small and unlikely to significantly affect any of the threatened fish species, as described above. The increased sedimentation in the Wakool River is also likely to be minimal and the effects are predicted to be very low.

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

Two key threatening processes are listed under the FM Act are relevant to this proposal:

- *The removal of large woody debris from NSW rivers and streams*
- *The degradation of native riparian vegetation along NSW water courses.*

Large woody debris provides important habitat and shelter for native fish in the rivers of NSW. Snags are often used for breeding and resting locations and they provide shelter from predators. Snags also support other aquatic organisms that fish species use as a food source. The removal of large woody debris adversely affects several threatened species.

The proposal would remove large woody debris under the existing bridge and in the immediate vicinity of the bridge which is likely habitat for all of the listed fish species. The proposal would therefore remove potential shelter and breeding habitat for the threatened fish species accessed. However, the risk to threatened fish species can be offset by relocating any snags or large woody debris that has to be removed as part of the Proposal. Furthermore, given the extent of the large woody debris and snags in the broader study area, the risk associated with the removal and / or relocation of woody habitat is considered negligible.

In the case of native riparian habitat, the majority of the ground cover was bare. However there were extensive continuous and semi continuous stands of the emergent macrophyte *Cyperus exaltatus* and clumps of *Juncus* spp. and *Bolboschoenus* spp. along either embankment. Under the *Fisheries Management Act 1994* the degradation of native riparian vegetation has been listed as a KTP because of the negative impacts clearing and degradation can have on threatened populations, species and communities.

The proposal will likely remove small patches of the macrophytes listed on either side of the bridge. However, because of the extent of these macrophytes in the study area, it is considered highly unlikely that this would have any detrimental impact on any threatened species, population or community in the study area.

Conclusion

The proposal would be unlikely to have a significant effect on the Trout Cod or Silver Perch.

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 national environmental significance are known or likely to occur in the area of the proposed action:

- Cattle Egret (*Ardea ibis*) (Migratory)
- Fork-tailed Swift (*Apus pacificus*) (Migratory)
- Great Egret (*Ardea alba*) (Migratory)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- South-eastern Long-eared Bat (*Nyctophilus corbeni*) (Vulnerable)
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) (Vulnerable)
- Silver Perch (*Bidyanus bidyanus*) (Critically Endangered)
- Murray Cod (*Maccullochella peelii*) (Vulnerable)
- Trout Cod (*Maccullochella macquariensis*) (Endangered)

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

The proposal would remove 2.1 hectares of native woodland and shrubland habitat. Trees to be removed include a mixture of juvenile and mature trees from remnant woodland on the floodplain of the Wakool River.

Thirteen hollow-bearing trees would be removed from the subject site. The removal of these trees has the potential to affect hollow-dependent fauna in the study area, including the South-eastern Long-eared Bat and Yellow-bellied Sheath-tail-bat. Trees to be removed provide roosting, movement and foraging habitat for a range of fauna species, including these threatened species that may use the study area for foraging. The removal of a relatively small area of habitat is unlikely to substantially affect any matters of NES due to the presence of much greater areas of habitat in the study area and locality.

The proposal would remove groundcover vegetation, shrubs and potentially emergent macrophytes along the river margins where the approach road and bridge are constructed, which may remove foraging and movement habitat for a range of fauna species.

The woodland in the study area may also provide roosting, foraging and movement habitat for the Cattle Egret, Fork-tailed Swift, White-bellied Sea-eagle and Great Egret. The woodland in the study area is however unlikely to be important to these species because:

- The habitat does not occur within a region that supports an ecologically significant proportion of the population of any of these species. The species have large distributions and the region of the proposal is not recognised as having a large proportion of the species
- The habitat in the study area does not provide preferred breeding habitat for these 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.

Therefore the migratory species listed above have not been further considered in the migratory species assessment.

The proposal would remove woodland that is likely to provide habitat for the threatened biota listed above and is therefore likely to have impacts on these biota.

The proposal would remove large woody debris that is likely to provide habitat for threatened fish species listed above.

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 6 of this report.

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

Important populations

In accordance with the Significant Impact Guidelines (DoE 2013), an 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

In the absence of specific information on whether important populations of the vulnerable species below are likely to occur in the study area, it is assumed that important populations of these species are likely to occur.

Vulnerable Species – Silver Perch, Murray Cod, Trout Cod,

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 instream woody debris, the emergent macrophytes and river contours are potential habitat for all of the listed threatened fish species.

Silver Perch and Murray Cod are known to occur in the study area, while the others are predicted to occur based on their known range and / or habitat suitability.

The proposed removal of large woody debris and small stands of emergent macrophytes is unlikely to limit the availability of this habitat type in the study area.

Good quality habitat for these species is present in other parts of the study area and the locality. Due to the mobility and relatively large ranges of these species, it is unlikely that the proposal would lead to a long-term decrease in the size of a population of Silver Perch, Murray Cod, Trout Cod.

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

The instream woody debris, the emergent macrophytes and river contours are potential habitat for all of the listed threatened fish species.

Silver Perch and Murray Cod are known to occur in the study area, while the others are predicted to occur based on their known range and / or habitat suitability.

The proposed removal of large woody debris and small stands of emergent macrophytes is unlikely to limit the availability of this habitat type in the study area due to the extent and frequency of quality habitat occurring in the study area.

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

No. The small footprint of the proposal is unlikely to cause fragmentation of the local population. During demolition and construction there will no need to block the instream passage at any time.

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

No. If there is a requirement for the removal of instream habitat, such as snags, then these should be reinstated once works have been completed, or suitably relocated.

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

Breeding of all the listed species occurs in spring and early summer. Silver Perch have an extended breeding period from September to April. Assuming the longitudinal connection is maintained in the study area, the Proposal will not disrupt the breeding cycle of the listed species. A conservative approach to minimise risk would involve conducting instream works outside of the months of September to April.

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

No. If there is a requirement for the removal of instream habitat, such as snags, then these should be reinstated once works have been completed, or suitably relocated. There is also extensive quality available habitat upstream and downstream of the study area so that if habitat were removed, the impacts on a species would be very minimal.

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

It is unlikely that additional invasive aquatic species would be introduced as part of the project. The study area already supports a number of alien fish species.

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

The likelihood of the introduction of disease from the project is minimal. All machinery and equipment will be cleaned prior to instream works according to standard operating procedures and the appropriate management plans.

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

The relatively small amount of woody debris or clearing of macrophytes in the study area compared to the area of habitat in the study area and locality would be unlikely to significantly interfere with the recovery of any of the threatened fish species listed.

Conclusion

The proposal would be unlikely to have a significant effect on the vulnerable fish species listed.

Vulnerable Species – South-eastern Long-eared Bat, Yellow-bellied Sheathtail-bat

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;**

Based on resources present and records in the locality, the woodland in the study area may provide habitat for the South-eastern Long-eared Bat and Yellow-bellied Sheathtail-bat.

The woodland in the study area provides potential foraging habitat for both bat species.

Trees in the study area also provide potential roosting and breeding habitat for the South-eastern Long-eared Bat and Yellow-bellied Sheathtail-bat in hollows or under loose bark.

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

The proposed removal of woodland would reduce the amount of foraging, roosting, movement and breeding habitat for threatened bats in the study area. The proposal would remove 2.1 hectares of native woodland habitat, including 13 hollow-bearing trees. This represents up to two per cent of the woodland in the study area and a minor fraction of the habitat in the locality. Murray Valley National Park, located in the study area, contains over 1600 hectares of native woodland directly connected to the subject site.

Thirteen hollow-bearing trees would be removed from the subject site. The removal of these trees is unlikely to affect the life cycle of the threatened bats due to the presence of many more habitat trees in the study area and locality. The removal of these trees would be unlikely to represent a significant loss of potential breeding habitat in the potential home ranges of these species.

The proposed removal of woodland habitat is relatively minor due to the small amount of habitat to be affected compared to the amount of habitat present in the study area and locality.

Good quality habitat for these species is present in other parts of the study area and the locality. Due to their mobility, it is unlikely that the proposal would lead to a long-term decrease in the size of an important population of these bat species.

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

The woodland in the study area forms part of the riparian corridor along the Wakool River and also forms part of the vegetation in Murray Valley National Park that extends outside of the study area. Woodland in the study area also provides connectivity to remnant vegetation outside the locality, including Koondrook and Perricoota State Forests and the riparian corridor of the Murray River to the south.

Fragmentation of the vegetation in the locality has previously occurred through the development of surrounding areas for agriculture and construction of linear infrastructure, including the Swan Hill-Barham Road. These developments are unlikely to prevent the threatened bats assessed from using the study area. A large expanse of woodland and potential habitat for the species still exists in the study area.

The proposal may result in the increased fragmentation of woodland habitat by increasing the distance between mature trees, decreasing the groundcover and reducing the overall extent of native vegetation cover. The removal of vegetation would marginally reduce vegetation connectivity along the Wakool River and in the patch of woodland. The proposal would create a gap in the vegetation of about 20-25 metres. It is unlikely that the proposal would significantly fragment woodland habitat in the study area.

Due to the small extent of vegetation removal involved, the proposal would be unlikely to result in significant additional fragmentation. 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 home ranges, the proposal is unlikely to create any substantial barriers to movement for these species or isolate them from other areas of habitat. The proposal would not fragment an existing important population into two or more populations.

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

Woodland habitats are important to the survival of the South-eastern Long-eared Bat and Yellow-bellied Sheath-tail-bat. The woodland to be removed provides potential habitat for both species. These species could potentially use hollow-bearing trees and loose bark in the study area for breeding. Vegetation in the study area is providing potential breeding and foraging habitat for this species by providing habitat suitable for its prey (eg invertebrates). The loss of this vegetation represents a loss of potential foraging habitat for this species.

The area of habitat for these species proposed to be removed is relatively small. Areas of high quality habitat value exist in patches connected to the study area, including the surrounding Murray Valley National Park. Given the mobility of the species, it is unlikely that the relatively small area of habitat to be removed would be important to the South-eastern Long-eared Bat or Superb Parrot.

The proposal is therefore unlikely to adversely affect habitat critical to the survival of the South-eastern Long-eared Bat or Yellow-bellied Sheath-tail-bat.

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

Roosting and breeding habitat for the South-eastern Long-eared Bat and Yellow-bellied Sheath-tail-bat may be present in the form of tree hollows and loose bark.

Thirteen hollow-bearing trees would be removed from the subject site. The removal of 13 hollow-bearing trees is unlikely to substantially affect the life cycle of these bat species due to the presence of many more habitat trees in the study area and in the locality.

The removal of a relatively small amount of vegetation and low number of habitat trees would be unlikely to significantly disrupt the breeding cycle of an important population of the South-eastern Long-eared Bat or Yellow-bellied Sheath-tail-bat.

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

The proposed removal of trees would reduce the amount of potential foraging, roosting, breeding and movement habitat for the South-eastern Long-eared Bat and Yellow-bellied Sheath-tail-bat in the study area. Habitat would be removed as described in 2) above. Areas of high quality habitat value exist in patches outside the study area and in the locality, including Murray Valley National Park. The proposal would therefore be unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the South-eastern Long-eared Bat and Yellow-bellied Sheath-tail-bat are likely to decline.

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

The South-eastern Long-eared Bat and Yellow-bellied Sheathtail-bat 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.

Due to the species large home ranges and mobility, and implementation of safeguards to minimise the spread of weeds, 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 be unlikely to introduce disease that may cause the South-eastern Long-eared Bat and Yellow-bellied Sheathtail-bat to decline.

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

The relatively small amount of vegetation to be removed by the proposal, compared to the area of habitat in the study area and locality would be unlikely to significantly interfere with the recovery of the South-eastern Long-eared Bat or Yellow-bellied Sheathtail-bat.

Conclusion

The proposal would be unlikely to have a significant effect on the vulnerable South-eastern Long-eared Bat or Yellow-bellied Sheathtail-bat.

Appendix F – Database search results



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: 12/06/15 15:05:59

[Summary](#)

[Details](#)

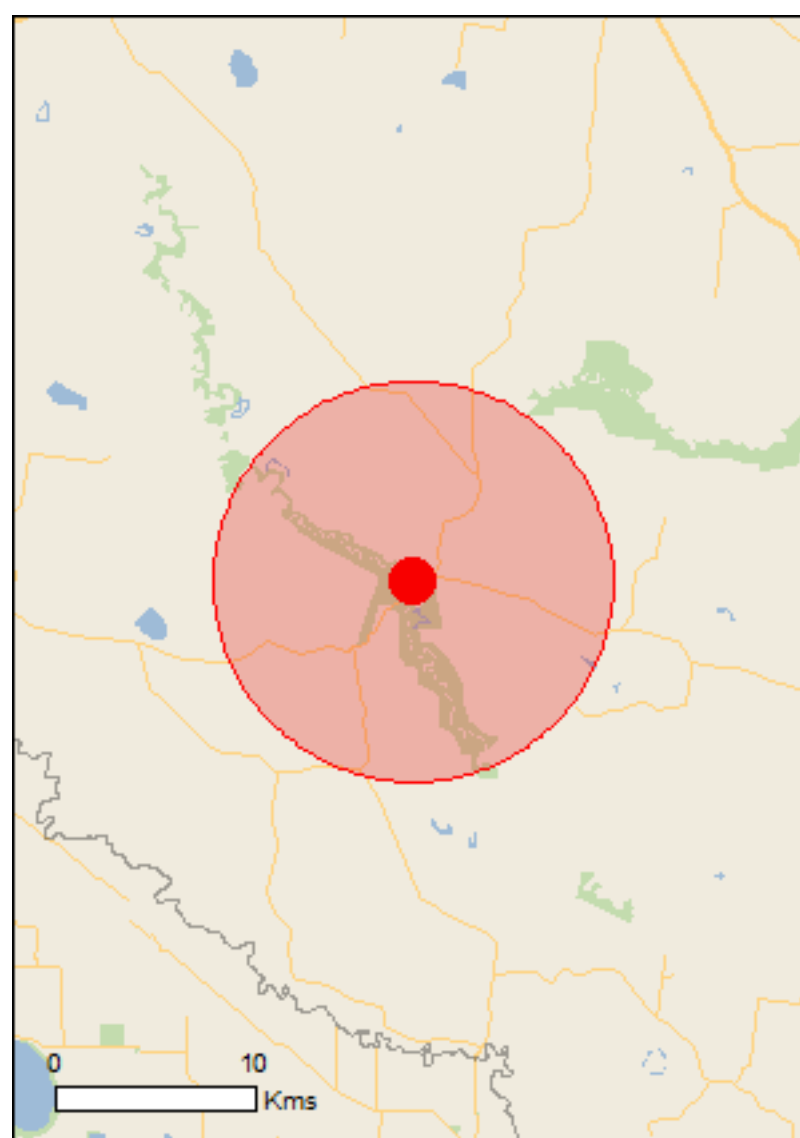
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

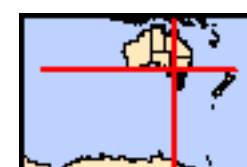
[Acknowledgements](#)



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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:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	16
Listed Migratory Species:	8

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. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

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:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	9
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	22
Nationally Important Wetlands:	2
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
Nsw central murray state forests	Within 10km of 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
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	Community may occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
Natural Grasslands of the Murray Valley Plains	Critically Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
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 may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Pedionomus torquatus Plains-wanderer [906]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Bidyanus bidyanus Silver Perch, Bidyan [76155]	Critically Endangered	Species or species habitat likely to occur within area
Craterocephalus fluviatilis Murray Hardyhead [56791]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may 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 may occur within area
Mammals		
Nyctophilus corbeni South-eastern Long-eared Bat [83395]	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		
Austrostipa metatoris [66704]	Vulnerable	Species or species habitat known to occur within area
Austrostipa wakoolica [66623]	Endangered	Species or species habitat likely to occur within area
Caladenia tensa Greencomb Spider-orchid, Rigid Spider-orchid [24390]	Endangered	Species or species habitat may occur within area
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 likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Breeding known to 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

Name	Threatened	Type of Presence area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	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 - Australian Telecommunications Commission

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 likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to 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
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Murray Valley	NSW

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
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Birds

Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
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Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
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Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
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Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
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Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
--	--	--

Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
--	--	--

Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
--	--	--

Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
---	--	--

Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
---	--	--

Mammals

Canis lupus familiaris Domestic Dog [82654]		Species or species
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Name	Status	Type of Presence
Felis catus Cat, House Cat, Domestic Cat [19]		habitat likely to occur within area Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

Plants

Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to 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

Nationally Important Wetlands [Resource Information]

Name	State
Koondrook and Perricoota Forests	NSW
Werai Forest	NSW

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 and National Heritage properties, Wetlands of International and National 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.

Coordinates

-35.32989 143.92806

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.

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) ,Commonwealth listed ,CAMBA listed ,JAMBA listed or ROKAMBA listed Entities in selected area [North: -35.15 West: 143.73 East: 144.13 South: -35.53] returned a total of 171 records of 16 species.

Report generated on 12/04/2017 10:45 AM

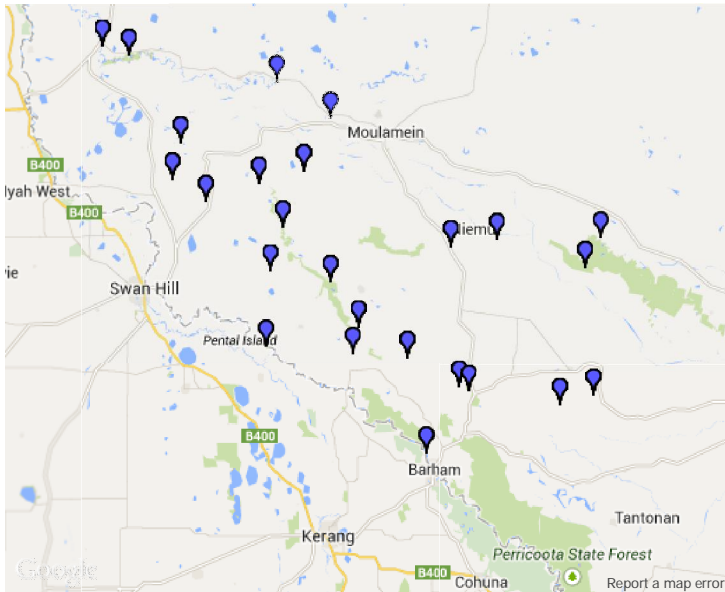
Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Hylidae	3207	<i>Litoria raniformis</i>		Southern Bell Frog	E1,P	V	1	
Animalia	Aves	Ardeidae	0977	<i>Ardea ibis</i>		Cattle Egret	P	C,J	4	
Animalia	Aves	Accipitridae	0218	<i>Circus assimilis</i>		Spotted Harrier	V,P		1	
Animalia	Aves	Falconidae	0238	<i>Falco subniger</i>		Black Falcon	V,P		1	
Animalia	Aves	Burhinidae	0174	<i>Burhinus grallarius</i>		Bush Stone-curlew	E1,P		10	
Animalia	Aves	Pedionomidae	0020	<i>Pedionomus torquatus</i>		Plains-wanderer	E1,P	CE	1	
Animalia	Aves	Laridae	0111	<i>Gelochelidon nilotica</i>		Gull-billed Tern	P	C	85	
Animalia	Aves	Cacatuidae	0270	<i>Lophochroa leadbeateri</i>		Major Mitchell's Cockatoo	V,P,2		2	
Animalia	Aves	Strigidae	0246	<i>Ninox connivens</i>		Barking Owl	V,P,3		1	
Animalia	Aves	Climacteridae	8127	<i>Climacteris picumnus victoriae</i>		Brown Treecreeper (eastern subspecies)	V,P		17	
Animalia	Aves	Pomatostomidae	8388	<i>Pomatostomus temporalis temporalis</i>		Grey-crowned Babbler (eastern subspecies)	V,P		13	
Animalia	Aves	Neosittidae	0549	<i>Daphoenositta chrysoptera</i>		Varied Sittella	V,P		3	
Animalia	Aves	Petroicidae	8367	<i>Melanodryas cucullata cucullata</i>		Hooded Robin (south-eastern form)	V,P		3	
Plantae	Flora	Chenopodiaceae	2124	<i>Maireana cheelii</i>		Chariot Wheels	V,P	V	1	
Plantae	Flora	Poaceae	10389	<i>Austrostipa metatoris</i>		A spear-grass	V,P	V	11	
Plantae	Flora	Poaceae	10388	<i>Austrostipa wakoolica</i>		A spear-grass	E1,P	E	17	



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Threatened & protected species - records viewer

Records for this map are from the NSW Department of Primary Industries 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

Murray cod	Waterbody: Wakool River	Year: 1998	Datasource: Research
Murray cod	Waterbody: Wakool River	Year: 1998	Datasource: Research
Murray cod	Waterbody: Wakool River	Year: 1998	Datasource: Research
Murray cod	Waterbody: Wakool River	Year: 1998	Datasource: Research
Murray cod	Waterbody: Murrumbidgee River	Year: 2004	Datasource: Research

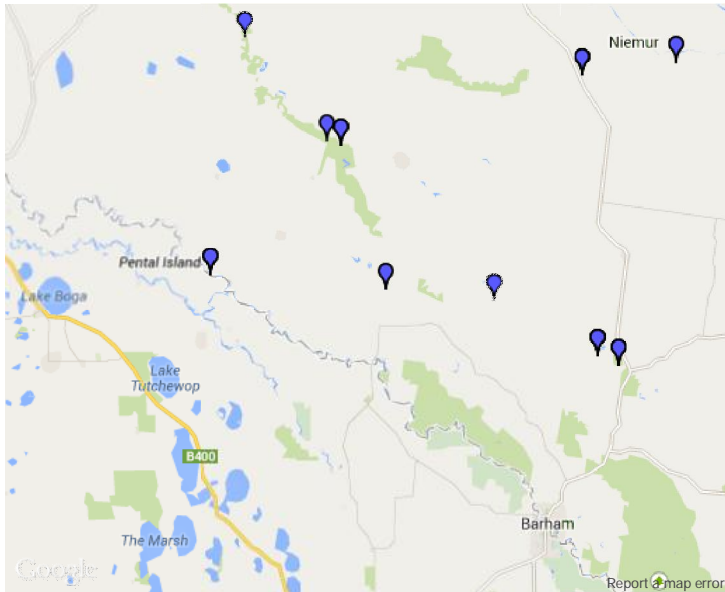




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Records search

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 pre 1980
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 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

Silver perch	Waterbody: Wakool River	Year: 1976	Datasource: Research
Silver perch	Waterbody: Wakool River	Year: 1995	Datasource: Research
Silver perch	Waterbody: Merran Creek	Year: 2005	Datasource: Research
Silver perch	Waterbody: Edward River	Year: 2005	Datasource: Research
Silver perch	Waterbody: Edward River	Year: 2005	Datasource: Research
Silver perch			





Healthy Environment, Healthy Community, Healthy Business

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Attention Internet Explorer 10 users

Some functionality on this webpage is currently not compatible with Internet Explorer 10.

We recommend you enable compatibility mode on your browser:

1. Press F12 on your keyboard to display the developer tools
2. On the developer tools menu, select Browser Mode then select Internet Explorer 9

Your original settings will be restored when you close the browser window. We are working to resolve this issue and apologise for the inconvenience.

Search results

Your search for: LGA: Wakool Shire Council

did not find any records in our database.

If a site does not appear on the record it may still be affected by contamination. For example:

- Contamination may be present but the site has not been regulated by the EPA under the Contaminated Land Management Act 1997 or the Environmentally Hazardous Chemicals Act 1985.
- The EPA may be regulating contamination at the site through a licence or notice under the Protection of the Environment Operations Act 1997 (POEO Act).
- Contamination at the site may be being managed under the [planning process](#).

More information about particular sites may be available from:

- The [POEO public register](#)
- The appropriate planning authority: for example, on a planning certificate issued by the local council under [section 149 of the Environmental Planning and Assessment Act](#).

See [What's in the record and What's not in the record](#).

If you want to know whether a specific site has been the subject of notices issued by the EPA under the CLM Act, we suggest that you search by Local Government Area only and carefully review the sites that are listed.

This public record provides information about sites regulated by the EPA under the Contaminated Land Management Act 1997, including sites currently and previously regulated under the Environmentally Hazardous Chemicals Act 1985. Your inquiry using the above search criteria has not matched any record of current or former regulation. You should consider searching again using different criteria. The fact that a site does not appear on the record does not necessarily mean that it is not affected by contamination. The site may have been notified to the EPA but not yet assessed, or contamination may be present but the site is not yet being regulated by the EPA. Further information about particular sites may be available from the appropriate planning authority, for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act. In addition the EPA may be regulating contamination at the site through a licence under the Protection of the Environment Operations Act 1997. You may wish to search the [POEO public register](#)

[Search Again](#)

[Refine Search](#)

Search TIP

To search for a specific site, search by LGA (local government area) and carefully review all sites listed.

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26 June 2015

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	M. Cotterill/ P. Taylor	L. Maloney/ C. McClung		S. Farrell		6/11/2015
1	R. Robinson	R. Robinson		S. Farrell		12/4/2017
4	R. Robinson	R. Robinson		S. Farrell		8/6/2017

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