Gee Gee Bridge replacement

Review of environmental factors

June 2017

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Roads and Maritime Services

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Approval and authorisation

Title	Gee Gee Bridge replacement review of environmental factors
Accepted on behalf of NSW Roads and Maritime Services by:	Dean Howard Senior Project Development Officer
Signed:	
Dated:	30/6/2017

Executive summary

The proposal

Roads and Maritime Services (Roads and Maritime) proposes to replace the existing Gee Gee Bridge at the Noorong Road (Main Road 94) crossing of the Wakool River. The proposal also includes realigning about 1.4 kilometres of Noorong Road. The existing Gee Gee Bridge is listed as a heritage item on the NSW State Heritage Register.

Roads and Maritime would manage the construction of the new bridge and removal of the existing Gee Gee Bridge and flood relief bridge. Murray River Council (Council) would manage the construction of the approach roads on behalf of Roads and Maritime. Once complete, ownership of the new bridge would transfer to Council.

Key features of the proposal include (see Figure 1.1):

- 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
- realigning about 1.4 kilometres of Noorong Road
- demolishing and removing the existing Gee Gee Bridge and flood relief bridge
- a new rest area near the southern end of the existing bridge.

Need for the proposal

Noorong Road links Deniliquin in NSW and Swan Hill in Victoria. The route has been identified as a strategic freight route in NSW. It is also an alternative freight route between Wagga Wagga in NSW and Swan Hill.

The existing Gee Gee Bridge and flood relief bridge restrict traffic because they do not meet current road design standards. The existing bridges:

- are narrow, with one lane, and vehicles must give way to oncoming traffic
- are not suitable for higher mass limit vehicles (HML) or oversized vehicles
- cannot be upgraded to meet the future operational needs of Noorong Road.

The proposal is required to meet current road design standards, remove traffic restrictions and improve road safety.

Proposal objectives

The primary objectives of the proposal are to:

- provide access across the Wakool River for higher mass limit vehicles (longer trucks carrying heavier loads) and oversized vehicles
- provide road infrastructure that supports:
  - the NSW and Victorian economies through improved connectivity of goods
  - the Swan Hill region's local and regional economy
- improve road safety
- minimise impacts on the natural environment, including:
  - native vegetation and habitat on the Wakool River floodplain

  - water quality and aquatic habitats of the Wakool River
- minimise impacts on the local community.

Options considered

Options considered for the proposal included:

- option 1 – new straight bridge immediately downstream of existing bridge, 80 km/h
- option 2 – new straight bridge immediately upstream of existing bridge, 80 km/h
- option 3 – new straight bridge 500 metres upstream of existing bridge, 100 km/h
- option 4 – new straight bridge immediately downstream of existing bridge, 100 km/h
- option 5 – new curved bridge immediately downstream of existing bridge, 80 km/h
- option 6 – do nothing.

The five potential alignments were assessed against the following considerations:

- land acquisition
- community impacts
- environmental impacts
- cost
- design considerations.

The preferred option is option 1, which is considered to best achieve the proposal objectives.

Option 1 is the preferred alignment option for the following reasons:

- it involves limited land acquisition and does not require land acquisition in the Murray Valley National Park
- it has low impacts on the 'Rest-down' property
- it has low environmental impact through native vegetation removal
- it is cost effective.

Statutory and planning framework

The NSW *State Environmental Planning Policy (Infrastructure) 2007* permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for the purpose of a road and is to be carried out by Roads and Maritime, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Development consent is not required. This review of environmental factors (REF) has been prepared to assess the proposal.

The description of the proposal and associated environmental impacts has been carried out in the context of clause 228 of the NSW *Environmental Planning and Assessment Regulation 2000*, the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1994*. In doing so, the REF helps to fulfil the requirements of Section 111 of the EP&A Act; that Roads and Maritime examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

Community and stakeholder consultation

Roads and Maritime has consulted with the following government authorities in line with the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP):

- Office of Environment and Heritage – National Parks and Wildlife Service
- Murray River Council.

Roads and Maritime and Council have also consulted with:

- the owner of the property 'Rest-down', north of Gee Gee Bridge
- Wamba Wamba Local Aboriginal Land Council
- Office of Environment and Heritage – National Parks and Wildlife Service, in relation to environmental impact assessment and proposed land acquisition from the property north of Noorong Road (Lot 101, DP 914897)
- Department of Primary Industries – Fishing and Aquaculture
- Department of Primary Industries – Water
- Murray Darling Basin Authority.

If the proposal is determined to proceed, ongoing consultation would occur with the community and stakeholders.

Environmental impacts

Benefits of the proposal would include:

- access across the Wakool River for higher mass limit vehicles and oversized vehicles
- improved road safety
- supporting the region's economic welfare by improving access across the Wakool River.

The proposal's main adverse impacts would include:

- demolition of Gee Gee Bridge, an item of state heritage significance listed on the NSW State Heritage Register (SHR). Demolition of the existing bridge will require delisting of the Gee Gee Bridge from the SHR. This impact would be mitigated in line with Roads and Maritime's 'Timber Truss Bridge Conservation Strategy' and recommendations in the Statement of Heritage Impact. Specific mitigation measures will include photographic archival recording, interpretive signage and access to the site of the original bridge
- biodiversity impacts, which are listed as key threatening processes under the TSC Act and/or the EPBC Act:
  - removing 2.1 hectares of native vegetation and habitat for listed fauna (such as the Brown Treecreeper and Gilbert's Whistler)
  - removing 13 hollow-bearing trees

  A flora and fauna management sub-plan will detail, as a minimum, exclusion zone requirements, re-use of cleared vegetation and fauna protection measures during construction
- temporary construction noise impacts on the residence at 'Rest-down'. This will be minimised by ongoing consultation with the resident and implementation of standard works hours and practices

- permanently acquiring about 1.57 hectares of land from the property north of Noorong Road (Lot 101, DP 914897). This impact will be mitigated by a land swap of the existing road reserve for the proposed acquired land
- a range of other short and long-term changes in amenity and environmental risks, including soils and erosion, noise, water quality, air quality and waste management. The adverse environmental impacts would be minimised through the implementation of safeguards and management measures outlined in this REF.

Justification and conclusion

The proposal is required to meet current design standards, remove restrictions to traffic and improve road safety.

This REF has examined and taken into account to the fullest extent possible all matters affecting, or likely to affect, the environment by reason of the activity. The REF found that the proposal would not result in significant environmental impacts or be of such a nature or extent as to be regarded as unacceptable. The safeguards and management measures detailed in this REF would avoid or minimise the expected impacts. Overall, the REF finds that any negative impacts are outweighed by the proposal's longer term positive impacts.

Display of the review of environmental factors

This REF is on display for comment from Monday 17 July to Monday 14 August 2017. You can access the documents in the following ways:

Internet

The documents will be available to view or download on the Roads and Maritime website at http://www.rms.nsw.gov.au/projects/south-western/replacement-gee-gee-bridge/index.html.

Display

The documents will be on display at the following locations:

- Murray Valley Council offices at Moulamein, 20 Tualka Terrace
- Murray Valley Council offices at Barham, 15 Murray Street
- Murray Downs Golf & Country Club, 100 Murray Downs Drive, Murray Downs.

The REF can be viewed during office hours at these locations, Monday to Friday, between 9am and 5pm.

Purchase

The documents are available for purchase in hard copy ($25) or CD/USB ($10) by contacting Roads and Maritime Senior Project Development Officer, Dean Howard, on (02) 6923 6521.

How can I make a submission?

To make a submission on the proposal, please send your written comments to dean.howard@rms.nsw.gov.au, or

Roads and Maritime Services
Senior Project Development Officer
Dean Howard
PO Box 484
Wagga Wagga, NSW 2650

Submissions must be received by Monday 14 August 2017.

Privacy information

All information included in submissions is collected for the sole purpose of assisting in the assessment of this proposal. The information may be used during the environmental impact assessment process by Roads and Maritime.

Where the respondent indicates at the time of supply of information that their submission should be kept confidential, Roads and Maritime will attempt to keep it confidential. However, there may be legislative or legal justification for the release of the information, for example under the *Government Information (Public Access) Act 2009* or under subpoena or statutory instrument.

The supply of this information is voluntary. Each respondent has free access at all times to the information provided by that respondent but not to any identifying

information provided by other respondents if a respondent has indicated that the representation should be kept confidential.

Any respondent may make a correction to the information that they have provided by writing to the same address the submission was sent.

The information will be held by Roads and Maritime, 193-195 Morgan Street, Wagga Wagga 2650.

What happens next?

Following the submissions period, Roads and Maritime will collate submissions. Acknowledgement letters will be sent to each respondent. The details of submission authors will be retained and authors will be subsequently advised when project information is released.

After consideration of community comments Roads and Maritime will determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are necessary. The community will be kept informed regarding this Roads and Maritime determination.

If the proposal goes ahead, Roads and Maritime proceeds with final design and tenders are called for construction of the project.

If you have any queries, please contact Senior Project Development Officer, Dean Howard, on (02) 6923 6521.

Contents

Appendices

1 Introduction

1.1 Proposal identification

Roads and Maritime Services (Roads and Maritime) proposes to replace the existing Gee Gee Bridge at the Noorong Road (Main Road 94) crossing of the Wakool River. The proposal also includes realigning about 1.4 kilometres of Noorong Road. The existing Gee Gee Bridge is listed as a heritage item on the NSW State Heritage Register.

Roads and Maritime would manage the construction of the new bridge and removal of the existing Gee Gee Bridge and flood relief bridge. Murray River Council (Council) would manage the construction of the approach roads on behalf of Roads and Maritime. Once complete, ownership of the new bridge would transfer to Council.

The proposal site is located about 33 kilometres east of Swan Hill (see Figure 1.1). It is located in Roads and Maritime's South West Region and in the Murray River Council local government area.

Key features of the proposal include (see Figure 1.1):

- 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
- realigning about 1.4 kilometres of Noorong Road
- demolishing and removing the existing Gee Gee Bridge and flood relief bridge
- a new rest area near the southern end of the existing bridge.

The proposal is required to meet current design standards, remove traffic restrictions and improve road safety. The proposal is planned to start in 2017/18 and would be constructed over about two years. It would be funded by the NSW Government through the Bridges for the Bush program.

The Wakool River flows from east to west through the study area. The proposal site is located in the existing road reserve passing through Murray Valley National Park. A residence is located north of the eastern end of the proposal site at 'Rest-down', 3357 Noorong Road (see Figure 1.1).

The study area contains extensive areas of River Red Gum (*Eucalyptus camaldulensis*) forest and Black Box (*Eucalyptus largiflorens*) woodland on the floodplain of the Wakool River. These vegetation communities are known or likely to provide habitat for a number of threatened fauna species such as the Brown Treecreeper (*Climacteris picumnus victoriae*). The Wakool River contains a threatened ecological community, the 'Aquatic ecological community in the natural drainage system of the lower Murray River catchment'. The river is known or likely to provide habitat for threatened fish species.

For the purposes of this REF, the following definitions are used:

- The 'proposal site' – refers to the area required for the construction of the proposal, including construction activities and construction vehicle access. It includes the construction footprint, site compound, stockpile sites and any areas that would be disturbed

- The ‘study area’ – the area likely to be affected by the proposal, either directly or indirectly. The ‘study area’ is defined by the extent of the potential impacts of the proposal relating to each specific discipline
- The ‘locality’ – the area within a 10 kilometre radius of the proposal site.

1.2 Purpose of the report

This REF has been prepared by GHD for Murray River Council, who is managing the project on behalf of Roads and Maritime. For the purpose of these works, Roads and Maritime is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, document the likely impacts of the proposal on the environment and detail protective measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts have been carried out in context of clause 228 of the *Environmental Planning and Assessment Regulation 2000*, the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government’s *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of section 111 of the EP&A Act, including that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act
- the significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement
- the significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured
- the potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of the Environment and Energy for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

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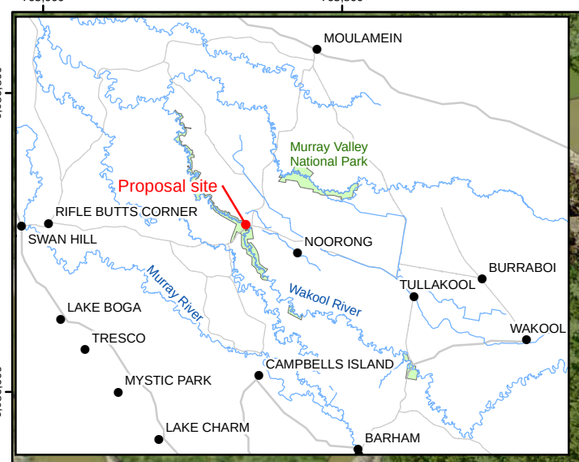

Murray Valley National Park

Lot 101, DP 914897

Residence - 'Re st-down' 3357 Noorong Road

Nacurrie Road

Proposed stockpile/ compound site

Proposed stockpile/ compound site (existing site)

Noorong Road

Proposed new bridge

Existing flood relief bridge

Property access road

Proposed compound site

Existing Gee Gee Bridge

Proposed rest area

Wakool River

Murray Valley National Park

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Paper Size A3

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

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LEGEND

- Road design
- Existing road
- Proposal 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

Proposal site

Figure 1.1

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Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia T 61 2 6923 7400 F 61 2 6971 9565 E wg amail@ghd.com W www .ghd.com

Data source: NSW Government: Roads, localities, waterways & National Parks - 2012; satellite imagery - 2015; Murray River Shire Council: Aerial photograph & road design - 2015. Created by:rtrobinson

2 Need and options considered

2.1 Strategic need for the proposal

2.1.1 Existing bridge constraints

The existing Gee Gee Bridge was built in 1929. The Gee Gee Bridge and flood relief bridge are located on Noorong Road, which links Deniliquin in NSW and Swan Hill in Victoria. The route has been identified as a strategic freight route in NSW. It is also an alternative freight route between Wagga Wagga in NSW and Swan Hill.

The existing Gee Gee Bridge and flood relief bridge restrict traffic because they do not meet current road design standards. The existing bridges:

- are narrow, with one lane, and vehicles must give way to oncoming traffic
- are not suitable for higher mass limit vehicles (HML) or oversized vehicles
- cannot be upgraded to meet the future operational needs of Noorong Road.

The proposal is required to meet current road design standards, remove traffic restrictions and improve road safety.

2.1.2 Crash history

A fatal crash occurred in 2012, when a vehicle travelling north on the southern approach road left the road on the curve before the bridge and collided with nearby trees.

The proposal would improve road safety by providing wider approach roads with gentler curves, road barriers, flatter batters, clear zone improvements and a new bridge meeting current design standards.

2.1.3 Relevant strategies and plans

Timber Truss Bridge Conservation Strategy

Roads and Maritime's 'Timber Truss Bridge Conservation Strategy Submissions Report and Revised Conservation Strategy' sets out how Roads and Maritime carried out public consultation on its draft strategy for conservation of timber truss road bridges in NSW, how submissions from stakeholders and the public were analysed, and presents the revised strategy in response to those submissions.

The strategy describes Gee Gee Bridge as an unremarkable example of a single span Dare truss bridge and is identified for replacement.

The proposed replacement of Gee Gee Bridge is in line with the 'Timber Truss Bridge Conservation Strategy'.

NSW 2021: A Plan to Make NSW No 1

'NSW 2021: A Plan to Make NSW No 1' (Department of Premier and Cabinet 2011) is a 10 year plan that provides goals and targets to rebuild the economy, provide quality services, renovate infrastructure, restore government accountability, and strengthen the local environment and communities. It is the NSW Government's strategic business plan, setting priorities for action and guiding resource allocation.

'NSW 2021: A Plan to Make NSW No 1' lists a number of goals relevant to the proposal, identified in Table 2.1.

Table 2.1: Relevant goals of NSW 2021: A plan to Make NSW No 1

Goal	How the proposal would assist in meeting the goal
Reduce travel time	The proposal would slightly reduce travel time due to the improved bridge crossing.
Improve road safety	The proposal would improve safety by providing a new bridge built to current design standards. The new bridge would provide two traffic lanes. This would be substantially safer than the current road environment on Gee Gee Bridge, which only has one traffic lane and requires vehicles to give way to oncoming traffic. The proposal would also improve road safety by providing wider approach roads with gentler curves, road barriers, flatter batters and clear zone improvements.
Drive economic growth in regional NSW	The constraints of the existing bridge impact on the region's productivity and economy. The proposal would allow for higher mass limit freight vehicles, which would likely improve the strategic freight transport route between Deniliquin in NSW and Swan Hill in Victoria, and would contribute to the region's economic growth.
Protect our natural environment	The proposal would remove native vegetation on the Wakool River floodplain and would result in some negative impacts to the natural environment (see chapter 6). Safeguards detailed in this REF would be implemented to minimise impacts on the natural environment.

Given the likely contribution of the proposal to the goals identified in Table 2.1, the proposal is considered to be consistent with *NSW 2021: A Plan to Make NSW No 1.*

NSW State Infrastructure Strategy 2012-2032

The 'State Infrastructure Strategy 2012-2032' (Infrastructure NSW 2012) includes details of priority infrastructure to be developed in NSW over the next 20 years and recommendations on how this will be achieved.

The strategy includes the following recommended actions:

- freight pinch point program for key road and rail links
- Bridges for the Bush Program to improve freight productivity (which includes Gee Gee Bridge).

The proposal would help achieve these actions by providing a new Gee Gee Bridge that would be suitable for higher mass limit vehicles. This would result in potential road freight productivity improvements.

Roads and Maritime 2020 Strategy

The 'Roads and Maritime 2020 Strategy' (Roads and Maritime 2015) outlines five strategic priorities in which Roads and Maritime will strive to meet its challenges and achieve its goals. The five priorities in the strategy are:

- making safety paramount
- delivering Roads and Maritime's infrastructure program
- meeting customer and community needs
- being an organisation that delivers
- enhancing economic and social outcomes.

The proposal would improve road safety by providing a new Gee Gee Bridge to meet current design standards. The proposal would also meet customer and community needs by providing access across the Wakool River for higher mass limit vehicles.

Although there would be environmental impacts associated with the proposal, these have been minimised as far as possible and would be appropriately managed through the safeguards described in this REF. The community and stakeholders have been consulted during the proposal's development. Consultation will continue through display of the REF and into construction.

NSW Long Term Transport Master Plan

The 'NSW Long Term Transport Master Plan' sets the framework for the NSW Government to deliver an integrated, modern transport system that puts the customer first.

The replacement of Gee Gee Bridge is a medium to longer-term action in the 'NSW Long Term Transport Master Plan'.

Murray-Murrumbidgee Regional Transport Plan

The 'Murray-Murrumbidgee Regional Transport Plan' supports the 'NSW Long Term Transport Master Plan' and outlines specific actions to address transport issues in the Murray-Murrumbidgee region. It includes matters identified during community consultation in 2012.

The replacement of Gee Gee Bridge is a medium to longer-term action in the 'Murray-Murrumbidgee Regional Transport Plan'.

NSW Freight and Ports Strategy 2013

The 'NSW Freight and Ports Strategy' (Transport for NSW 2013) sets out a range of strategic action programs to improve the efficiency, capacity and sustainability of the NSW freight network. Implementation includes assessment of the road network.

The proposal is identified in the Strategy under the 'Bridges for the Bush program'. It is in line with the strategy as it includes the construction of a new bridge to provide accessibility for higher mass limit vehicles, which would improve freight productivity in regional NSW.

National Land Freight Network Strategy

The overarching purpose of the 'National Land Freight Network Strategy' (Commonwealth of Australia 2012) is to drive development of efficient, sustainable freight logistics that balance the needs of a growing Australian community and

economy, with the quality of life aspirations of the Australian people. The objectives under consideration aim to:

- improve freight movement efficiency across infrastructure networks
- minimise externalities associated with such freight movements
- influence policy making in areas relevant to freight.

The proposal would help provide a more suitable freight link between Deniliquin in NSW and Swan Hill in Victoria, which would benefit the agricultural industry and promote the state and regional economies.

Draft Murray Regional Strategy 2009-36

The 'Draft Murray Regional Strategy 2009-36' (NSW Planning 2009) represents the NSW Government's position on the future of the Murray region. It applies to 10 local government areas in the Murray region, including the Murray River Council local government area in which the proposal is located.

Once finalised, the strategy will guide local government's land use planning decisions and help inform State agencies' regional decisions on service provision and infrastructure for the period to 2036.

The strategy is designed to manage the region's growth and change in a sustainable manner, boosting prosperity for existing and new residents while ensuring the region's valuable natural and cultural assets are protected. It will also assist in cross-border issues management, particularly in light of opportunities arising from higher growth rates on the Victorian side of the river.

In relation to infrastructure, the draft strategy notes there are currently 30 road and/or rail bridges across the Murray River, with 100,000 road vehicles and 20 million tonnes of freight crossing the river each year. Many of the Murray region communities, particularly on the NSW side of the border, are disadvantaged by low quality bridges across the river. The strategy identifies issues such as weight restrictions and old narrow bridges, which hinder industry development in NSW. While not located on the Murray River, the issues considered are relevant to the proposal, as Gee Gee Bridge is located on a strategic freight route between Deniliquin in NSW and Swan Hill in Victoria. The constraints posed by Gee Gee Bridge are similar to those of low quality bridges on the Murray River.

One of the economic development outcomes of the draft strategy is that local councils and State Government will explore opportunities for better cross-border infrastructure and service delivery.

The proposal would contribute to the NSW Government objective of improving traffic access between NSW and Victoria by providing a new Gee Gee Bridge, which would improve freight transport between Deniliquin and Swan Hill.

NSW Flood Prone Land Policy

The 'NSW Flood Prone Land Policy' is relevant to the proposal as the proposal site is located on flood prone land on the Wakool River floodplain. The primary objective of the NSW Flood Prone Land Policy is to reduce flooding impacts and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, using ecologically positive methods wherever possible. The policy seeks to support appropriate floodplain development.

The NSW Flood Prone Land Policy identifies a merit approach for all floodplain development decisions to take into account social, economic and ecological factors, as well as flooding considerations. This REF has been prepared to meet this requirement.

The gazetted Floodplain Development Manual (NSW Government 2005a) addresses the development of flood liable land for the purposes of section 733 of the *Local Government Act 1993* and incorporates the NSW Flood Prone Land Policy.

The proposal would be consistent with the NSW Flood Prone Land Policy in that it would not cause any significant flooding impacts on surrounding land uses. This has been addressed in section 6.5.

Edward and Wakool Rivers Floodplain Management Strategy – Noorong Road to Wakool Murray Junction

The NSW Government prepared this strategy in line with its responsibilities in administering the *Water Act 1912*.

The strategy has the following objectives:

- to provide floodways with adequate capacity for the orderly passage of floodwaters
- to maintain and restore, as far as practicable, the natural flooding pattern
- to enable flood protection for agricultural land and other property
- to enable flooding to support the floodplain environment, particularly flood-dependent ecosystems
- to implement floodplain management consistent with the planning principles of Murray Regional Environmental Plan No 2 (Murray REP2)
- to implement floodplain management consistent with State natural resource management policies.

The proposal would be consistent with the strategy in that it would not significantly alter the existing flooding regime in the study area and would not cause any significant flooding impacts on surrounding land uses. This has been addressed in section 6.4.

2.2 Existing infrastructure

2.2.1 Roads

Local road network

Two roads exist in the study area, Noorong Road and Nacurrie Road, which are shown in Figure 1.1.

Noorong Road is a two lane, two way sealed road with partly sealed shoulders. Its speed limit is 100 km/h, however the speed limit on the section of Noorong Road from about 100 metres east of the flood relief bridge to about 120 metres south of Gee Gee Bridge is 60 km/h.

Nacurrie Road is an unsealed road that connects to Noorong Road about 640 metres east of the flood relief bridge. The speed limit of Nacurrie Road is 100 km/h.

A number of unsealed tracks open to the public are present in the national park on the Wakool River floodplain, on both sides of Noorong Road (see Figure 1.1).

Bridges

The locations of Gee Gee Bridge and the flood relief bridge are shown in Figure 1.1. The bridges are separated by a section of road constructed on fill, about 60 metres in length.

Gee Gee Bridge

Gee Gee Bridge is a Dare type timber truss bridge constructed in 1929. It is listed as a heritage item on the NSW State Heritage Register, Roads and Maritime's Section 170 Heritage and Conservation Register and the Wakool LEP.

Gee Gee Bridge has a length of 72.5 metres, with a 27.7 metre timber truss span over the Wakool River (see Figure 2.1). The truss span has a clearance of about four metres over normal water level. The bridge has three approach spans at the northern end and two at the southern end.

Work to strengthen the timber piers was completed in the 1990s. The cross girders of the Gee Gee Bridge truss were replaced in 2004. The truss's diagonal beams were replaced in 2008.

The bridge has a single traffic lane with a width of 5.5 metres and timber posts and rails along the full length of the bridge.

Figure 2.1: Gee Gee Bridge and Wakool River

Gee Gee flood relief bridge

The flood relief bridge is of timber construction, with a length of 112 metres and about 16 spans (see Figure 2.2). Steel supports have been added to strengthen the bridge structure. The flood relief bridge has a concrete deck. The bridge has a single traffic lane with a width of about 5.5 metres and steel guard rail along its full length.

The floodplain under the flood relief bridge is generally dry and only inundated by the Wakool River during floods.

Figure 2.2: Gee Gee flood relief bridge

Traffic volumes

Based on traffic counts completed over a period of one month in March/April 2014, the daily traffic volume on Noorong Road is 203 vehicles per day, of which heavy vehicles comprise about 33 per cent. Without construction of the proposal, traffic volumes are forecast to increase by about four per cent per year (data provided by Murray River Council, 2015). The proposal would be likely to generate a 30 per cent increase in heavy vehicles (see section 6.6).

Nacurrie Road is an unsealed road that connects to the town of Moulamein about 28 kilometres to the north. In the study area, the road has minimal traffic volumes.

2.2.2 Property access

An unsealed access road to the property 'Rest-down', 3357 Noorong Road, is located about 450 metres east of the flood relief bridge (see Figure 1.1).

2.2.3 Wakool River

Water vessels use the Wakool River for recreation activities such as fishing. The existing Gee Gee Bridge truss span has a clearance of about four metres over normal water level.

An informal boat access point is located on the northern river bank more than 50 metres downstream of the existing bridge.

2.3 Proposal objectives

The primary objectives of the proposal are to:

- provide access across the Wakool River for higher mass limit vehicles (longer trucks carrying heavier loads) and oversized vehicles
- provide road infrastructure that supports:
  - the NSW and Victorian economies through improved connectivity of goods
  - the Swan Hill region's local and regional economy
- improve road safety
- minimise impacts on the natural environment, including:
  - native vegetation and habitat on the Wakool River floodplain
  - water quality and aquatic habitats of the Wakool River
- minimise impacts on the local community.

2.4 Alternatives and options considered

Roads and Maritime considered six options for the replacement of the Gee Gee Bridge, including the 'do nothing' option. The five potential alignments were assessed against the following considerations:

- land acquisition
- community impacts
- environmental impacts
- cost
- design considerations.

The road alignment options assessed for the proposal are shown in Figure 2.3 and described below.

Option 1 – New straight bridge immediately downstream of existing bridge, 80km/h

Option 1 involves constructing a new straight bridge immediately downstream (north) of the existing bridge, with an advisory speed limit of 80 kilometres per hour. Noorong Road would be realigned through Lot 101, DP 914897 north of the existing road.

Option 2 - New straight bridge immediately upstream of existing bridge, 80km/h

Option 2 involves constructing a new straight bridge immediately upstream (south) of the existing bridge, with an advisory speed limit of 80 kilometres per hour. Noorong Road would be realigned through Lot 101, DP 914897 north of the existing road, passing closer to the 'Rest-down' residence than option 1. Noorong Road would also be realigned through the Murray Valley National Park south of Gee Gee Bridge, west of the existing road.

Option 2 was not selected for the following reasons:

- it would involve acquiring land from the 'Rest-down' property and the Murray Valley National Park
- it would likely have greater potential for noise impacts to the 'Rest-down' residence than option 1
- it would involve removing more native vegetation than option 1.

Option 3 - New straight bridge 500 metres upstream of existing bridge, 100km/h

Option 3 involves constructing a new straight bridge 500 metres upstream (east) of the existing bridge, with an unrestricted speed limit of 100 kilometres per hour. Noorong Road would be realigned through the Murray Valley National Park to the south of the existing road.

Option 3 was not selected for the following reasons:

- it would require substantially greater cost than the other options due to having the longest bridge component
- it would involve substantially greater land acquisition from the Murray Valley National Park than the other options
- it would involve substantially greater removal and fragmentation of native vegetation than the other options.

Option 4 – New straight bridge immediately downstream of existing bridge, 100km/h

Option 4 involves constructing a new straight bridge immediately downstream (north) of the existing bridge, with an unrestricted speed limit of 100 kilometres per hour. Two sub-options with different curve alignments (4a and 4b) were assessed. Noorong Road would be realigned through Lot 101, DP 914897 and the 'Rest-down' property to the north of the existing road. It would also be realigned through the Murray Valley National Park south of Gee Gee Bridge, west of the existing road.

Option 4 was not selected for the following reasons:

- it would have major impacts to the residence at the 'Rest-down' property
- it would involve acquiring land from the Murray Valley National Park
- it would involve removing more native vegetation than options 1 and 2.

Option 5 – New curved bridge immediately downstream of existing bridge, 80km/h

Option 5 involves constructing a new curved bridge immediately downstream (north) of the existing bridge, with an advisory speed limit of 80 kilometres per hour. The bridge would pass through part of Murray Valley National Park. Noorong Road would be realigned immediately to the east of the approach bridge.

Option 5 was not selected for the following reasons:

- the curved bridge would not have sufficient sight distance to meet current road design standards and maintain traffic safety
- it would involve acquiring land from the Murray Valley National Park.

Option 6 – do nothing

The do nothing option would involve maintaining access across the Wakool River on the existing road, bridge and approach bridge. Restrictions on higher mass limit vehicles would remain at the river crossing. These constraints would continue to limit efficiency for the transport industry, impacting on the region's productivity and economy. The do nothing option is not considered acceptable.

2.5 Preferred option

The preferred option is option 1, which is considered to best achieve the proposal objectives.

Option 1 is the preferred alignment option for the following reasons:

- it involves limited land acquisition and does not require land acquisition in the Murray Valley National Park
- it has low impacts on the 'Rest-down' property
- it has low environmental impact through native vegetation removal
- it is cost effective.

As Noorong Road has a posted speed limit of 100 kilometres per hour, Roads and Maritime has investigated options that maintain that speed limit for the new bridge (options 3 and 4 – see section 0). These options were rejected for the reasons described in section 0. The advisory speed limit of 80 kilometres per hour for the preferred option is considered to be acceptable for the following reasons:

- there are curves at other locations along Noorong Road (3.5 and 5.5 kilometres south of the existing Gee Gee Bridge) that have advisory speed limits of 80 kilometres per hour. Council does not intend to upgrade these curves
- the current posted advisory limit of the road in the vicinity of Gee Gee Bridge and the approach bridge is 60 kilometres per hour. Option 1 would provide a safer road environment with a faster advisory speed than the existing road environment
- Council notified Roads and Maritime that it does not require the road design speed in the vicinity of the proposed new bridge to be 100 kilometres per hour and that it accepts an advisory speed of 80 kilometres per hour.

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Residence - 'Re st-down'
3357 Noorong Road

Option 4a

Option 4b

Lot 101, DP 914897

Murray Valley
National Park

Option 1

Noorong Road

Nacurrie Road

Option 5

Existing Gee
Gee Bridge

Option 2

Existing flood
relief bridge

Option 3

Wakool River

Murray Valley
National Park

765,600 766,000 766,400 766,800 767,200

Paper Size A3

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

LEGEND

Proposal option
Option 1
Option 2
Option 3
Option 4a
Option 4b
Option 5
Existing road
Lot 101, DP 914897 (indicative only)
Murray Valley National Park (indicative only)

Wakool Shire Council
Gee Gee Bridge replacement

Job Number 23 15324
Revision 0
Date 11 Apr 2017

Road alignment options considered for the proposal

Figure 2-3

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Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia T 61 2 6923 7400 F 61 2 6971 9565 E wg amail@ghd.com W www .ghd.com

Data source: NSW Government: Roads & National Parks -201 2; Wakool Shire Council: Road options - 2015; Google Inc: Satellite imagery - 2/12/2015. Created by:rtrobinson

3 Description of the proposal

3.1 The proposal

Roads and Maritime proposes to build a new concrete bridge downstream (north) of the existing Gee Gee Bridge at the Noorong Road (Main Road 94) crossing of the Wakool River. The proposal also includes realigning about 1.4 kilometres of Noorong Road. Following construction of the new bridge and realigned road, Roads and Maritime proposes to demolish the existing Gee Gee Bridge and flood relief bridge. An overview of the proposal is shown in Figure 1.1.

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
- realigning about 1.4 kilometres of Noorong Road
- demolishing and removing the existing Gee Gee Bridge and flood relief bridge
- a new rest area near the southern end 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.

3.2 Design

3.2.1 Design criteria

Specific design criteria have been developed for the proposal. The key criteria include:

- Gee Gee Bridge:
  - design speed of 80 km/h with associated advisory signage
  - bridge road width of nine metres, including two 3.5 metre travel lanes and two 1.0 metre shoulders
  - designed to cater for higher mass limit and oversized vehicles
  - designed to have an elevation greater than the highest recorded flood at the location (70.6 metres above sea level in 1975). The top of the bridge deck would have a height of 71.8 metres above sea level.
- new approach roads:
  - design speed of 80 km/h with associated advisory signage
  - a nominal sealed road width of 9.0 metres, including two 3.5 metre travel lanes and two 1.0 metre shoulders, with two unsealed 0.75 metre verges
  - road surface grades of less than five per cent
  - fill embankment slopes of 4:1 (horizontal:vertical) and 2:1 behind safety barriers
  - cut embankment slopes of 2:1 (horizontal:vertical)
  - designed to cater for higher mass limit and oversized vehicles

- designed to have an elevation greater than the highest recorded flood at the location (70.6 metres above sea level in 1975). At its lowest point, the proposed road would have a height of 70.8 metres above sea level.

3.2.2 Engineering constraints

Engineering constraints identified for the proposal include:

- the Wakool River
- the Murray Valley National Park – work would not be permitted within the national park. Construction activities would need to be confined to a corridor of about 40 metres between the existing road and the national park boundary.

3.2.3 Major design features

Bridge over the Wakool River

The proposed Gee Gee Bridge would have a length of about 245 metres (see Figure 1.1 and Figure 3.1). It would be constructed of precast and poured concrete components.

The bridge would have a span of 32 metres over the Wakool River. The span over the river would have a height of about six metres above the typical river water level. On the northern side of the river, the bridge would have about 11 approach spans, including 10 spans of 17 metres and one span closest to the river of about 21 metres in length. On the southern side of the river, the bridge would have a single 21 metre approach span. The height of the bridge deck above ground level varies but would generally be about two metres.

Piers 11 and 12 would be built within the river channel's typical zone of inundation. All other piers would be constructed outside the river channel. A cross section of the design for piers 11 and 12 (located adjacent to the main Wakool River channel, southern bank) is shown in Figure 3.1.

The bridge deck would have the following depths (ie between the road surface and the underside of the bridge):

- about 1.7 metres for the span over the Wakool River
- about one metre for the short spans.

The bridge would have a road width of nine metres, including two 3.5 metre travel lanes and two 1.0 metre shoulders. Concrete safety barriers would be built along both sides of the bridge.

Drainage outlets in the bridge deck are designed at intervals of two metres along the entire bridge. The bridge would discharge road runoff directly to the Wakool River.

Approach roads

The northern approach road would have a length of 674 metres and would be realigned through the property north of Noorong Road (Lot 101, DP 914897). The southern approach road would have a length of 736 metres. The northern 530 metres of the southern approach road would be realigned close to the existing road alignment, within the road corridor. The southern 206 metres of the road would follow the existing road alignment (see Figure 1.1).

The road would have a sealed road width of 9.0 metres, including two 3.5 metre travel lanes and two 1.0 metre shoulders, with two unsealed 0.75 metre verges. Guard rail safety barriers would be built on both sides of both approach roads for distances of 50 to 100 metres from the proposed bridge.

The northern 580 metres of the southern approach road would be built on a fill embankment, with a maximum height above ground level of about 1.8 metres (see Figure 3.1). The western 300 metres of the northern approach road would be built on a fill embankment with a maximum height above ground level of about one metre. The fill embankment slopes would range from 2:1 (horizontal:vertical) (near the proposed bridge) to 4:1 (horizontal:vertical).

Most of the eastern section of the northern approach road would be built through a cutting with a length of about 300 metres (see Figure 3.1. The cutting would have a maximum depth of about 1.5 metres.

One or two culverts would be required for the northern approach road.

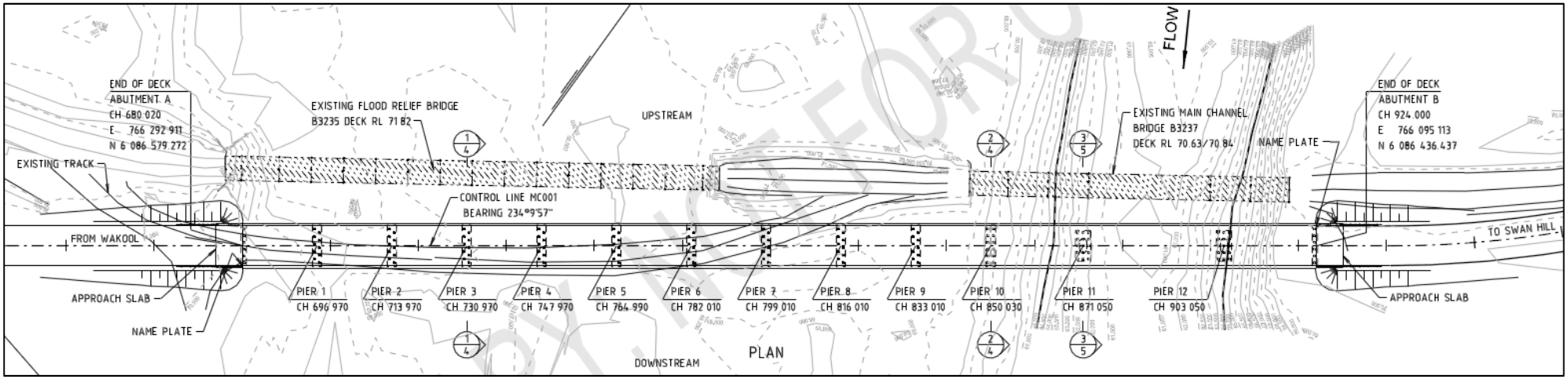

Figure 3.1: Proposed bridge design

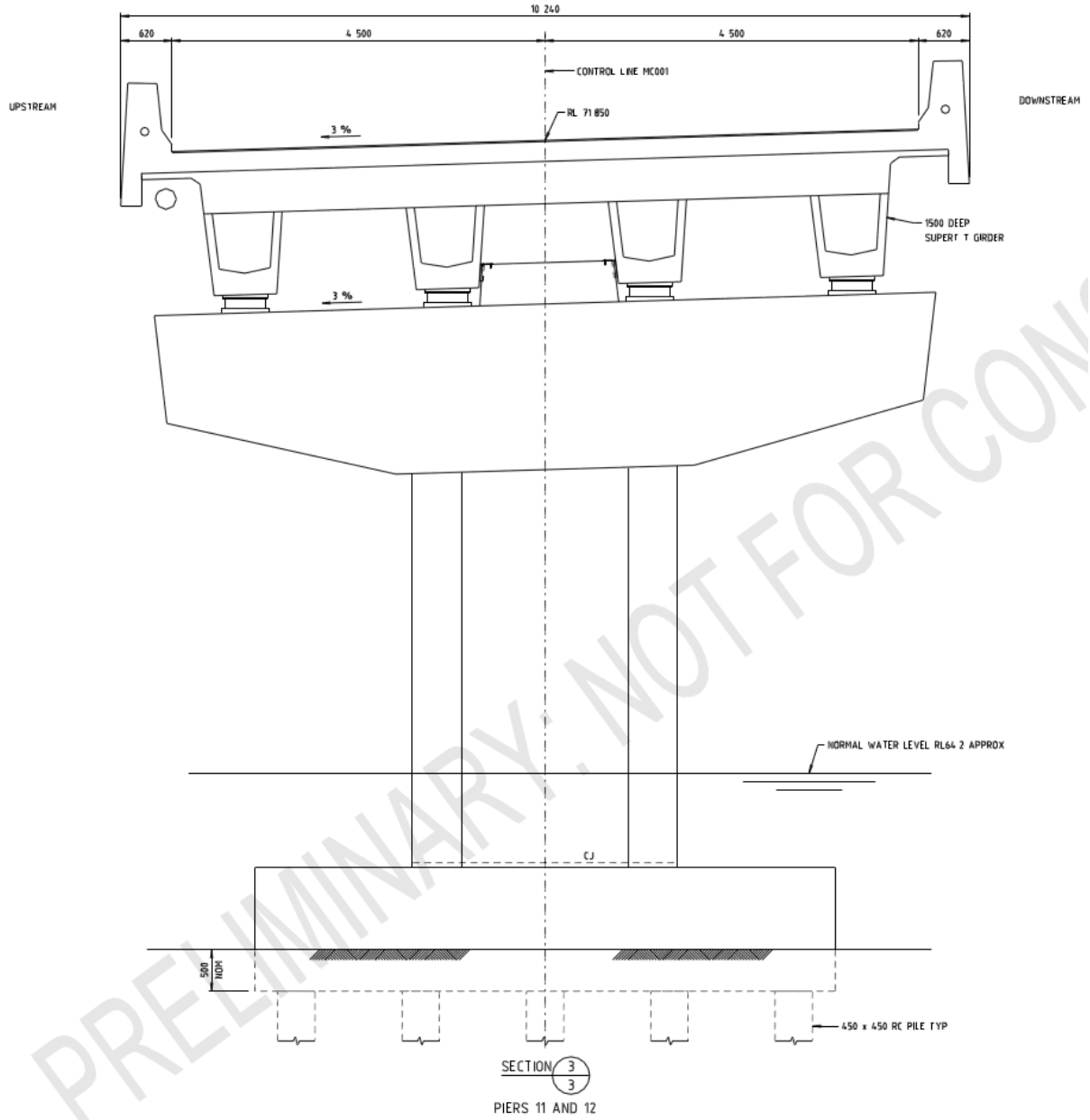

Figure 3.2: Cross section design of piers 11 and 12

3.3 Construction activities

3.3.1 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 (see section 3.5)
- 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. Coffer dams 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) (see piers in Figure 3.1)
- 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 section 6.4)
- 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 near the approach bridge piers
- salvaging road material from the approach road, reshaping and capping with topsoil and revegetating the site for stability
- removing the existing road embankment between the bridges
- reshaping and revegetating the batters.

3.3.2 Construction hours and duration

It is anticipated that most of the work for the proposal would be completed in line with the Office of Environment and Heritage's (OEH) recommended standard hours for construction work (DECC 2009):

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and public holidays: no work.

It is not anticipated that night work would be required. Any out of hours work would be subject to approval by Roads and Maritime and would be in line with Roads and Maritime's 'Environmental Noise Management Manual 2001: Practice Note vii – Road works Outside of Normal Working Hours' (RTA 2001). This would include notifying the nearby residents at 'Rest-down' before out of hours work.

The contractor would determine the size of the workforce. It is estimated that up to 25 construction and site management personnel would be needed for construction at any time.

3.3.3 Plant and equipment

Plant and equipment needed for the proposal would be determined by the contractor(s) during the construction planning phase.

The plant and equipment likely to be used for the proposal would include:

General

- excavators
- bulldozers
- graders
- water carts
- semi-trailers and large delivery trucks
- hand tools
- welding equipment
- haulage trucks
- backhoe
- front-end loader

- air compressors
- light vehicles
- water pumps
- tree clearing and mulching equipment
- bobcats
- generators

Road embankment and drainage work

- scrapers
- graders
- vibrating and static rollers
- backhoes
- trenching machines

Road pavement construction

- milling machine
- compactor
- vibrating sheep foot roller
- vibrating smooth drum roller
- multi-wheel rubber tyred roller
- concrete agitator trucks
- concrete pumps
- concrete paver
- concrete vibrators
- bitumen sprayers and asphalt paver
- bitumen trucks
- kerb extruding machine
- profiler
- linemarking plant

Traffic management

- safety barriers
- variable message boards

Construction of new bridge

- piling rigs
- concrete pumps
- vibrators
- cranes
- trucks
- agitators

Demolition of bridges

- chainsaw
- cranes
- trucks
- excavator

3.3.4 Earthworks

Earthworks for construction of new Gee Gee Bridge

Earthworks would occur over an area of about 4.1 hectares. The extents of cut and fill earthworks are shown in Figure 3.3.

About 6000 cubic metres of material would be excavated from a cut area near the eastern end of the proposal site. Subject to the material's suitability for use as fill, all of this material would be used to build the northern approach road and possibly some of the southern approach road.

The total volume of fill material needed to build the new approach roads is about 13,000 cubic metres. It is therefore anticipated that about 7000 cubic metres of fill material would be imported to build the southern approach road.

Any material remaining would be used during construction for flattening fill batters or in landscaping.

Earthworks for removal of existing road embankment

Demolishing the existing Gee Gee Bridge and flood relief bridge would involve removing the section of road fill embankment between the two bridges, which is about 60 metres in length. The amount of material to be removed is about 1000 cubic metres. This material would be transported to a registered stockpile site for use in future road maintenance projects (see Figure 1.1).

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Murray Valley National Park

Residence - Re st-down'
3357 Noorong Road

Nacurrie Road

Noorong Road

Proposed new bridge

Existing flood relief bridge

Property access road

Existing Gee Gee Bridge

Wakool River

Murray Valley National Park

765,600 765,800 766,000 766,200 766,400 766,600 766,800 767,000

Paper Size A3

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

LEGEND

Road design
Existing road
Proposal site
Murray Valley National Park (indicative only)

Earthworks
Cut
Fill

Wakool Shire Council
Gee Gee Bridge replacement

Job Number	23 15324
Revision	0
Date	19 May 2017

Cut and fill earhworks

Figure 3.3

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Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia T 61 2 6923 7400 F 61 2 6971 9565 E wg amail@ghd.com W www .ghd.com

Data source: NSW Government: Roads, localities, waterways & National Parks - 2012; Wakool Shire Council: Aerial photograph & road design - 2015; Google Inc: Satellite imagery - 2/12/2015. Cr eated by:rtrobinson

3.3.5 Source and quantity of materials

Fill, sub-base and base materials and aggregates for bitumen sealing and culvert concrete works would consist of:

- soil
- gravel
- crushed and screened rock.

Road embankment material would be obtained from cutting on site. Additional fill material and road surface materials will be imported from a licensed quarry about nine kilometres north of the proposal site. The approximate material quantities needed for the proposal are estimated to be:

- fill – 7000 cubic metres
- base and sub-base – 5500 cubic metres
- spray seal – 12,600 square metres.

These volumes are indicative only and may change as a result of the detailed design.

Steel and pre-cast concrete structures would be required for the new bridge. Precast structures would include girders, parapets and piles. One or two concrete culverts would be needed for the approach roads. Concrete would be required for the bridge deck, abutments and piers. Structures and concrete would be sourced locally where possible, including from Barham or Swan Hill.

Road drainage structures would either be pre-fabricated off site at an approved and licensed facility, or would be constructed on-site (for example kerb and gutter).

Water would be needed during construction to achieve required earthworks moisture content and to suppress dust. The contractor engaged to build the river crossing may source water for the proposal directly from the Wakool River. Water may also be obtained from sediment basins during construction where possible. The volume of water needed would depend on construction timing and weather conditions. Extraction of water from the Wakool River would require a water supply work approval under the NSW *Water Management Act 2000*.

3.3.6 Traffic management and access

Construction access management

Construction vehicles and machinery would access the proposal site using:

- Noorong Road and Swan Hill Road (coming from Swan Hill, west of the proposal site)
- Noorong Road and Moulamein Road (coming from Barham, east and south of the proposal site)
- Nacurrie Road (coming from Moulamein, north of the proposal site)
- Cunninyeuk Road (moving between the proposal site and the licensed Council quarry about nine kilometres north of the proposal site).

Designated access tracks (haul roads) along the construction corridor would also be used. All construction access routes would be included in the traffic management plan.

Vehicle movements

During construction, the proposal would generate heavy vehicle movements through transporting fill, materials, structures, machinery, fuel and general provisions. During demolition of the existing bridges, the proposal would generate heavy vehicle movements through transporting demolished bridge components and road embankment material from the existing road.

Light vehicles would be needed to transport staff to and from the site. Light vehicles would also be used in various roles on site. Light vehicles would generally be parked at the main site compound.

For transport of fill and road materials (during construction of the new bridge and demolition of the existing bridges), heavy vehicle movements may vary depending on construction methodology and weather conditions. It is estimated that up to 50 heavy vehicles would access the site per day (100 movements per day) over the construction period.

Additional heavy vehicle movements would be needed for transport of bridge and road structures, machinery, demolished bridge components and other construction activities (during construction of the new bridge and demolition of the existing bridges).

Light vehicle movements may comprise in the order of 25 light vehicles accessing the site per day for the transportation of staff (50 movements per day). These movements would typically be expected to occur during early morning and late afternoon periods.

Traffic management

A Traffic Management Plan would be prepared in line with the 'Traffic Control at Work Sites Manual' (RTA 2010) and Roads and Maritime's 'Specification G10 – Control of Traffic before commencement of construction'. The traffic management plan would provide details of traffic management to be implemented during construction and how to manage traffic flow and driving conditions during construction. All traffic management would be in line with current Roads and Maritime standards.

For short periods of time during construction, traffic may be restricted to one lane on Noorong Road. It is likely that traffic barriers would be installed where necessary to separate the construction site from passing traffic. Temporary speed restrictions of 40 km/h would also be implemented.

It is not anticipated that any temporary detours would be implemented during construction. No major disruptions to traffic are expected.

3.4 Ancillary facilities

3.4.1 Site compounds and stockpile sites

Site compounds would be used to store plant and equipment, provide site offices, parking and amenities for construction staff, and to stockpile materials. Chemicals and fuels would be stored in appropriate storage areas within the site compounds. Stockpile sites would be used for storing construction materials.

Site compounds would be established within the assessed proposal footprint with agreement between Roads and Maritime, Council and the contractor. They would be located to avoid unnecessary vegetation removal within previously disturbed areas (see Figure 1.1).

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 proposal site, on the southern side of Noorong Road
- at an existing stockpile site west of, and next 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 proposal site. The stockpile sites would be subject to the criteria set out in Roads and Maritime's 'Stockpile Site Management Guideline' (RTA 2011a).

3.4.2 Construction sediment basins

If required, sediment basins would be constructed in line with the 'Blue Book - Soils and Construction - Managing Urban Stormwater Volume 1' (Landcom 2004) and 'Volume 2D' (DECC 2008a). Sediment basins would also capture nearby fuel or chemical spills that could potentially occur during construction.

3.4.3 Batch plant

At the current stage of planning it is not known if a concrete batch plant would be established. This will depend on the ability to source suitable concrete from local suppliers to the site without compromising quality. If it is determined at a later stage that a batch plant is needed, the contractor would need to consider a range of impacts and demonstrate consistency with the current assessments or provide additional impact assessment. Items that would need to be addressed would be:

- the need for out of hours work and compliance with Roads and Maritime's out of hours works procedure
- proximity to the 'Rest-down' residence and compliance with Roads and Maritime's 'Environmental Noise Management Manual' and the NSW 'Industrial Noise Policy'
- the potential for pollution, including dust and water or land pollution
- other impacts considered in the REF and specialist studies.

3.5 Public utility adjustment

A disused Telstra line is located on the western side of the southern approach road to Gee Gee Bridge. The Telstra line was originally installed to service a Roads and Maritime site compound at the location. This site compound has since been decommissioned and removed. The Telstra line would be reconnected to the proposed site compound for use during construction.

An underground powerline crosses the proposal site about 20 metres south-west of the existing Gee Gee Bridge. An overhead powerline crosses the proposal site about 110 metres east of the northern end of the flood relief bridge. Minor adjustments to these powerlines would be required.

The presence of any other utilities would be determined through detailed investigation before construction.

3.6 Property acquisition

For construction of the new road, Roads and Maritime would compulsorily acquire about 1.57 hectares of land from the property north of Noorong Road (Lot 101, DP 914897). This land is owned by the NSW Minister administering the *National Parks and Wildlife Act 1974*. Roads and Maritime would also compulsorily acquire about 2.8 hectares of Council-owned land from the existing Noorong Road reserve (see Figure 3.4).

The road reserve acquired from Murray River Council would be transferred to the Minister administering the *National Parks and Wildlife Act 1974* in exchange for the land acquired for the new road. Ownership of the land acquired for the new road would then be transferred to Council.

The property owned by the NSW Minister administering the *National Parks and Wildlife Act 1974* is currently leased to the neighbouring landholder for agricultural production. The total area of the property is about 9.53 hectares. The total loss of land for the leaseholder (including about 0.76 hectares severed by the proposed road) would be about 2.33 hectares, leaving a residual area of about 7.2 hectares.

These areas are indicative only and may change once boundaries are finalised during detailed design.

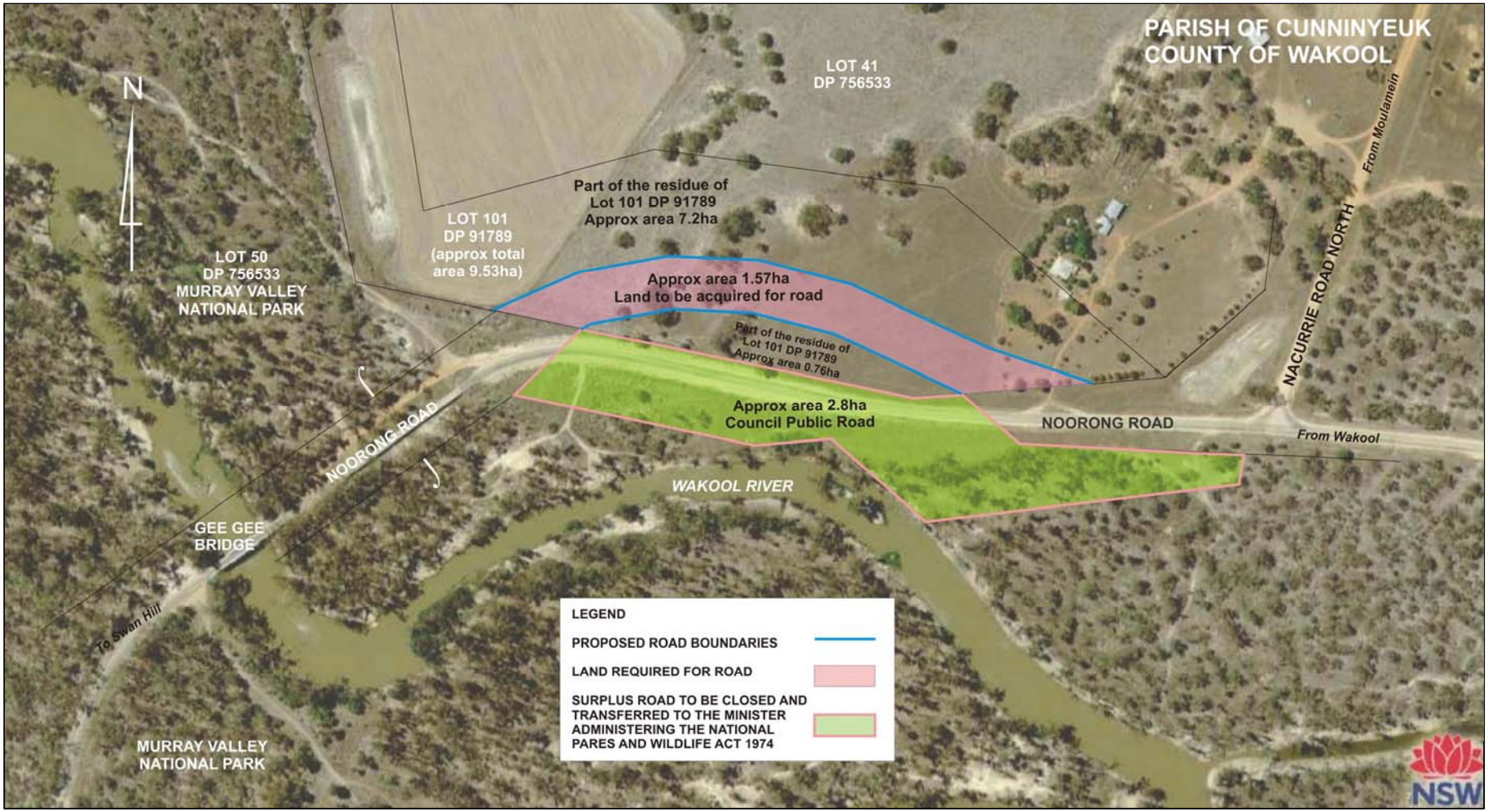

Figure 3.4 Property acquisition

4 Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for a new road and road infrastructure facilities and is to be carried out by Roads and Maritime, it can be assessed under Part 5 of the EP&A Act. Development consent from Council is not required.

The proposal would require temporary construction access through the Murray Valley National Park next to the proposal site. Under clause 94 of the ISEPP, this can only occur if it is authorised by or under the *National Parks and Wildlife Act 1974*.

The proposal does not affect land or development regulated by *State Environmental Planning Policy No. 14 - Coastal Wetlands*, *State Environmental Planning Policy No. 26 - Littoral Rainforests*, *State Environmental Planning Policy (State and Regional Development) 2011* or *State Environmental Planning Policy (Major Development) 2005*.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the start of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in chapter 5 of this REF.

4.1.2 Murray Regional Environmental Plan No 2—Riverine Land

As of 1 July 2009, the Murray Regional Environmental Plan No 2 – Riverine Land (Murray REP) is deemed a State Environmental Planning Policy.

The aims of the Murray REP are to conserve and enhance the riverine environment of the Murray River, including its tributaries, for the benefit of all users. The Wakool River is a tributary of the Murray River. Murray River Shire is one of the local government areas to which the Murray REP applies.

Planning principles

Clause 8(c) states that the planning principles set out in Part 2 (clauses 9 and 10) must be applied when a public authority or person proposes to carry out development which does not require development consent but which has the potential to adversely affect the riverine environment of the Murray River. The riverine environment includes the Murray River's tributaries, such as the Wakool River. The planning principles are listed in Table 4.1, with responses describing how the proposal relates to these principles, with consideration of potential impacts to the Wakool River.

Table 4.1 Planning principles in the Murray REP

Planning principle	Response
9a - Aims Conserve and enhance the riverine environment of the River Murray for the benefit of all users.	In developing the concept design, Roads and Maritime has aimed to conserve the Wakool River environment for the benefit of all users. Vegetation removal would be minimised as detailed in section 6.2, limiting impacts on the natural environment and the amenity of the river for recreational users. The proposed bridge has been designed to minimise the construction of piers in the river bed as much as possible, minimising potential impacts to the aquatic environment. The impacts of the proposal on the aquatic environment have been addressed in section 6.3. The impacts of the proposal on land use and the community have been assessed in sections 6.10 and 6.11.
9a – Objective (a) Ensure that appropriate consideration is given to development with the potential to adversely affect the riverine environment of the River Murray.	This REF assesses to the fullest extent possible, the impacts of the proposal on the Wakool River environment. Safeguards and management measures are detailed in sections 6.2 and 6.3.
9a – Objective (b) Establish a consistent and co-ordinated approach to environmental planning and assessment along the River Murray.	Planning for the proposal has been conducted in line with the relevant NSW and Commonwealth legislation (chapter 4), and has included consultation with agencies that administer aspects of environmental management relating to the Murray River (chapter 5).
9a – Objective (c) Conserve and promote the better management of the natural and cultural heritage values of the riverine environment of the River Murray.	The potential impacts of the proposal on the natural values (ecology, soils and water quality) of the riverine environment have been assessed in sections 6.2, 6.3 and 6.4 of this REF. The assessment of visual impacts in section 6.9 is also relevant to the natural heritage of the riverine environment. Cultural heritage values have been assessed in sections 6.1 and 6.8.
9b Any relevant River Management Plan must be taken into account.	Consultation has been carried out with government agencies that have management plans for the River Murray (chapter 5).
9c Any likely effect of the proposed plan or development on adjacent and downstream local government areas must be taken into account.	The potential impacts of the proposal on the water quality and hydrology of the Wakool River (and therefore effects on nearby and downstream local government areas) have been identified and addressed in sections 6.4 and 6.5.

Planning principle	Response
9d The cumulative impact of the proposed development on the River Murray must be taken into account.	The proposal would not result in significant cumulative impacts on the Wakool River. Long term cumulative impacts of the additional crossing on the river in relation to terrestrial and aquatic ecology and hydrology have been minimised through the proposal's design. Cumulative impacts of the proposal have been addressed in section 6.16.
10 – Access The waterway and much of the foreshore of the River Murray is a public resource. Alienation or obstruction of this resource by or for private purposes should not be supported.	The proposal is for a public purpose. It would not cause alienation or obstruction of the foreshore. Access to the Wakool River in the immediate vicinity of the proposal site would be blocked during construction, however access to the river at other locations nearby would remain available. Access for water vessels along the Wakool River would be maintained during construction.
10 – Access Development along the main channel of the River Murray should be for public purposes. Moorings in the main channel should be for the purposes of short stay occupation only.	The proposal is for a public purpose. The proposal includes the development of a road and bridge across the Wakool River for public transport.
10 – Access Human and stock access to the River Murray should be managed to minimise the adverse impacts of uncontrolled access on the stability of the bank and vegetation growth.	The proposal would temporarily increase the level of human access to the Wakool River for the construction of the bridge. Safeguards would be implemented to minimise impacts to river bank stability and vegetation growth during construction (see sections 6.2, 6.3 and 6.4). The proposal would not cause any long-term increase in human and stock access to the Wakool River.
10 – Bank disturbance Disturbance to the shape of the bank and riparian vegetation should be kept to a minimum in any development of riverfront land.	The proposal would disturb the shape of river banks within the proposal site to provide access for construction activities. The extent of disturbance to the shape of the river banks would be minor. The stumps and root systems of any trees that need to be removed from the banks of the river would be retained to minimise disturbance.
10 – Flooding Where land is subject to inundation by floodwater:	
(a) the benefits to riverine ecosystems of periodic flooding.	The proposal would maintain flows across the floodplain during floods (see section 6.5). The River Red Gum vegetation on the floodplain would continue to receive periodic flooding, when it occurs.

Planning principle	Response
(b) the hazard risks involved in developing that land.	The hazards associated with developing the land near the Wakool River, including hazards relating to hydrology and water quality, have been assessed in sections 6.4, 6.5 and 6.14 of this REF.
(c) the redistributive effect of the proposed development on floodwater.	The redistributive effect of the proposed development on floodwater has been assessed in the hydrology impact assessment (Appendix G) and section 6.5 of this REF. The proposal minimises the risk of scouring of the floodplain and road embankment, and associated water quality impacts.
(d) the availability of other suitable land in the locality not liable to flooding	The proposal requires the construction of a road crossing of the Wakool River and its floodplain. As such, it cannot be relocated to other suitable land in the locality not liable to flooding.
(e) the availability of flood free access for essential facilities and services.	The proposal has been designed to have an elevation greater than the highest recorded flood at the location (70.6 metres above sea level in 1975). The deck of the new bridge would be about one metre higher than the deck of the existing bridge. The proposal would therefore improve the availability of flood free access across the river for essential facilities and services.
(f) the pollution threat represented by any development in the event of a flood.	Management measures would be implemented during construction to minimise potential pollution. During operation, the pollution risk would be reduced by a new bridge and approach roads meeting current design standards (see section 6.4).
(g) the cumulative effect of the proposed development on the behaviour of floodwater.	The cumulative effect of the proposal on the behaviour of floodwater has been assessed in sections 6.5 and 6.16. The proposal would be unlikely to cause a significant cumulative flooding impact.
(h) the cost of providing emergency services and replacing infrastructure in the event of a flood.	The proposal has been designed to have an elevation greater than the highest recorded flood at the location (70.6 metres above sea level in 1975), making it unlikely that emergency services and infrastructure replacement would be required for most floods. If necessary, the cost of providing emergency services and replacing road infrastructure would be addressed by Council.

Planning principle	Response
10 – Flooding Flood mitigation works constructed to protect new urban development should be designed and maintained to meet the technical specifications of the Department of Water Resources.	The proposal does not include any flood mitigation works. The proposal is located in a rural area and would not affect any new urban development.
10 – Land degradation Development should seek to avoid land degradation processes such as erosion, native vegetation decline, pollution of ground or surface water, groundwater accession, salination and soil acidity, and adverse effects on the quality of terrestrial and aquatic habitats.	The impacts and management measures associated with erosion, native vegetation decline, ground or surface water pollution, groundwater impacts and salination from vegetation removal, soil acidity and adverse effects on terrestrial and aquatic habitats are addressed in sections 6.2, 6.3 and 6.4 of this REF.
10 – Landscape Measures should be taken to protect and enhance the riverine landscape by maintaining native vegetation along the riverbank and adjacent land, rehabilitating degraded sites and stabilising and revegetating riverbanks with appropriate species.	Vegetation removal along the riverbank would be minimised as much as possible, and sections of the proposal site would be rehabilitated with locally native species, as detailed in section 6.2 of this REF.
10 – River related uses Only development which has a demonstrated, essential relationship with the River Murray should be located in or on land adjacent to the River Murray. Other development should be set well back from the bank of the River Murray.	The proposal involves building a road crossing of the Wakool River and its floodplain, as described in chapter 3 of this REF. The need for the proposal in relation to the existing Wakool River crossing is described in chapter 2.
10 – River related uses Development which would intensify the use of riverside land should provide public access to the foreshore.	The proposal would not occupy a large portion of the riverside land in the local area, and would not intensify the use of the riverside land. Public access to the foreshore by boat would be maintained in the vicinity of the proposal.
10 – Settlement New or expanding settlements (including rural-residential subdivision, tourism and recreational development) should be located: (a) on flood free land. (b) close to existing services and facilities. (c) on land that does not compromise the potential of prime crop and pasture land to produce food or fibre.	The proposal does not constitute a new or expanding settlement (including rural-residential subdivision, tourism and recreational development).

Planning principle	Response
10 – Water quality All decisions affecting the use or management of riverine land should seek to reduce pollution caused by salts and nutrients entering the River Murray and otherwise improve the quality of water in the River Murray.	The impacts of the proposal on water quality and salinity, and management measures to minimise impacts are addressed in section 6.4.
10 – Wetlands Wetlands are a natural resource which have ecological, recreational, economic, flood storage and nutrient and pollutant filtering values. Land use and management decisions affecting wetlands should:	
(a) provide for a hydrological regime appropriate for the maintenance or restoration of the productive capacity of the wetland.	The proposal would maintain overland flows during floods, and would not affect the hydrological regime of any wetlands.
(b) consider the potential impact of surrounding land uses and incorporate measures such as a vegetated buffer which mitigate against any adverse effects.	The proposal would not affect any permanent or seasonal wetlands.
(c) control human and animal access.	The proposal would not affect any permanent or seasonal wetlands.
(d) conserve native plants and animals.	The proposal would not affect any permanent or seasonal wetlands.

The assessment of planning principles in Table 4.1 finds that the proposal is generally consistent with the principles of the Murray REP.

Consultation

The Murray REP provides that where a public authority proposes to carry out development that does not require development consent, but which has the potential to adversely affect the riverine environment of the River Murray, consultation required by Part 3 of the Murray REP must be carried out by the public authority or person carrying out the development.

Clause 12 contains general provisions for consultation and clause 13 contains planning controls and a consultation table which includes specific matters for consideration.

Consultation with OEH under the Murray REP is required, and has occurred, as detailed in section 5.5.

4.1.3 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 natural vegetation areas that provide habitat for Koalas (*Phascolarctos cinereus*).

While SEPP 44 does not apply under Part 5 of the EP&A Act, as a matter of best practice, consideration has been given to the intent of the SEPP.

SEPP 44 applies to the Murray River LGA and lists preferred feed tree species of the Koala, including River Red Gum (*Eucalyptus camaldulensis*).

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

The ecological assessment (Appendix D) found that the Koala is unlikely to inhabit the ecological assessment study area due to a lack of recent local records, and due to the species not being recorded in the ecological assessment study area during surveys.

There is no evidence of either a current or historical Koala population in the study area. Therefore, the habitat is not 'core koala habitat' as defined in the SEPP and the provisions of this SEPP do not apply.

4.2 Local Environmental Plans

The proposal is located within the Murray River Local Government Area, which is subject to the provisions of the *Wakool Local Environmental Plan 2013* (Wakool LEP). The provisions of the Wakool LEP do not apply to the proposal due to the application of the ISEPP. Nevertheless, consideration is given below to the provisions of the Wakool LEP.

4.2.1 Wakool Local Environmental Plan 2013

Zoning

The proposal is located within the following Wakool LEP zones:

- E1 National Parks and Nature Reserves – includes land within the Murray Valley National Park. All land in this zone covered by the proposal site is located within the existing road reserve
- RU1 Primary Production – includes land owned by the NSW Minister administering the *National Parks and Wildlife Act 1974* (see section 3.6), which is currently leased for agricultural land use
- W1 Natural Waterways – covers the Wakool River corridor.

Further consideration is given below to the impacts of the proposal in these LEP zones.

E1 National Parks and Nature Reserves

The objectives of the E1 National Parks and Nature Reserves zone are:

- to enable the management and appropriate use of land that is reserved under the *National Parks and Wildlife Act 1974* or that is acquired under Part 11 of that Act
- to enable uses authorised under the *National Parks and Wildlife Act 1974*
- to identify land that is to be reserved under the *National Parks and Wildlife Act 1974* and to protect the environmental significance of that land.

The Murray Valley National Park has a range of environmental values, including ecological, cultural heritage and aesthetic values.

The proposal would remove about 1.3 hectares of native vegetation from the E1 zone. The vegetation provides habitat for biota listed under the TSC Act and EPBC Act. The ecological assessment (refer to section 6.2) has considered the proposal's potential impacts and has assessed that the proposal would be unlikely to have a significant effect on biota listed under the TSC Act and EPBC Act.

The proposal is unlikely to have impacts on any items of Aboriginal cultural heritage significance (refer to section 6.8). Two sites of potential non-Aboriginal heritage significance are located outside the proposal site and are unlikely to be affected by the proposal (refer to section 6.1). The existing Gee Gee Bridge will be delisted from the State Heritage Register before demolition (see section 6.1).

The proposal would affect the aesthetic values of the land zoned E1 (refer to section 6.9).

RU1 Primary Production

The objectives of the RU1 Primary Production zone are:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- to encourage diversity in primary industry enterprises and systems appropriate for the area
- to minimise the fragmentation and alienation of resource lands
- to minimise conflict between land uses within this zone and land uses within adjoining zones
- to promote the use of agricultural land for efficient and effective agricultural production without the encroachment of urban land uses
- to allow the development of processing, service and value-adding industries related to agriculture and primary industry production
- to allow the development of complementary non-agricultural land uses that are compatible with the zone's character.

The proposal would permanently remove 2.33 hectares of agricultural land from production. Agricultural land is however well represented in the study area and locality, and the proposed removal does not represent a large proportion of agricultural land. The proposal would not cause significant fragmentation of the rural property. The proposal would therefore have only minor impacts on agricultural land. The proposal would benefit primary industry in the region by providing access across the Wakool River for higher mass limit vehicles (longer trucks carrying heavier loads) and oversized vehicles.

W1 Natural Waterways

The objectives of the W1 Natural Waterways zone are:

- to protect the ecological and scenic values of natural waterways
- to prevent development that would have an adverse effect on the natural values of waterways in this zone
- to provide for sustainable fishing industries and recreational fishing.

The proposal has the potential to affect the natural values of the Wakool River. The proposal would involve building new bridge piers in the Wakool River and demolishing the existing bridges, with the potential for adverse water quality effects. Potential water quality impacts have been assessed in section 6.4.

Potential water quality impacts may affect the aquatic and terrestrial plants and animals that depend on the Wakool River. The potential ecological impacts of the proposal have been assessed in sections 6.2 and 6.3.

The proposal has the potential to affect the scenic values of the river through the construction of the new bridge and demolition of the existing bridges. The landscape and visual impacts of the proposal are assessed in section 6.9.

The proposal would be unlikely to substantially affect recreational fishing in the study area.

4.3 Other relevant NSW legislation

4.3.1 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 in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. For any of these that 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.

Potential impacts on terrestrial ecology have been considered in section 6.2. The ecological assessment (Appendix D) concluded that the proposal would be unlikely to have a significant impact on any threatened species, populations, ecological communities or their habitats listed under the TSC Act. Therefore, a species impact statement is not required.

4.3.2 Noxious Weeds Act 1993

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

- identifying noxious weeds in respect of which particular control measures need to be taken, and specifying those control measures
- specifying the duties of public and private landholders as to the control of those noxious weeds
- providing 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. 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 ecological assessment study area, considered in section 6.2. The potential impacts of the proposal relating to noxious weeds, and site specific safeguards, are included in section 6.2.

4.3.3 Fisheries Management Act 1994

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 fish species 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 species impact statement must be completed and consultation with the NSW Department of Primary Industries (Fishing and Aquaculture) is required. The potential impacts of the proposal on biota listed under the FM Act are assessed in section 6.3.

The FM Act requires a permit for work involving 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 removing material from water land, including woody debris, snags, gravel beds, cobbles, rocks, boulders, rock bars or aquatic vegetation.

Reclamation refers to using any material 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.

Public authorities are exempt from obtaining a permit for dredging or reclamation work under Part 7 of the FM Act (refer section 201(2)(b)). However, Section 199 of the FM Act requires that notification be given to the Minister before a public authority carries out or authorises the carrying out of dredging or reclamation work and any matters raised by the Minister be considered within 28 days after the giving of the notice.

The construction of the proposal in the Murray River and on its floodplain is classified as dredging and reclamation work. The demolition of the bridges and removal of the existing road embankment are also likely to constitute dredging work. Notification to the Minister is therefore required.

Construction of new bridge piers, removal of existing bridge piers, construction of temporary coffer dams and construction of temporary work platforms in the Wakool River may cause obstructions to fish passage. A permit is therefore required under Section 219 of the FM Act to block fish passage.

4.3.4 Water Management Act 2000

The *Water Management Act 2000* (WM Act) controls the carrying out of activities in or near water sources in NSW, the extraction and use of water and the construction of works such as dams and weirs. ‘Water sources' are defined as a river, lake, estuary, place where water occurs naturally on or below the surface of the ground or NSW coastal waters.

The proposal is exempt from the requirement to obtain a ‘controlled activity' approval under section 38 of the *Water Management (General) Regulation 2011* for work on waterfront land.

Under clause 61 of the WM Act, a person may apply to the Minister for Water for an access licence (section 56) if the application is for a specific purpose access licence and a management plan provides that an application for the licence may be made. Under clause 18 of the *Water Management (General) Regulation 2011*, Roads and Maritime is exempt from obtaining an access licence for road construction and maintenance operations, including dust suppression.

Under section 90 of the WM Act, a water supply work approval authorises its holder to construct and use a specified water supply work at a specified location (eg for pumping water from a river). As extraction of water from the Wakool River is required for the proposal, a water supply work approval is required.

A licence is required under section 91F of the WM Act for any aquifer interference activity (the penetration, interference, obstruction or taking of water from an aquifer). Due to the shallow depth to groundwater on the Wakool River floodplain (see section 6.4), it is likely that construction of bridge piers would penetrate the groundwater aquifer and may require dewatering of excavations. An aquifer interference licence would therefore be required.

Water sharing plans created under the WM Act establish rules for sharing water between the environmental needs of a river or aquifer and water users, and also between different types of water use such as town supply, rural domestic supply, stock watering, industry and irrigation.

The proposal occurs within the area administered by the *Water Sharing Plan for the New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2004*. Water extraction approvals may be granted in the water sources covered by the Plan.

4.3.5 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides the basis for legal protection and management of Aboriginal sites within NSW, and for the management of National Parks estate.

The proposal would require temporary construction access through the Murray Valley National Park next to the proposal site. Under clause 94 of the ISEPP, this can only occur if it is authorised by or under the NPW Act. Roads and Maritime would seek authorisation under the NPW Act for this activity from the Office of Environment and Heritage (OEH).

The Aboriginal cultural heritage assessment concluded that the proposal would be unlikely to have impacts on Aboriginal objects or Aboriginal places (see section 6.8). An Aboriginal heritage impact permit from OEH is not required for the proposal.

Section 2A of the Act provides for the conservation of nature, including habitat, ecosystems and ecosystem processes. Although the proposal site is located within the Murray Valley National Park, and would remove flora and fauna habitat, these impacts would only occur on land within the existing road reserve.

4.3.6 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) is concerned with all aspects of heritage conservation, ranging from basic protection against indiscriminate damage and demolition of buildings and sites through to restoration and enhancement.

Heritage places and items of particular importance to the people of NSW are listed on the State Heritage Register. Only heritage items that are of State significance are listed on the State Heritage Register. Approval under Section 60 of the Heritage Act may be required for impacts to a listed heritage item.

One item listed on the State Heritage Register is present in the study area, the existing Gee Gee Bridge. Roads and Maritime's Chief Executive submitted a notification to de-list Gee Gee Bridge to the Heritage Division of OEH on 24 March 2017. The proposed bridge demolition is dependent on it being delisted from the State Heritage Register. The demolition of the existing Gee Gee Bridge has been assessed in section 6.1.

Gee Gee Bridge is also listed on Roads and Maritime's Section 170 register. Section 170(A)(1) of the Heritage Act requires Roads and Maritime to provide written notice to the NSW Heritage Council not less than 14 days before the start of transferral or demolition work of any items listed on an Section 170 register.

The Heritage Act also protects 'relics', which can include archaeological material, features and deposits. Section 4(1) of the Heritage Act defines a 'relic' as follows:

> *relic means any deposit, artefact, object or material evidence that:*
> *(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and*
> *(b) is of State or local heritage significance.*

Under Section 139 of the Heritage Act, NSW Heritage Council approval is required before the disturbance or excavation of land if a project will, or is likely to result in, disturbance to a relic.

Areas with archaeological potential within the study area are discussed in section 6.1. These include two areas of potential local heritage significance:

- an old low level river crossing located about 50 metres downstream (north) of the existing Gee Gee Bridge, which was used to cross the Wakool River before the existing bridge was built
- the historic site of a River Red Gum sawmill, about 170 metres south-east of the existing Gee Gee Bridge.

An exception notification would be sought from the NSW Heritage Council under Section 139 (4) of the Heritage Act if it is determined at any stage that there is the potential for impacts to these areas of potential local heritage significance.

4.4 Commonwealth legislation

4.4.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (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.

On 14 August 2014 the Australian Government entered into an agreement with Roads and Maritime to carry out a strategic assessment of road and traffic management works assessed under Part 5 of the EP&A Act. The strategic assessment was completed in line with section 146 of the EPBC Act. The strategic

assessment was approved by the Australian Government Department of the Environment in September 2015. The strategic assessment relates to the following matters of national environmental significance:

- nationally listed threatened species and ecological communities protected by sections 18 and 18A of the EPBC Act
- listed migratory species protected by sections 20 and 20A of the EPBC Act.

Roads and Maritime activities assessed under Part 5 of the EP&A Act no longer require Australian Government approval with respect to these matters.

Where Roads and Maritime intends to carry out Part 5 activities that may impact on other matters of national environmental significance, the relevant assessment and approval requirements under the EPBC Act apply.

The potential impacts of the proposal on matters of national environmental significance are considered in Appendix A and chapter 6 of this REF.

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment and Energy.

4.5 Confirmation of statutory position

An assessment of the relevant statutory planning instruments has concluded that the proposal can be assessed under Part 5 of the EP&A Act, by Roads and Maritime Services NSW as the proponent and determining authority.

5 Consultation

This chapter discusses the consultation carried out to date for the proposal and the consultation proposed for the future.

5.1 Consultation strategy

Roads and Maritime and Council have consulted with potentially affected property owners, government agencies and other stakeholders during the selection of the preferred option and development of the concept design. The purpose of consultation has been to:

- inform the community of the proposal
- advise potentially affected stakeholders of the proposal and its possible impacts.

Roads and Maritime and Council would continue to consult with the community and stakeholders during the detailed design and construction phases of the proposal.

5.2 Community involvement

A community update was placed on the Roads and Maritime project website in April 2015. The community update was advertised in the local media. The community update contained contact details for Council to enable the community to comment on the proposal or request further information. No responses to the community update have been received by Council or Roads and Maritime.

Council has consulted with the owner of the property 'Rest-down'. This consultation has included notifying the property owner of:

- the proposed Noorong Road realignment closer to the residence on the property
- the proposed acquisition of land owned by the Minister administering the *National Parks and Wildlife Act 1974*, which is currently being leased by the owner of 'Rest-down'
- access changes to the 'Rest-down' property during the proposal's construction and operation.

Roads and Maritime and Murray River Council will continue to consult with the owner of 'Rest-down'.

5.3 Aboriginal community involvement

Consultation with the Aboriginal community was consistent with Stage 2 of Roads and Maritime's 'Procedure for Aboriginal Cultural Heritage Consultation and Investigation', summarised in Table 5.1.

Table 5.1: Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial Roads and Maritime assessment
Stage 2	Site survey and further assessment

Stage	Description
Stage 3	Formal consultation and preparation of a cultural heritage assessment report
Stage 4	Implement environmental impact assessment recommendations

Consultation with the Wamba Wamba Local Aboriginal Land Council (LALC) was carried out by Jacobs for the specialist Aboriginal heritage assessment (see section 6.8). A representative of the Wamba Wamba LALC participated in the archaeological field survey. Wamba Wamba LALC provided a survey report following the field assessment (see Appendix B of the Aboriginal heritage assessment in Appendix J of this REF). The Wamba Wamba LALC representative found that the proposal would be unlikely to affect any Aboriginal cultural heritage features.

5.4 ISEPP consultation

Clauses 13 to 16 of the ISEPP require that public authorities consult with councils and other public authorities for certain activities when proposing to carry out development without consent. Table 5.2 assesses the relevance of these clauses to the proposal.

Table 5.2: Assessment of clauses 13, 14, 15 and 16 of the ISEPP

Clause	Is consultation required?
Clause 13	
1(a) Substantial impact on stormwater management services provided by a council.	Stormwater management services provided by Council are not present in the study area. Consultation with Council is not required for this item.
1(b) Likely to generate traffic to an extent that would strain the capacity of the road system in a local government area.	The likely daily traffic increases during construction would be minor. The proposal would make Gee Gee Bridge accessible to higher mass limit and oversized vehicles. This is predicted to generate an increase in the daily heavy vehicle traffic volume from 67 to 87 vehicles per day. Given the low number of vehicles, this is unlikely to strain the capacity of the road system in a local government area. Consultation with Council is not required for this item.

Clause	Is consultation required?
1(c) Involves connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council.	A sewage system owned by Council is not present in the study area. Consultation with Council is not required for this item.
1(d) Involves connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council.	A water supply system owned by Council is not present in the study area. Consultation with Council is not required for this item.
1(e) Involves the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential.	The proposal would not involve the construction of a temporary structure on, or the enclosing of, a public place that would cause a disruption to pedestrian or vehicular traffic. Consultation with Council is not required for this item.
1(f) Involves excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the *Roads Act 1993* (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath).	The proposal would involve excavation that is not minor or inconsequential, of the surface of Noorong Road, a Council road. Consultation under the ISEPP has therefore been carried out with Council.
Clause 14	
Is likely to have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area.	The proposal would involve demolishing the existing Gee Gee Bridge, which is listed as a heritage item under Schedule 5 of the Wakool LEP. Consultation under the ISEPP has therefore been carried out with Council.
Clause 15	
Development that is to be carried out on flood liable land that may be carried out without consent and that would change flood patterns other than to a minor extent.	The proposal is located on flood liable land but has been assessed as having only minor impacts on flood patterns (see section 6.5). Consultation with Council is not required for this item.

Clause	Is consultation required?
Clause 16	
Clause 16 of the ISEPP states that a consent authority must not carry out any of the following development without giving written notice to the specified authority and taken their responses into consideration:	
(a) development adjacent to land reserved under the *National Parks and Wildlife Act 1974*—the Office of Environment and Heritage,	The proposal is located in a road reserve adjacent to land reserved under the *National Parks and Wildlife Act 1974*. Consultation with OEH is required for this item.
(b) development adjacent to a marine park declared under the *Marine Parks Act 1997*—the Marine Parks Authority,	The proposal is not located adjacent to a marine park.
(c) development adjacent to an aquatic reserve declared under the *Fisheries Management Act 1994*—Department of Primary Industries—Fishing and Aquaculture,	The proposal is not located adjacent to an aquatic reserve.
(d) development in the foreshore area within the meaning of the Sydney Harbour Foreshore Authority Act 1998—the Sydney Harbour Foreshore Authority,	The proposal is not located in the foreshore area.
(e) development comprising a fixed or floating structure in or over navigable waters—Roads and Maritime,	Roads and Maritime is the proponent.
(f) development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act)—the NSW Rural Fire Service.	The proposal is not for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes.

ISEPP consultation with Council has been carried out in relation to excavation of a council road (item 1f under clause 13) and impacts to a local heritage item (clause 14). Roads and Maritime has consulted extensively with Council in relation to all the relevant matters in clauses 13 to 15 of the ISEPP, and would continue to do so during the detailed design and construction of the proposal.

ISEPP consultation was carried out with OEH on 16 February 2016 in relation to development next to land reserved under the *National Parks and Wildlife Act 1974* (item 'a' under clause 16). A response to the ISEPP consultation was not received. However, issues raised by OEH during informal consultation are addressed in section 5.6.

5.5 Murray REP consultation

Consultation with stakeholders is provided for by clauses 11, 12 and 13 of the Murray REP. These apply to the public authority or person carrying out the development.

Consultation is required in relation to the circumstances set out in clause 12 of Murray REP, as summarised in Table 5.3.

Table 5.3 Assessment of clause 12 of the Murray REP

Clause	Is consultation required?
Where development is contrary to the aims, objectives or principles of this plan and may have a significant environmental effect along the Murray River—the P&D (Vic), C&NR (Vic) and the adjacent local Council in Victoria must be consulted.	The proposal has been assessed against the planning principles in the Murray REP in section 4.1.2. Based on the assessment of planning principles in Table 4.1, it is considered unlikely that the proposal would significantly compromise the principles of the Murray REP. This REF finds that the proposal is unlikely to have a significant environmental effect. Therefore, consultation with the relevant agencies is not required.
Where development is within or may adversely affect land dedicated or reserved under the *National Parks and Wildlife Act 1974*—the NPWS must be consulted.	The proposal is located next to, and within, land dedicated or reserved under the NPW Act. The potential impacts of the proposal (such as vegetation clearing and water quality impacts) could indirectly adversely affect this land. Consultation has been carried out with OEH – National Parks and Wildlife Service.
Where development may adversely affect endangered fauna within the meaning of the National Parks and Wildlife Act 1974—the NPWS must be consulted.	The proposal may adversely affect fauna listed as vulnerable and endangered under the TSC Act and FM Act. OEH has therefore been consulted, and has raised matters to be addressed in relation to threatened fauna, as detailed in section 5.6.
Where development may affect an Aboriginal site or any other place that is generally recognised as a place of cultural significance to the Aboriginal community—the NPWS must be consulted.	The proposal would be unlikely to affect an Aboriginal site or any other place that is generally recognised as a place of cultural significance to the Aboriginal community. Nevertheless, OEH has been consulted, and has commented on the need to assess potential impacts to Aboriginal heritage, as detailed in section 5.6.

Clause	Is consultation required?
Where development is within or may adversely affect a State Forest—the Forestry Commission must be consulted.	The proposal is not located within, and would be unlikely to adversely affect a State Forest. Consultation is therefore not required with the Forestry Corporation of NSW.
Where development may affect boating safety—the MSB must be consulted.	Roads and Maritime is the proponent.

Clause 13 of the Murray REP requires consultation for a public utility undertaking (including for roads) where the undertaking is likely to significantly affect the environment. The clause requires consultation with the Murray Darling Basin Authority, the relevant NSW local council and any other agencies that may be affected, as the public authority (in this case Roads and Maritime) considers appropriate. As the proposal would be unlikely to result in a significant environmental impact (refer to section 8.3), this consultation is not required.

5.6 Government agency and stakeholder involvement

Council and Roads and Maritime consulted with two government agencies during a meeting at the proposal site on 16 April 2015. The agencies in attendance included:

- Office of Environment and Heritage (OEH)
- Department of Primary Industries – Water.

Verbal consultation has been carried out by Council with the Department of Primary Industries – Fishing and Aquaculture.

A letter of consultation was sent by Roads and Maritime to the Murray Darling Basin Authority (MDBA).

Consultation by email has taken place between Roads and Maritime and Water NSW in relation to Hydrometric Station No. 409062.

Additional consultation has occurred with OEH (National Parks and Wildlife Service) in relation to proposed work within the Murray Valley National Park and the requirements for authorisation under the NPW Act.

Issues raised by the government agencies are summarised in Table 5.4.

Table 5.4 Issues raised by government departments

Issue	Details	Where addressed in this REF
OEH		
Species habitat	• Rick Webster has previously carried out fauna surveys in the nearby forest. Results of these surveys may be useful to inform the ecological assessment.	Section 6.2

Issue	Details	Where addressed in this REF
Vegetation removal	• Minimise hollow-bearing tree removal • Retain two large hollow-bearing trees on the northern river bank and implement safeguards to avoid if possible.	Section 6.2
Fauna habitat	• Hollow logs provide terrestrial fauna habitat and these should be retained or relocated in the study area where appropriate • Potential habitat for Gilbert's Whistler is present in the study area in *Exocarpos*, Wilga and River Cooba shrubby areas • The study area is unlikely to provide habitat for the Regent Parrot.	Section 6.2
Aboriginal heritage	• The potential Aboriginal heritage impacts will need to be assessed.	Section 6.8
Department of Primary Industries – Fishing and Aquaculture		
Fish habitat	• Placing the root boles from removed trees into the river would provide potential habitat for fish.	Section 6.3
Department of Primary Industries – Water		
Refuelling of rigs	• Specific training should be provided to personnel for refuelling procedures for static rigs on temporary platforms in the river and bunding of chemical storage areas.	Section 6.4
Concrete waste	• An appropriate disposal method for the concrete/slurry mix from concrete trucks would need to be in place.	Section 6.4
Bored piles (if applicable)	• An appropriate disposal method for any bored out material should be in place to avoid spoil impacting on the river.	Bridge piles would be driven (not bored)
MDBA		
Impacts to Hydrometric Station No. 409062	• MDBA's interest in this project is in relation to the potential for effects of flows on Hydrometric Station No. 409062. Water NSW will need to be consulted.	Section 6.5
Water NSW		
Impacts to Hydrometric Station No. 409062	• The project manager should contact Water NSW (Richard Brown) to advise of the construction date to manage possible rating changes and document this on the station history file.	Section 6.5
Murray River Council		
Demolition of Gee Gee Bridge	• Council has no objection to the proposed replacement of the existing timber truss bridge, demolition, removal, recovery and salvage of timber from existing structure and the proposed view point.	Noted.

5.7 Ongoing or future consultation

Ongoing consultation would be carried out in line with Roads and Maritime's 'Community Engagement Policy Statement 2012' and Roads and Maritime's 'Community Engagement and Communication Manual 2012'.

5.7.1 Consultation during public display of the REF

This REF will be exhibited for public comment in line with Roads and Maritime's 'Environmental Assessment Procedure: Project review of environmental factors'. Roads and Maritime will continue to inform landowners, stakeholders and the broader community about the findings of the REF to ensure people are kept up to date, and where appropriate, to provide feedback.

5.7.2 Consideration of submissions

An REF submissions report will be prepared following the public display of the REF, addressing all issues raised.

The REF submissions report will be made available to the public via the project website. The community will be informed about any subsequent changes to the proposal.

5.7.3 Consultation after display of the REF

If the proposal is determined to proceed, the following ongoing consultation would be carried out by Roads and Maritime and/or Council:

- consultation with Department of Primary Industries (Fishing and Aquaculture) in relation to notification of dredging and reclamation work and application for Section 219 permit for obstruction to fish passage
- consultation with OEH (National Parks and Wildlife Service) in relation to work in and next to the Murray Valley National Park
- consultation with community stakeholders and property owners in the study area to assist in managing construction impacts. This will include discussing access arrangements to 'Rest-down' with the property owner
- ongoing meetings with Roads and Maritime, community stakeholders and utility providers as required
- ongoing updates throughout the planning phase and construction period to the immediately affected community
- affected landowners would be notified at least seven days before construction activities that would directly impact on properties
- Roads and Maritime's website would include updates, contact details for further information or complaints, and notices of upcoming work
- a contact number would be provided for the community to register any comments or complaints during construction of the proposal
- where required, information would be published in local newspapers, including notices of traffic control
- utility providers would be consulted in relation to impacts to services and requirements for service relocations during the construction phase.

6 Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of:

- potential impacts on matters of national environmental significance under the EPBC Act
- the factors specified in the guidelines Is an EIS required? (DUAP 1995/1996) as required under clause 228(1) of the *Environmental Planning and Assessment Regulation 2000* and the Roads and Related Facilities EIS Guideline (DUAP 1996). The factors specified in clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* are also considered in Appendix A.

6.1 Non-Aboriginal heritage

A Statement of Heritage Impact for the proposal was completed by the NSW Government Architect's Office (NSW GAO 2015a). It is summarised below and provided in Appendix I.

6.1.1 Methodology

The study area for the non-Aboriginal heritage assessment is defined as the area within 500 metres of the proposal.

Heritage databases were searched by the NSW Government Architect's Office and by GHD on 26 June 2015 to identify heritage items recorded in the study area. These databases included:

- Australian Heritage database
- Australian Heritage Places Inventory
- NSW State Heritage Register
- Heritage Schedule 5 of *Wakool Local Environmental Plan 2013*
- Roads and Maritime section 170 Heritage and Conservation Register.

The existing Gee Gee Bridge site was physically inspected by a heritage specialist and a landscape architect from the NSW Government Architect's Office on 21 July 2015.

6.1.2 Existing environment

Brief history of the region

The Murray River region around Barham, about 48 kilometres south-east of the proposal site, was settled by graziers, mainly in the 1840s. River frontage land was first developed, while the open plains to the north in NSW remained undeveloped (WSC 2015).

Swan Hill, about 33 kilometres west of the proposal site, was established in about 1846 and, for some time, provided the only Murray River crossing for about 100 kilometres. The crossing serviced the growing agricultural area. Produce was transported to Echuca by paddle steamers along the Murray River until the railway reached Swan Hill in about 1890 (WSC 2015).

Heritage sites

Gee Gee Bridge

Gee Gee Bridge (see Figure 1.1 and Figure 6.1) is listed in the following registers and legislation:

- NSW State Heritage Register
- Heritage Schedule 5 of the Wakool LEP
- Roads and Maritime section 170 Heritage and Conservation Register.

Gee Gee Bridge is a Dare type timber truss bridge constructed in 1929. A description of the bridge is provided in section 2.2.1.

The bridge is identified for replacement under Roads and Maritime's 'Timber Truss Bridge Conservation Strategy' (Roads and Maritime 2012c), which was endorsed by the Heritage Council of NSW in August 2012. The existing bridge cannot be upgraded to meet the future operational requirements of Noorong Road. The bridge will be delisted from the State Heritage Register before demolition.

Gee Gee bridge is a representative example of Dare truss road bridges. It was assessed as being State significant primarily on the basis of its technical and historical significance. The bridge has many associated links with important historical events, including the expansion of the road network and economic activity in NSW, and Harvey Dare, the designer of this type of truss.

Roads and Maritime's Chief Executive submitted a notification to de-list Gee Gee Bridge to the Heritage Division of OEH on 24 March 2017.

The Gee Gee flood relief bridge was assessed during the heritage listing process for Gee Gee Bridge, and was assessed as not meeting the requirements for inclusion in the heritage listing.

Figure 6.1: Gee Gee Bridge over Wakool River

Historic low level river crossing

Before Gee Gee Bridge and the flood relief bridge were built, there was a low level river crossing near the current bridge site. The location of the original low level river crossing site is uncertain. The Department of Lands 1915 map of the Parish of Cunninyeuk, obtained from NSW Land and Property Information, indicates the crossing may have been about 550 metres upstream of the existing bridge (approximate location shown in Figure 6.4). Local enquiries have indicated a crossing site was located about 70 metres downstream (north) of the existing Gee Gee Bridge. The downstream site is typically inundated by water, but milled timbers have been observed at the site during periods of low flow in the Wakool River (see Figure 6.2 and Figure 6.4).

The low level river crossing site is not listed as a heritage item, however may have local heritage significance. The low level river crossing is not located in the proposal site.

Figure 6.2: Potential historic low level river crossing site north of Gee Gee Bridge

Historic River Red Gum sawmill site

The historic site of a River Red Gum sawmill is located in the study area about 170 metres south-east of the existing Gee Gee Bridge (see Figure 6.3 and Figure 6.4). The mill operated between 1926 and 1940, and was owned by Frank Morton of Barham. A commemorative stone at the site remembers the families and single men that lived and worked at the site. Earnest Lowe managed the mill until 1940 and was in the process of moving it to Barham when he died at age 44. The stone recognises the site as an integral part of the Lowe family history and contains remnants of milled timber from the time.

The River Red Gum sawmill site is not listed as a heritage item, however may have local heritage significance.

Figure 6.3: Historic River Red Gum sawmill site at Gee Gee Crossing

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6,086,800 6,086,600 6,086,400 6,086,200 6,086,000

Murray Valley National Park

Historic low level river crossing site - local information (potential heritage)

Existing flood relief bridge

Noorong Road

Nacurrie Road

Historic low level river crossing site (approx.) - 1915 parish map (potential heritage)

Existing Gee Gee Bridge (heritage listed)

Wakool River

Historic River Red Gum saw mill site (potential heritage)

Murray Valley National Park

765,600 765,800 766,000 766,200 766,400 766,600 766,800 767,000 767,200

Paper Size A3

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

LEGEND

- Potential heritage site
- Road design
- Existing road
- Proposal site
- Proposed stockpile site
- Murray Valley National Park (indicative only)

Wakool Shire Council
Gee Gee Bridge replacement

Job Number	23 15324
Revision	0
Date	08 Jun 2017

Non-Aboriginal heritage sites in the study area

Figure 6.4

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Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia T 61 2 6923 7400 F 61 2 6971 9565 E wg amail@ghd.com W www .ghd.com

Data source: NSW Government: Roads & National Parks -201 2; Wakool Shire Council: Aerial photograph & road design - 2015; Google Inc: Satellite imagery -2/ 12/2015. Created by:rtrobinson

6.1.3 Potential impacts

Gee Gee Bridge

Gee Gee Bridge has been delisted from the NSW Heritage Register. The removal of the bridge is identified in the 'Timber Truss Bridge Conservation Strategy' (Roads and Maritime 2012c). Roads and Maritime, through the Strategy, and with the endorsement of the Heritage Council, is carrying out a broad range of actions to reduce this impact. The key mitigations are set out in Table 4 of the Statement of Heritage Impact (SOHI) (NSW GAO 2015a) (see Appendix I). These include the following measures:

- retain other selected Dare truss bridges in NSW
- historical-contextual interpretation (preparation of a Timber Truss Bridges book, local signboards and heritage markers)
- photographic archival recording and measured drawings
- benefits for natural landscape and environment through wetlands regeneration
- updating of the RMS Section 170 Register
- biennial reporting to the Heritage Council of NSW on the progress of the Strategy and its associated conservation actions.

The 'Timber Truss Bridge Conservation Strategy' incorporates a set of implementation guidelines and milestones. These were established in consultation with the NSW Heritage Council and clearly outline the agency's implementation objectives. The guidelines include a number of measures, to which Roads and Maritime has committed, to collectively mitigate the heritage impacts arising from the Strategy across the timber truss bridge portfolio as a whole.

The SOHI determines that the replacement of the Gee Gee Bridge will detrimentally impact on the heritage significance of the heritage item. However, it has been demonstrated that:

- long-term operability of the bridge has been shown to be not feasible. The bridge has been scheduled for replacement since the early stage of the 'Timber Truss Bridge Conservation Strategy' and infrastructure needs have not changed in regard to the bridge
- it is apparent from a site inspection and discussion with Roads and Maritime that adaptive re-use opportunities are few and local community engagement is very limited. Roads and Maritime has demonstrated that the 'Transfer' and 'Adaptive Re-use' options have been investigated and have so far produced no viable solutions. Roads and Maritime and Murray River Council have identified practicable heritage impact mitigation measures
- the bridge has been extensively reinforced and the majority of its original timbers have been replaced. The cost of upkeep will increase over time as the original fabric quantity further diminishes
- Roads and Maritime's 'Timber Truss Bridge Conservation Strategy' has charted positive long term strategic goals for timber truss bridges in NSW and is being followed in line with commitments made to the Heritage Council
- Roads and Maritime has advised that archival recording before demolition is being completed in line with NSW Heritage Branch guidelines 'How to Prepare Archival Records of Heritage Items'

- Roads and Maritime is willing to develop appropriate interpretation strategies to set the cultural, pastoral and natural history of the bridge and crossing in context, and when implemented this will mitigate some of the loss
- Roads and Maritime is engaged in updating its Section 170 Register to reflect changes to the bridge portfolio and to monitor heritage safeguards for its other timber truss bridges
- Roads and Maritime has a set of safeguards to ensure biodiversity gains are optimised after any new construction. Safeguards can be conscientiously applied at Gee Gee to the site of the old road after the blacktop and bridge superstructure are removed, either wholly or partly.

The SOHI recognises Roads and Maritime's need to divest an agreed number of assets from the timber bridge portfolio. The standard mitigations identified in the 'Timber Truss Bridge Conservation Strategy', combined with other site-specific mitigations, provide measures that reduce the adverse impact of removal. The SOHI considers the issue in the strategic context rather than in isolation.

Other sites of potential heritage significance

The low level crossing and River Red Gum sawmill site are located outside the proposal site and it is unlikely that the proposal would have impacts on these sites. No construction vehicles or machinery would be required to access these areas.

It is therefore unlikely that any other sites of non-Aboriginal heritage significance would be affected by the proposal.

6.1.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Non-Aboriginal heritage – impacts to the existing Gee Gee Bridge	• A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the construction environmental management plan (CEMP). It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage. It will incorporate relevant heritage de-listing approval conditions. A revegetation strategy for the existing road corridor will be developed as part of a wider approach to compensate loss of heritage values through demolition. Murray River Council will be guided by Roads and Maritime, the National Parks and Wildlife Service and other stakeholders in appropriate and sympathetic remediation for the new bridge, and the strategy used will be integrated with	Project manager and contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	landscape planning for the old bridge and road. This will include guidelines on how the landscaping of the area could be handled to combine interpretation, natural landscape regeneration, viewpoint, sightline and possibly trestle fragments close to the water line • Photographs of the bridge will be taken before demolition for archiving and research conducted for the Timber Truss Bridges book.		
Non-Aboriginal heritage – impacts to other sites	• The River Red Gum sawmill site will be protected by a physical barrier or fence as appropriate • The low level river crossing site will be identified on construction plans as an exclusion zone.	Project manager and contractor	Pre-construction
Non-Aboriginal heritage – impacts to the existing Gee Gee Bridge	• Access will be provided to the site of the original bridge, with a viewing point and parking area, on the southern side to make use of sightlines of the original bridge. On-site interpretation signage following the Roads and Maritime 'Timber Bridge Interpretation Guidelines' will be developed • Interpretation will focus on the bridge, but will also explore the local historical issues connected with agricultural transport and travelling stock routes. The interpretation strategy for Gee Gee crossing will be seen as part of a wider, planned approach that links all timber truss bridges in the area • Options for retention or re-use of timber and/or steel elements of the bridge in situ will be explored as a priority • Standard mitigation measures including archival photography, research for the Timber Bridges Book, and salvage and stockpile of timber for re-use in line with Roads and Maritime's 'Recycling	Project manager	Post-construction

Impact	Environmental safeguards	Responsibility	Timing
	of Timber Bridges' policy will be fully implemented.		
Non-Aboriginal heritage – inadvertent impacts on heritage items	• As part of the site induction, all workers will be advised of their obligations in relation to heritage before working on the site and the guidelines to follow if unanticipated heritage items or deposits are located during construction.	Project manager and contractor	Construction
Non-Aboriginal heritage – unanticipated archaeological finds	• The 'Standard Management Procedure - Unexpected Heritage Items' (Roads and Maritime 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. • Work will only re-start once the requirements of that procedure have been satisfied.	Project manager and contractor	Construction

6.2 Terrestrial ecology

A terrestrial ecological assessment was completed for the proposal (GHD 2017a). It is summarised below and provided in Appendix D.

6.2.1 Methodology

The study area for the terrestrial ecological assessment is defined as the area within 500 metres of the proposal site.

The assessment involved the following methods:

- background ecology information was reviewed. This information included relevant databases and species profiles
- terrestrial flora and fauna surveys were conducted by two ecologists between 1 and 3 June 2015
- targeted surveys for threatened terrestrial flora species with the potential to occur in the study area on 28 and 29 September 2015, including:
  - Speargrass (*Austrostipa wakoolica*)
  - Slender Darling-pea (*Swainsona murrayana*)
  - Chariot Wheels (*Maireana cheelii*)
  - Winged Peppercress (*Lepidium monoplocoides*)
- an assessment of the likelihood of occurrence was completed for threatened species, populations and ecological communities, and migratory species, with the potential to occur in the study area. The possibility of an impact on each species, population or ecological community was also assessed

- potential impacts on species listed under the TSC Act were assessed in line with the Assessment of Significance included in section 5A of the EP&A Act, with reference to DECC (2007) (see ecological assessment in Appendix D)
- potential impacts on species listed under the EPBC Act were assessed in line with the EPBC Act Policy Statement 'Matters of National Environmental Significance: Significant impact guidelines 1.1' (DotE 2013) (see ecological assessment in Appendix D).
- safeguards and management measures for the proposal were developed based on site conditions and the potential impacts of the proposal.

6.2.2 Existing environment

Vegetation corridors

Vegetation along the Wakool River in the study area forms part of a riparian vegetation corridor in the Murray Valley National Park that allows fauna to move across the landscape. This connected vegetation within the national park has an area of about 1700 hectares.

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.

Flora

Overview

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. The forest in the study area was previously part of Noorong State Forest and was historically logged. The state forest was transferred to Murray Valley National Park in 2011.

Vegetation communities

Three native vegetation communities were identified in the study area during field surveys. They are described in Table 6.1 and mapped in Figure 6.8. None of these vegetation communities are listed as threatened. River Red Gum forest and Black Box woodland are groundwater dependent ecosystems, relying on aquifers connected to the Wakool River.

Table 6.1: Vegetation communities in the study area

Vegetation community	Description
River Red Gum forest (see Figure 6.5)	Forest in the immediate vicinity of the Wakool River is dominated by River Red Gum which predominantly occurs along the riparian zone and inner floodplain of the Wakool River. 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 (*Astrebla lappacea*) and Ruby Saltbush (*Enchylaena tomentosa*). Woody debris and leaf litter are common.
Black Box woodland (see Figure 6.6)	Woodland dominated by Black Box (*Eucalyptus largiflorens*) occurs on the outer floodplain of the Wakool River adjacent to the River Red Gum community. The mid storey includes Pale-fruit Ballarat which forms locally dense stands in some locations. Dense patches of shrub cover are present 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 ground layer. Groundcover plants are common but not dense in this community and include Black Rolypoly (*Sclerolaena muricata*) Black Cotton Bush (*Maireana decalvans*), Creeping Saltbush (*Atriplex semibaccata*) Climbing Saltbush and Ringed Wallaby Grass (*Rytidosperma caespitosum*).
Black Roly Poly shrubland (see Figure 6.7)	This community is a low shrubland that occurs past the limits of the immediate floodplain on the northern side of the Wakool River. The upper and mid strata are generally absent, with only a few scattered Black Box trees. The shrub layer is dominated by chenopods including Black Roly Poly, Creeping Saltbush and Black Cotton Bush. There was evidence of past and current grazing in this community.

Areas of non-native vegetation 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 in agricultural land in the north and east of the study area. Introduced tree species occur in the study area including Pepper Tree (*Schinus areira*).

Figure 6.5: River Red Gum forest in the study area

Figure 6.6: Black Box woodland in the study area

Figure 6.7: Black Roly Poly shrubland in the study area

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Murray Valley National Park

Existing flood relief bridge

Existing Gee Gee Bridge

Noorong Road

Nacurrie Road

Wakool River

Murray Valley National Park

765,600 765,800 766,000 766,200 766,400 766,600 766,800 767,000

Paper Size A3

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

LEGEND

Hollow-bearing tree
- Remove
- Retain

Road design
- Road
- Proposal site

Vegetation community
- Introduced grass and tree plantings
- PCTID 13 - Black Box woodland
- PCTID 216 - Black Roly Poly shrubland
- PCTID 7 - River Red Gum forest

Wakool Shire Council
Gee Gee Bridge replacement

Job Number 23 15324
Revision 0
Date 19 May 2017

Vegetation communities and hollow-bearing trees

Figure 6.8

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Data source: NSW Government: Roads - 2012; Wakool Shire Council: Aerial photograph & road design - 2015; Google Inc: Satellite imagery - 2/12/2015.

Flora survey results

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

Targeted flora surveys for the threatened flora species Speargrass, Slender Darling-pea, Chariot Wheels and Winged Peppercress did not detect any of these species and they are considered unlikely to occur in the study area.

Noxious weeds

One flora species listed as noxious for the Murray River 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.

Fauna

Fauna habitats

Forest and woodland

Fauna habitat in the study area primarily includes areas of River Red Gum forest and Black Box woodland. The trees in the study area are used for nesting and foraging by a range of woodland birds, arboreal mammals and microchiropteran bats.

Remnant vegetation in the proposal site and study area provides foraging, movement and potential breeding habitat for a variety of bird species including the threatened Brown Treecreeper (*Climacteris picumnus victoriae*). 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*).

Hollow-bearing trees occur throughout the study area. Hollow-bearing trees located in or near the proposal site are shown in Figure 6.8. Hollow-bearing trees in the study area are likely to provide roosting and nesting habitat for microchiropteran bats, arboreal mammals and a range of woodland birds.

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*).

Bridges

Gee Gee Bridge and the flood relief bridge contain potential roosting habitat for microchiropteran bats in the timber framework under the bridge deck. Although no guano was found, crevices in the bridge under the deck may 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 near the bridge during surveys and captured bats that were released were observed looking for entry points into the bridge.

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

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*). These were both recorded during surveys. Grassy areas also provide foraging habitat for birds.

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 other terrestrial fauna.

Fauna survey results

During field surveys, 40 fauna species were identified, all of which are native. These included 32 bird species and eight mammal species (of which five were bats). The forest and woodland in the study area provide habitat for a number of bird species.

One threatened bird species was observed during 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 near the bridge during surveys. One species of bat was recorded during the harp trap surveys. Four species of bats were recorded by the Anabat surveys. None of the species recorded are threatened.

No amphibians or reptiles were recorded during surveys, possibly due to the cold conditions experienced at the time of the field surveys.

Threatened flora and fauna

Based on the field assessment and the review of existing information, the proposal could impact 16 bird species and five mammal species (including four bat species) listed as threatened or migratory under the NSW TSC Act and/or the Commonwealth EPBC Act. These species are listed in Table 6.2.

The Brown Treecreeper (Climacteris picumnus victoriae), which is listed as vulnerable under the TSC Act, was observed during field surveys for the proposal.

Table 6.2: Threatened biota likely to be impacted by the proposal

Species/population/ecological community	Status
Birds	
Barking Owl *Ninox connivens*	V – TSC Act

Species/population/ecological community	Status
Blue-billed Duck *Oxyura australis*	V – TSC Act
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	V – TSC Act
Cattle Egret *Ardea ibis*	Mi – EPBC Act
Diamond Firetail *Stagonopleura guttata*	V – TSC Act
Fork-tailed Swift *Apus pacificus*	Mi – EPBC Act
Freckled Duck *Stictonetta naevosa*	V – TSC Act
Gilbert's Whistler *Pachycephala inornata*	V – TSC Act
Great Egret *Ardea alba*	Mi – EPBC Act
Grey-crowned Babbler *Pomatostomus temporalis temporalis*	V – TSC Act
Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*	V – TSC Act
Major Mitchell's Cockatoo *Lophochroa leadbeateri*	V – TSC Act
Spotted Harrier *Circus assimilis*	V – TSC Act
Varied Sittella *Daphoenositta chrysoptera*	V – TSC Act
White-bellied Sea-Eagle *Haliaeetus leucogaster*	Mi – EPBC Act
White-fronted Chat *Epthianura albifrons*	V – TSC Act
Mammals	
Squirrel Glider *Petaurus norfolcensis*	V – TSC Act
Microchiropteran bats	
Little Pied Bat *Chalinolobus picatus*	V – TSC Act
South-eastern Long-eared Bat *Nyctophilus corbeni*	V – TSC Act V – EPBC Act
Southern Myotis *Myotis macropus*	V – TSC Act

Species/population/ecological community	Status
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V – TSC Act V – EPBC Act

V – Vulnerable, E – Endangered, Mi – Migratory

EP&A Act assessments of significance were completed for species listed under the TSC Act that are known or likely to occur in the study area and that are likely to be affected by the proposal. Significance assessments were also completed for species listed under the EPBC Act that are known or likely to occur in the study area and are likely to be affected by the proposal (see ecological assessment in Appendix D). The results of these are described in section 6.2.3.

6.2.3 Potential impacts

Construction

Loss of vegetation/habitat

The proposal would remove about 2.1 hectares of native vegetation. The area of each vegetation type proposed to be removed is provided in Table 6.3.

Table 6.3: Vegetation removal

Vegetation type	Area removed (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 area	**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 forest and woodland habitat in the study area.

The vegetation types to be cleared are groundwater dependent ecosystems, as identified in section 6.2.2. The proposal would therefore impact on groundwater dependent ecosystems through vegetation removal. This impact is unlikely to be significant, given the extent of the groundwater dependent ecosystems in the study area and locality.

Loss of hollow-bearing trees

The proposal would result in the removal of 13 hollow-bearing trees (see Figure 6.8). The size and type of those hollows is detailed in Table 5.2 of the ecological assessment in Appendix D.

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 a range of fauna. 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.

The hollow-bearing trees proposed to be removed may 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 34 hollows to be removed by the proposal would be suitable nesting habitat for the species. The loss of these hollows is likely to 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.

Habitat fragmentation and connectivity

Vegetation along the Wakool River in the study area forms part of a riparian vegetation corridor in the Murray Valley National Park that allows fauna to move 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.

Vegetation fragmentation in the locality has previously occurred through construction of Noorong Road and other local roads, and clearing for agriculture. These developments have created movement barriers 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 gap to be created in the vegetation for construction of the proposal would generally be no greater than 50 metres. The existing gap in the vegetation immediately north of Gee Gee Bridge is about 25 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 under the bridge.

The removal of forest and 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 vegetation connectivity along both sides of the approach road and bridge would be retained, Squirrel Gliders would still be capable of crossing 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.

Removal of potential bat habitat

The existing main bridge and flood relief bridge contain potential bat habitat in the timber framework under the bridge deck. There was evidence of bat guano in the main 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 bridge demolition 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.

Injury and mortality

Death or injury may occur to any fauna present during tree clearing. 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.

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 vegetation clearing, soil stockpiling 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 6.2.4.

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.

Water quality

The proposal could cause water quality impacts during construction, including sedimentation and contamination of aquatic habitats, as described in section 6.3. These impacts would affect aquatic fauna species and therefore foraging resources for terrestrial species such as the Great Egret and White-bellied Sea-eagle. Safeguards and management measures detailed in this REF would be implemented to minimise sedimentation.

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 (*Batrachocytrium 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.

Bushfire

The proposal has the potential to cause bushfire during construction. Bushfire impacts may include fauna death and injury, woodland habitat loss, 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. This would be unlikely provided a bushfire management plan is developed and implemented, as detailed in section 6.14.

Operation

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.

Key threatening processes

The proposal would result in the following key threatening processes listed under the TSC 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
- loss of hollow-bearing trees (TSC Act) – the proposal would remove about 13 hollow-bearing trees
- removal of dead wood and dead trees (TSC Act) – the proposal would relocate woody debris and remove one dead tree.

The impacts of these key threatening processes would be minimised through the implementation of safeguards detailed in section 6.2.4.

Summary of assessments of significance

Biota listed under the TSC Act

The ecological assessment found that the proposal would be likely to affect 11 bird species and four mammal species listed as vulnerable or endangered under the TSC Act. Assessments of significance under Section 5A of the EP&A Act were completed for these (see ecological assessment in Appendix D).

The assessments of significance completed for the fauna species found that the proposal would be unlikely to have a significant impact primarily for the following reasons:

- the relatively small area of habitat that would be affected by the proposal
- the mobility of the species assessed
- implementation of recommended safeguards and management measures such as strategic revegetation, and relocation and reuse of woody debris
- the proposal being unlikely to significantly fragment habitat for these species.

Biota listed under the EPBC Act

The ecological assessment found that the proposal would be likely to affect two bat species and four bird species listed as vulnerable or migratory under the EPBC Act. Significance assessments (with reference to the EPBC Act Policy Statement 'Matters of National Environmental Significance: Significant impact guidelines 1.1') were completed for these (see ecological assessment in Appendix D).

The significance assessments completed for the fauna species found that the proposal would be unlikely to have a significant impact primarily for the following reasons:

- the relatively small area of habitat that would be affected by the proposal
- the mobility of the species assessed
- the proposal being unlikely to significantly fragment habitat for these species.

6.2.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Terrestrial ecology – loss of native vegetation habitat	• Native vegetation removal will be minimised during detailed design • A flora and fauna management plan will be prepared as part of the CEMP to minimise the ecological impacts of the proposal. The CEMP will incorporate measure outlined in the relevant guidelines of Roads and Maritime's 'Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects'. As a minimum this will include: – pre-clearing surveys will be undertaken in accordance with 'Guide 1: Pre-clearing process' – an exclusion zone plan will be implemented in line with 'Guide 2: Exclusion zones' and 'Guide 10: Aquatic habitats and riparian zones'. Exclusion zones will be established to prevent unnecessary clearing or disturbance of native vegetation and aquatic and terrestrial habitats	Project manager	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	– native vegetation will be re-established in accordance with 'Guide 3: Re-establishment of native vegetation' – vegetation removal will be undertaken in accordance with 'Guide 4: Clearing of vegetation and removal of bushrock' • The flora and fauna management plan will address terrestrial and aquatic matters and include, but not necessarily be limited to: – 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.		
Terrestrial ecology – impacts to native fauna	• The flora and fauna management plan will incorporate fauna protection measures outlined in the relevant guidelines of Roads and Maritime's Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects; including: – fauna will be managed in accordance with 'Guide 9: Fauna handling' – if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site the unexpected species find procedure in 'Guide 1: Pre-clearing process' 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	Project manager and contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	in the bridge or surrounding vegetation. The plan would include: – 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 engaging an experienced bat handler to remove bats during the demolition of the bridge and notifying WIRES and/or a veterinarian to care for injured bats collected by the bat handler).		
Terrestrial ecology – spread of weeds	• A weed management plan will be prepared before construction, for implementation before, during and after the work, as detailed in 'Guide 6: Weed management' of the Biodiversity Guidelines. This will include management of Horehound in the proposal site.	Project manager	Pre-construction
Terrestrial ecology – loss of native vegetation habitat	• Native vegetation removal will be minimised during construction • All staff will be inducted and informed of the CEMP requirements, including the limits of vegetation clearing and vegetation areas to be retained.	Project manager and contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Terrestrial ecology – loss of woody debris habitat	• Woody debris will be re-used as detailed in the Biodiversity Guidelines 'Guide 5: Re-use of woody debris and bushrock'.	Project manager and contractor	Construction
Terrestrial ecology – impacts to threatened species	• 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'.	Project manager and contractor	Construction
Terrestrial ecology – pathogen spread and establishment	• Measures for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be implemented, as detailed in RTA (2011) – 'Biodiversity Guidelines Guide 7: Pathogen management'.	Project manager and contractor	Construction
Terrestrial ecology – impacts to native fauna	• 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 'Wildlife Connectivity Guidelines for Road Projects' (RTA 2011).	Project manager and contractor	Post-construction

6.3 Aquatic ecology

An aquatic ecological assessment was completed for the proposal (GHD 2017a), which is summarised below and provided in Appendix D.

6.3.1 Methodology

The study area for the aquatic ecological assessment is defined as the area within 500 metres of the proposal site.

The aquatic ecology assessment involved the following methods:

- background ecology information was reviewed, including the DPI Fishing and Aquaculture records viewer (DPI 2014a) and unofficial fishing records
- aquatic fauna and habitat surveys were completed on 13 May 2015
- an assessment of the likelihood of occurrence was completed for threatened species, populations and ecological communities with the potential to occur in the study area. The possibility of an impact on each species, population or ecological community was also assessed

- potential impacts on species listed under the FM Act were assessed in line with the Assessment of Significance included in section 5A of the EP&A Act, with reference to DECC (2007) (see ecological assessment in Appendix D)
- potential impacts on species listed under the EPBC Act were assessed in line with the EPBC Act Policy Statement 'Matters of National Environmental Significance: Significant impact guidelines 1.1' (DotE 2013) (see ecological assessment in Appendix D).
- safeguards and management measures for the proposal were developed based on the site conditions and the potential impacts of the proposal.

6.3.2 Existing environment

Aquatic habitat

The Wakool River is a major permanent waterway and provides habitat for a variety of aquatic fauna and flora. Within this study area, there are several accumulations of woody debris in the river, both upstream and downstream of the existing bridge (see Figure 6.9).

There is limited trailing bank vegetation on either side of the macro channel, however large semi-continuous stands of emergent macrophytes likely provide habitat for macroinvertebrates and small and/or juvenile fish species.

Figure 6.9: Large woody debris downstream of Gee Gee Bridge

The existing bridge may be used by fish as an artificial shelter (see Figure 6.10).

Deep pools and runs are the dominant habitat types in the study area. The river bed is dominated by materials with small particle sizes, including sand, fine silt and clay. There was a relatively high organic load on the river bed, largely from the surrounding River Red Gums.

Materials with larger particle sizes, including cobbles, gravel and pebbles, accounted for less than 10 per cent of the bed substrate and are moderately embedded in finer sediments.

The river bank is predominately concave in shape and steep in gradient with several large areas of bare ground. There were also considerably large areas of bare ground and minimal trailing bank vegetation where small sections of the river banks flattened out.

Figure 6.10: Existing bridge

Fish

The Wakool River at Gee Bridge is known to provide habitat for a number of native fish species including the threatened species Murray Cod (*Maccullochella peelii*) and Silver Perch (*Bidyanus bidyanus*) (information provided by Department of Primary Industries – Fishing and Aquaculture, 2015).

There are no current records of the threatened Trout Cod (*Maccullochella macquariensis*) in the Wakool River. Despite this, there is potential suitable habitat (logs and deep pools) for the species and it may occur in the study area.

A number of introduced fish species have been recorded in the study area. The Redfin Perch *(Perca fluviatilis),* a Class 1 Noxious fish (listed under the FM Act), has

been recorded in the Wakool River, but not in the study area (information provided by Department of Primary Industries – Fishing and Aquaculture 2015).

Platypus

The Platypus (*Ornithorhynchus anatinus*) has been recorded in the Niemur River about 30 kilometres from Gee Gee Bridge. The Platypus is unlikely to be resident in the study area but the species may use the study area for foraging.

Macroinvertebrates

Some habitat for macroinvertebrates is present in the study area in the form of emerging macrophytes, woody debris, detritus and the artificial habitat provided by the bridge.

A total of 19 macroinvertebrate taxa were collected in this survey. AUSRIVAS results indicate the ecological health was below reference condition and resulted in BAND B assessments ("significantly impaired") at each sampling location.

The majority of the taxa collected in this study were either tolerant or moderately tolerant to pollution, with the exception of the mayfly.

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 sedges along the channel margins of both banks. Three species of floating aquatic plants and four species of rushes and sedges were recorded.

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 proposal site is considered unlikely based on no observations during the surveys and a lack of records in the study area.

Ecological communities

The Wakool River in the study area is part of the threatened ecological community 'Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment' (referred to as the 'Murray River EEC') (DPI 2007).

The Murray River EEC 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.

This ecological community is listed as endangered under the FM Act.

Threatened biota

Threatened aquatic biota considered as having the potential to be impacted by the proposal are listed in Table 6.4.

Table 6.4: Threatened aquatic biota with the potential to be impacted by the proposal

Species/ecological community	Status
Murray Cod *Maccullochella peelii peelii*	Vulnerable – EPBC Act
Silver Perch *Bidyanus bidyanus*	Critically endangered – EPBC Act Vulnerable – FM Act
Trout Cod *Maccullochella macquariensis*	Endangered – EPBC Act Endangered – FM Act
Murray River EEC	Endangered – FM Act

6.3.3 Potential impacts

Construction

Removal and disturbance of aquatic habitat

The bridge itself may provide shelter for a number of fish species. Woody debris and the habitat provided by the bridge would be removed during construction. Removing woody debris is unlikely to substantially impact on resident fish populations, as there are high levels of woody debris in other parts of the study area which provide alternative habitat. Any large woody debris removed during construction would be relocated to another part of the river outside the proposal site.

The construction of piers and temporary work platforms may disturb, remove or destroy aquatic vegetation in the Wakool River. Removing 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 to be impacted and the relative abundance of aquatic vegetation in the study area.

Construction of piers and temporary work platforms in the river may result in river bed disturbance, which may impact some species that use the river bed as foraging habitat.

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 on the river banks, removal of the existing bridge piers and general construction activities. Vegetation removal and machinery work next to the river banks could also result in sedimentation of Wakool River.

Sedimentation has the potential to affect aquatic 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 migration. More extreme impacts on fish species as a result of sedimentation and accompanying turbidity increases in the creek can include:

- smothering gill surfaces with sediment leading to asphyxiation
- swallowing large amounts of sediment leading to illness

- inhibiting 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 interstitial spaces inhabited by fish.

Water quality

Potential accidental releases of contaminants, such as fuel or chemicals, or lead paint from the existing Gee Gee Bridge, could impact on aquatic fauna and flora in the Wakool River. Provided safeguards detailed in section 6.4.4 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.

Changes to fish passage

Fish passage may be blocked by sedimentation in the Wakool River, new piers, temporary work platforms, coffer dams, silt curtains and deposition of debris.

The proposal would be unlikely to substantially affect fish passage due to the relatively small proportion of the river cross section that would be affected by the proposal.

Disturbance of fauna

The proposal has the potential to temporarily affect the use of the study area by aquatic fauna as a result of increased disturbance during construction. Machinery use may temporarily deter some fauna species from using potential habitat in the study area during construction.

Operation

Shading

Relative to the amount of riparian vegetation near the proposal, the reduction of shading, plant litter or woody habitat resulting from the removal of riparian vegetation is considered minor, and therefore the impact on aquatic fauna is also considered to be minor.

The proposed bridge may cause shading of the Wakool River. This may change habitat characteristics for aquatic biota, such as plant growth, water temperature and visual characteristics. The extent of impact is likely to be small in relation to the extent of river habitat in the study area.

Key threatening processes

The proposal would result in the following key threatening processes listed under the FM Act:

- removal of large woody debris from NSW rivers and streams – the proposal may remove woody debris from the bed of the Wakool River for the construction of the bridge and demolition of the existing bridge
- degradation of native riparian vegetation along New South Wales water courses – the proposal would remove native riparian vegetation next to the Wakool River, and could further damage vegetation through construction vehicle and machinery movements. The proposal could also degrade native vegetation by causing waterway sedimentation, 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 6.3.4.

Summary of assessments of significance

The assessment of likelihood of occurrence found that the proposal may affect three fish species and one ecological community listed under the FM Act and/or EPBC Act.

Assessments of significance under Section 5A of the EP&A Act were completed for biota listed under the FM Act. Significance assessments (with reference to the EPBC Act Policy Statement 'Matters of National Environmental Significance: Significant impact guidelines 1.1') were completed for species listed under the EPBC Act (see ecological assessment in Appendix D).

The assessments of significance found that provided the proposed safeguards and management measures are implemented, construction and operational impacts of the proposal on threatened biota would be minor. The proposal would be unlikely to have a significant impact on any threatened biota primarily for the following reasons:

- with the implementation of safeguards, sedimentation of the river would be limited
- fish passage would not be blocked
- there would be minimal removal of woody debris from the waterway
- there would be minimal removal and disturbance of aquatic plants.

6.3.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Aquatic ecology – impacts to fauna	• A flora and fauna management plan will be prepared as part of the CEMP to minimise the ecological impacts of the proposal.	Project manager and contractor	Pre-construction
Aquatic ecology – disturbance to aquatic habitats	• An exclusion zone plan will be implemented in line with RTA (2011b) – 'Biodiversity Guidelines Guide 2: Exclusion zones' and 'Guide 10: Aquatic habitats and riparian zones'. Exclusion zones will be established to prevent unnecessary clearing or disturbance of aquatic habitats • 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.	Project manager and contractor	Pre-construction
Aquatic ecology – disturbance to aquatic habitat	• Aquatic habitat will be protected in accordance with 'Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines' and Section	Project manager and contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	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.		
Aquatic ecology – loss and disturbance of woody debris habitat	• Woody debris will be managed in line with RTA (2011b) – 'Biodiversity Guidelines Guide 10: Aquatic habitats and riparian zones' • Root boles from large felled trees will be placed in the Wakool River as habitat for aquatic fauna.	Project manager and contractor	Construction
Aquatic ecology – blockage of fish passage	• 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.	Project manager and contractor	Construction

6.4 Soils, water quality and groundwater

A geotechnical investigation report for the proposal was carried out by Black Geotechnical (2015). The assessment findings are summarised below and included in Appendix E.

A contamination assessment for the proposal was completed by GHD (2016b). The assessment findings are summarised below and included in Appendix F.

6.4.1 Methodology

The study area for soils, water quality and groundwater is defined as the area within 500 metres of the proposal.

To assess soils in the study area, 13 cone penetration tests and three rotary drill boreholes were conducted to a maximum depth of 34 metres below the existing surface level (Black Geotechnical 2015).

The contamination assessment scope included the following:

- a review of available site information including construction plans and timber replacement history
- field investigation including visual inspection and sampling of bridge timbers and soils
- laboratory analysis of samples collected for potential contaminants
- preparation of the contamination assessment with reference to the OEH 'Guidelines for Consultants Reporting on Contaminated Sites'.

6.4.2 Existing environment

Topography

The study area occurs within the boundary of the Murray Channels and Floodplains Mitchell Landscape, which 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 terrain of the study area is generally flat due to its location on the floodplain of the Wakool River. A natural levee exists on the edge of the immediate floodplain, north of the river, with a height of up to four metres above the immediate floodplain. The river banks are generally steep in the study area, with a height of up to five metres above the typical water level. Beyond the immediate floodplain, the land is flat with occasional low dune rises.

Geology

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

Geomorphology

The study area is located in the Riverine Plain geomorphic region. The Riverine Plain of NSW is a very extensive and complex alluvial plain associated with the Murray River and its tributaries region (Birch et al 2003).

Soils

Mapped soil types

The Murray Channels and Floodplains Mitchell Landscape contains 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).

Site investigations

The geotechnical investigation identified four main soil layers in the study area. From the surface, these are:

- silty clay
- clay interbedded with sand
- sand interbedded with clay
- clay interbedded with sand

The thickness of the two upper clay layers increases with distance from the Wakool River. The soil closest to the river does not comprise these two upper layers. The thickness of the sand layer generally increases towards the river but is variable.

Salinity

The proposal would be mainly constructed on fill material. Minimal excavation would be needed for piling. The potential to encounter saline soils in any large quantity is unlikely based on the land formations in the study area and the low volumes of material that would be excavated during construction.

Acid sulphate soils

There are no known occurrences of acid sulphate soils in the study area.

A study of sulfidic channel sediments along the Wakool River by OEH (2013) included a site about 300 metres downstream of Gee Gee Bridge. No sulfidic sediments were identified at the site, although these have been identified at other locations along the Wakool River and other streams in the region.

Soil contamination

A contamination assessment of the existing Gee Gee Bridge and the flood relief bridge (GHD 2017b) found that soils immediately next to the piers of the flood relief bridge (piers AB-S5, AB-S6 and AB-S8) contain elevated levels of benzo(a)pyrene. The soil next to pier AB-S7 contains elevated levels of lead.

A search of the Environment Protection Authority (EPA) contaminated land register did not find any declared contaminated sites located in or near the study area. Search results are provided in Appendix C.

Historical land uses in the study area include agriculture (cropping and grazing) and forestry operations. These land uses are unlikely to have caused contamination in the study area.

Bridge contamination

The contamination assessment (GHD 2017b) found elevated lead levels in the paint system on Gee Gee Bridge. Samples were taken from the posts, rails and kerbs, on which the paint system was flaking or chalking. Elevated lead levels were recorded in five of the 12 paint samples collected. Possible lead paint under the surface coat was also observed on the main bridge truss.

The contamination assessment also found the following contaminants of concern were above Roads and Maritime's Acceptable Contaminant Residue Concentrations identified in the Roads and Maritime 'QA specification – Recycling of bridge timber' (2011):

- arsenic concentrations in the timbers sampled from the main bridge - Abutment A, decking timbers and truss timbers including diagonals and principals with concentrations ranging from 8 mg/kg to 3500 mg/kg, which are above Roads and Maritime's Acceptable Contaminant Residue Concentration of 6 mg/kg
- polycyclic aromatic hydrocarbons (total) concentrations in timbers sampled from the main bridge Abutment A, piers 1, 2 and 3 and pier pile bracing (piers 1 and 3) with concentrations ranging from 25 mg/kg to 12,000 mg/kg, which are above Roads and Maritime's Acceptable Contaminant Residue Concentration for PAHs of 5 mg/kg

- polycyclic aromatic hydrocarbons (total) concentrations in timbers sampled from both flood relief bridge abutments, piers 1 to 5 and piers 13 to 16, pier capwales, pier pile bracing and pier pile posts with concentrations ranging from 7.6 mg/kg to 3500 mg/kg, which are above Roads and Maritime's Acceptable Contaminant Residue Concentration for PAHs of 5 mg/kg
- total chromium concentrations in the timbers sampled from the main bridge Abutment A, decking timbers and truss timbers including diagonals and principals with concentrations ranging from 6 mg/kg to 3400 mg/kg. The total chromium results may indicate results above Roads and Maritime's Acceptable Contaminant Residue Concentration for chromium (VI) of 5 mg/kg.

Water quality

Water salinity in the Wakool River at Gee Gee Bridge is typically in the range of 50 to 200 microSiemens per centimetre (NSW Government water quality data – DPI 2016). Salinity is elevated in times of low flow.

The water quality in the study area is likely to be impacted by agricultural runoff. Agricultural runoff may contain farm chemicals and fertilisers that degrade water quality. Agricultural runoff may also contain manure from stock, which can increase:

- biochemical oxygen demand
- Levels of nutrients such as nitrogen
- Levels of bacteria such as faecal coliforms.

Groundwater

Measurements from boreholes drilled in the study area during the geotechnical investigation indicate that depth to groundwater is at the following levels:

- 2.8 metres
- 6.4 metres
- 6.8 metres.

Generally, the level of the water table in the study area is likely to fluctuate with a range of factors including proximity to the Wakool River, soil type, location of aquifers, elevation, season and rainfall.

6.4.3 Potential impacts

Construction

Soil erosion

There are no major geotechnical or soil constraints to the construction and long term maintenance of the proposal. The proposal would be unlikely to cause any substantial impacts to the geomorphic stability of the areas next to the Wakool River. Overall, soil impacts are expected to be low due to the limited amounts of excavation needed for the proposal. Stabilisation and revegetation would resist soil erosion to the same extent achieved by existing vegetation.

Vegetation removal

About 2.1 hectares of vegetation would be removed from the Wakool River floodplain. Vegetation removal would expose soils to weathering processes, increasing the risk of erosion and sedimentation.

Earthworks

The proposal would involve earthworks over an area of about five hectares. The proposal would require about 5830 cubic metres of excavation. The estimated quantity of fill needed for the proposal is 12,847 cubic metres. It is therefore anticipated that about 7017 cubic metres of fill material would be imported for construction of the southern approach road.

Loose fill may be eroded during rainfall events by runoff. There is also the potential for soil erosion at cut excavations, particularly on cutting faces. Given the location of the proposal site on the Wakool River floodplain, flooding of the construction site also has the potential to cause erosion.

Erosion of earthworks could cause mass soil movements and sedimentation of the Wakool River. Sedimentation may also influence the vegetation and habitat of nearby areas by smothering groundcover vegetation and changing soil surface characteristics.

Construction of the bridge

Driven piles would be needed for the foundations of the new bridge in the bed of the Wakool River. This has the potential to cause soil erosion, and sedimentation of the river, but would be minimised through the installation of coffer dams around the piers. River bed disturbance would also occur through the installation of a temporary work platform beside the proposed bridge. This disturbance is anticipated to be of a small extent and is unlikely to cause substantial erosion and sedimentation.

Construction of new roads

During construction of new roads there would be a risk of soil compaction from the movement and operation of large machinery, such as excavators, rollers and trucks. Heavy machinery can disturb the soil surface, which increases the potential for erosion.

Demolition of the existing bridges

If the piers of the existing Gee Gee Bridge are required to be removed below river bed level, this would lead to disturbance of the river bed and potential sedimentation impacts to the Wakool River. Where possible, this would be minimised through the installation of coffer dams around the piers. At the current stage of planning, it is anticipated that piers would be cut at river bed level, with minimal disturbance of the river bed.

Soil disturbance associated with demolition of the existing bridges may occur during removal of the abutments and bridge piers outside the Wakool River channel. Soil disturbance would also be required for the removal of the existing road embankment between the two bridges. Soil disturbance has the potential to lead to soil erosion and sedimentation of the river, but this would be managed through stabilisation of soils immediately following each stage of demolition.

Demolition of Gee Gee Bridge has the potential to release lead into the surrounding environment, including the Wakool River, through disturbance of the posts, rails and kerbs, which have flaking or chalking lead paint. The risk of lead contamination impacts to the surrounding environment would be managed through the implementation of a lead paint management plan (see section 6.4.4).

Vehicle movements, including machinery and support vehicles

Machinery and support vehicles used for the construction of the proposal and for the relocation of utilities would be driven off road and would have the potential to transport excess material onto sealed roads near the construction site.

Stockpiling

Material would be stockpiled at various stages during construction. Inadequately stabilised stockpile material could erode in periods of high rainfall or windy conditions.

Landscaping

Landscaping activities would require minor earthworks that could lead to the erosion of disturbed soils where they are not stabilised.

Acid sulphate soils

Although acid sulphate soils have not been detected near Gee Gee Bridge (OEH 2013), they have been detected at other locations on the Wakool River and there is some potential that sulfidic sediments could be exposed and mobilised during construction.

Soil contamination

Fuel and chemical spills

There is potential for fuel or chemical spills during construction, which may result in localised soil contamination. Spills could occur during refuelling or through leaking of hydraulic and lubricating oil from plant and equipment. The potential for contamination from fuel and chemical spills is considered to be low provided the safeguards and management measures outlined in section 6.4.4 are implemented.

Exposure of contaminated soil

Soils immediately next to the flood relief bridge piers (piers AB-S5, AB-S6, AB-S7 and AB-S8) contain elevated levels of benzo(a)pyrene and lead. Excavation or disturbance of any of these areas has the potential to expose these contaminants and release them to the environment. The specialist contamination assessment (GHD 2017b) found there is low potential for the soil contamination to pose a risk to human health and/or the environment. Where excavation or disturbance of potentially contaminated soils is not required, they can remain in situ as necessary.

Water quality

Sedimentation

The proposal may cause sedimentation of the Wakool River through construction activities, including construction of bridge piers in the river, as well as vegetation removal and machinery works next to the river. Works could destabilise the river banks, leading to channel erosion and sediment deposition, impacting on water quality.

Disturbance to the river bed caused by construction (and removal) of the temporary work platform and installation of the coffer dams 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. Turbidity caused by decommissioning of the temporary work platform would be minimised by cutting off the piers at bed level (rather than full removal from the river bed).

Piling work in the Wakool River would be carried out using driven piles. The use of coffer dams around piers 11 and 12 would reduce the potential for water quality impacts through sedimentation and spills.

The potential for sedimentation impacts to the Wakool River is considered to be moderate given its close proximity to the proposal site. Increased sediment load and organic matter could cause adverse water quality impacts in the Wakool River, such as increased turbidity. Provided safeguards and management measures are implemented, the proposal would be unlikely to contribute significant amounts of sediment and organic matter to the Wakool River

Water contamination

Lead based paint systems were identified on the posts, rails and kerbs of the existing Gee Gee Bridge. Demolition work may dislodge hazardous lead paint debris from the bridge structure, causing soil and water contamination. There is also a risk of inadvertent disturbance of lead paint during the handling and transport of potentially contaminated bridge components. The potential for contamination is considered to be low with the implementation of safeguards and management measures outlined in section 6.4.4.

Construction activities could introduce additional materials to the Wakool River, particularly during high rainfall events. Contaminants could include rubbish and construction materials, and fuel or chemicals from accidental spills.

Water quality impacts could also occur through uncontrolled release of rinse water from plant washing and concrete slurries.

The potential for construction water contamination impacts to the Wakool River is considered to be moderate, given its close proximity to the proposal site.

Groundwater

The water table is located close to the ground surface (Black Geotechnical 2015) and would likely be intercepted during construction of bridge piers. The construction of driven piles would be unlikely to significantly affect any groundwater systems during construction.

The construction of the proposal is not likely to affect groundwater levels, as these are controlled by river levels rather than groundwater recharge via infiltration.

Excavation dewatering may be required where the water table is intercepted. The water would be disposed of in line with the EPA Waste Classification Guidelines.

There is the potential for the proposal to cause groundwater contamination during construction through fuel, oil and chemical spills on the floodplain and leaching to the water table.

Operation

Soils

The proposed road embankments on the Wakool River floodplain would affect overland flows during flood events. The embankments could cause increased floodplain scouring where flows are concentrated, leading to soil erosion. Road

embankment scouring could also occur, potentially leading to undermining of the road.

Potential scouring impacts during operation would be minimised through:

- design of the proposal to minimise impacts to overland flows during flooding. It is anticipated that detailed design would be able to mitigate the impacts of scour through standard design
- road embankment revegetation to protect and stabilise soils during rainfall and flooding events
- installation of water control structures to reduce the velocity of water flows.

Water quality

Fuel and chemical spills

During operation, there is the potential for a fuel or chemical spill, such as from a B-double tanker near the Wakool River. Any discharge on the new bridge would drain through drainage outlets in the bridge deck. The drainage outlets are designed at two metre intervals along the entire bridge. Seventeen drainage outlets would drain directly to the Wakool River and the remainder would drain to the floodplain.

There is already a risk of spills to the Wakool River due to the sub-standard design and condition of the existing Gee Gee Bridge.

A risk assessment completed by Roads and Maritime found the risk of a spill on the new bridge would be very low due to the low traffic and freight volumes on the bridge. The new bridge has been designed to current design standards and would reduce the risk of potential spills and contamination, compared to the current risk of the existing sub-standard bridge.

To further address the risk of contamination from spills, Council would have an incident response plan in place to respond to spill events.

General road runoff

General stormwater runoff from the road has the potential to impact on the water quality of the river. Operation of roads leads to the build-up of contaminants (such as oil and heavy metals) on road surfaces, median areas and roadside corridors. During rain events these contaminants can be transported by runoff into surrounding waterbodies and lands.

Scouring and sedimentation

Increased erosion caused by the floodplain embankment as described above could lead to increased water turbidity in the Wakool River. Potential scouring and associated sedimentation impacts are considered to be low.

Water quality impacts during maintenance activities

Bridge and road maintenance activities during operation may result in chemical or fuel spills. Maintenance activities could also disturb soils during culvert and table drain cleaning, potentially leading to sedimentation. Maintenance activities would generally be infrequent. The potential for water quality impacts during maintenance of the road and bridges would be minimised through implementing standard safeguards for maintenance activities.

Groundwater

General stormwater runoff from the road has the potential to impact on groundwater quality in the same way as surface water quality (see 'General road runoff' above).

The proposal may increase the recharge of water to the water table through the generation of additional runoff and concentration of flows. The operation of the proposal is not likely to substantially affect groundwater levels. These are controlled by the river levels rather than groundwater recharge via infiltration.

6.4.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Soils and water quality – soil erosion, sedimentation and water quality	• A soil and water management plan (SWMP) must be prepared in line with Roads and Maritime's QA Specification G38 and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution associated with carrying out the activity, and describe how these risks will be managed and minimised during construction • The SWMP will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms, and floods) and specific controls and follow-up measures to be applied in the event of wet weather and flood • A site specific erosion and sediment control plan will be prepared and implemented as part of the SWMP.	Project manager and contractor	Pre-construction
Soils and water quality – contamination	• The CEMP will include a contamination management plan, which must comply with the *Contaminated Land Management Act 1997*, 'Contaminated Land Management Guideline' (Roads and Maritime 2013a), 'Environmental Incident Classification and Reporting Procedure' (Roads and Maritime 2014a), and EPA	Project manager and contractor	Pre-construction and construction

Impact	Environmental safeguards	Responsibility	Timing
	guidelines on contaminated land management • The contamination management plan will provide for: – areas and structures of known contamination – unexpected contamination finds – any contamination caused during construction • The contamination management plan will include management of contaminated bridge timbers and will address the following: – a detailed risk assessment of lead paint risk during the demolition project. The risk assessment and recommended controls will assume that the lead based paint systems observed will be disturbed during demolition – all lead based paint systems observed flaking or chalking or likely to be disturbed by demolition or refurbishment works will be removed or over-painted at the site in accordance with the Australian Standard AS4361.2 1998 Guide to Lead Paint Management Part 1: Residential & Commercial Buildings – collection of any hazardous paint debris dislodged during work on Gee Gee Bridge to minimise the risk of it being dispersed – during demolition, and prior to removal, visual inspections of timber will be undertaken to ensure the classification as provided in this report is accurate. If classification is not considered accurate, then additional sampling and		

Impact	Environmental safeguards	Responsibility	Timing
	analysis will be conducted. Additional sampling and analysis of all non-sampled bridge elements, which have not been classified, will be conducted after demolition and prior to removal • Steps will be taken to avoid excavating soils next to the approach bridge piers (AB-S5 to AB-S8). Where excavation of these soils cannot be avoided, the excavated material will be managed as restricted solid waste • A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime 'Code of Practice for Water Management' (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).		
Soils and water quality – groundwater	• The soil and water management plan will include measures to manage groundwater unexpectedly encountered during construction • The contractor will consider the beneficial uses, quality and quantity of groundwater when determining ongoing groundwater management.	Project manager and contractor	Pre-construction
Soils and water quality – sedimentation	• Coffer dams will be installed around the new bridge piers in the Wakool River to minimise the sedimentation risk from river bed disturbance	Project manager and contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	• Where construction activities have the potential to disturb the river banks, measures will be put in place to minimise soil erosion and sedimentation where practicable, such as: – laying geofabric on exposed soils and disturbed areas on the river bank – installing sediment netting down-slope of disturbed areas • Low lying areas of construction formations and excavations that collect stormwater or groundwater will be dewatered in line with the soil and water management plan and Technical Guideline: 'Environmental management of construction site dewatering' (Roads and Maritime 2011c) • Removing trees from river banks will be avoided wherever possible. Where tree removal is necessary, the stump and roots will be retained where possible to minimise river bank destabilisation.		
Soils and water quality – water contamination	• If required, specific training will be provided to personnel for refuelling procedures for static rigs on temporary platforms in the river and bunding of chemical storage areas • Carry out any refuelling of plant and equipment, chemical storage and decanting at least 50 metres away from aquatic habitats unless otherwise approved by the Principal • Storage locations will be located away from areas subject to flooding wherever practicable • Machinery will be checked daily for leaks of oil, fuel or other liquids	Project manager and contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	• Control of dirty water will be managed on site to avoid release into drainage lines and/or waterways • Containment material will be used to capture/filter water used in vehicle wash-downs • Vehicle and plant wash downs and/or concrete truck washouts will be carried out within a designated bunded area with an impervious surface or will be carried out off site • Concrete wastes will be collected and disposed of at a licensed facility • Visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) will be carried out on a regular basis to identify any potential spills or deficient erosion and sediment controls. A record will be kept of these inspections • Emergency spill kits will be kept on site at all times • All staff will be inducted about incident and emergency procedures and made aware of the locations of emergency spill kits • Should a spill occur during construction, the emergency response plan will be implemented, and Roads and Maritime's lead environment advisor contacted. The EPA will also be notified if necessary.		
Soils and water quality – soil contamination and acid sulphate soils	• In the event that indicators of contamination or acid sulphate soils are encountered during construction (such as odours or visually contaminated materials), work in the area will cease until advice on appropriate management is obtained.	Project manager and contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Soils and water quality – spills	• If a spill occurs during operation of the new road, maintenance contractors or staff will implement an incident response plan. Relevant agencies will be contacted to manage the spill and implement appropriate traffic control measures.	Council and maintenance contractors/staff	Operation

6.5 Hydrology and flooding

A hydrology impact assessment for the new Gee Gee Bridge was completed by Roads and Maritime (2016a) (Appendix G). The assessment findings are included below.

6.5.1 Existing environment

The Wakool River is part of the Edward River anabranch system of the Murray River. It starts at its offtake from the Edward River near Deniliquin and flows to the Murray River near Kenley, across a straight distance of about 160 kilometres.

Water flows from the Edward River into the Wakool River are highly regulated. Flows in the Wakool River are regulated to deliver water for irrigation primarily in the months from October to March, when flows are at their highest. Flows during winter are generally lower.

Due to the large catchment area of the river, the Gee Gee Bridge site has long flood warning times. For large flood events at Gee Gee Bridge, it is anticipated there would generally be at least one week's lag time before impending flood events reach the site.

The most recent notable flood was in October/November 2016. Before this, there was a flood event in 1993, which reached a peak level of 70.5 metres (Australian Height Datum). The flood level was 0.3 metres below the existing bridge deck.

The highest recorded flood at the site was in 1975. The flood reached a peak level of 70.6 metres (Australian Height Datum), with the water level reaching 0.2 metres below the existing bridge deck. The hydrology impact assessment (Roads and Maritime 2016a) is based on this flood level.

A natural levee exists on the edge of the immediate floodplain, north of the river, with a height of up to four metres above the immediate floodplain. The river banks are generally steep in the study area, with heights of up to five metres above the typical water level.

The elevation of the floodplain varies from 71 metres to 73 metres above sea level, while the height of the land surface above the immediate floodplain is typically greater than 74 metres above sea level.

A river monitoring station, Hydrometric Station No. 409062, is located about 470 metres upstream of the existing Gee Gee Bridge. This hydrometric station is an asset

of the MDBA Joint Venture and is part of the river monitoring network on which other agencies rely. The hydrometric station is managed on MDBA's behalf by Water NSW.

6.5.2 Potential impacts

Construction

For large flood events at Gee Gee Bridge, there is generally at least one week's lag time before impending flood events reach the site.

Stockpiles, plant and other structures associated with the construction site could impede flows and cause minor flood impacts. Given the small area that these would cover, and the likelihood that most materials and equipment would be moved off the floodplain before the arrival of a major flood, this would be unlikely to cause substantial flooding impacts.

Flooding during construction also has the potential to disrupt construction activities and damage plant and equipment. Given the long lag time for major floods, it is possible to locate the site compound and stockpile site on the floodplain, with measures in place for relocating away from the floodplain at short notice.

Operation

The hydrology impact assessment (Roads and Maritime 2016a) found that the proposed construction of the new Gee Gee Bridge and approach roads and demolition of the existing bridges and road embankment would result in a net waterway cross-sectional area increase of about 65 square metres (see Appendix G). The proposed approach roads would maintain the same vertical alignment as the existing approach roads. The proposed approach roads would not therefore cause any flow distribution change on either side of the road during a large flood outside the immediate Wakool River floodplain. The full proposal is therefore unlikely to result in any substantial hydrology changes that would affect the river floodplain or adjacent properties, including the residence at 'Rest-down', which is about 450 metres east of the existing approach bridge.

The potential for cumulative flood impacts in the period between construction of the new bridge and approach roads and demolition of the existing bridges and road embankment has also been assessed. As the waterway cross-sectional area for the proposed bridge is larger than that for the existing Gee Gee Bridge, the existing bridge would act as the hydraulic control during a flood. Therefore, there would be no cumulative flood impact before demolition of the existing bridges.

The proposal has the potential to affect flow measurements at Hydrometric Station No. 409062 through minor changes to the river hydrology in the immediate vicinity of the proposal site. This would be managed by notifying Water NSW of the proposal as detailed in section 6.5.3 to allow adjustments to the flow ratings for the hydrometric station.

6.5.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Hydrology and flooding – proposed works result in change to hydraulic conditions	• During detailed design, structures within waterways (such as culverts) will be sized and sited to minimise afflux.	Project manager and contractor	Pre-construction
Hydrology and flooding – hydrologic impact to Hydrometric Station No. 409062	• Water NSW will be notified of the proposal to allow adjustments to the hydrometric station's flow ratings: – before start of construction – when the new Gee Gee bridge and approach roads are built – when the existing road and bridges are demolished.	Project manager	Pre-construction and construction
Hydrology and flooding – construction risk of impact on the floodplain function during a flood event	• Weather and flood warnings will be monitored and plans established for each construction stage to minimise flooding impacts • In the event of a flood warning, equipment and blockages on the floodplain will be removed wherever possible.	Project manager and contractor	Construction

6.6 Traffic and transport

6.6.1 Existing environment

Existing roads

The existing roads and infrastructure are described in section 2.2. Details are summarised below.

Two roads exist in the study area; Noorong Road and Nacurrie Road, which are shown in Figure 1.1.

A number of unsealed tracks open to the public are present in the national park on the Wakool River floodplain, on both sides of Noorong Road (see Figure 1.1). The locations of Gee Bridge and the approach bridge are shown in Figure 1.1. The bridges are separated by a section of road constructed on fill, about 60 metres in length.

Gee Gee Bridge is a Dare type timber truss bridge constructed in 1929. It is listed as a heritage item on the NSW State Heritage Register, the Roads and Maritime Section 170 Heritage and Conservation Register and the Wakool LEP. Due to its age,

structure and design, Gee Gee Bridge is not suitable for higher mass limit vehicles or oversized vehicles.

Traffic volumes

Based on traffic counts completed over a one month period in March/April 2014, the daily traffic volume on Noorong Road is 203 vehicles per day, of which heavy vehicles comprise about 33 per cent.

Nacurrie Road is an unsealed road that connects to the town of Moulamein about 28 kilometres to the north. In the study area, the road has minimal traffic volumes.

Crash history

A fatal crash occurred in 2012 at the existing Gee Gee Bridge. A northbound vehicle on the southern approach road left the road on the curve before the existing Gee Gee Bridge and collided with nearby trees.

Property access

An unsealed driveway to the property 'Rest-down', 3357 Noorong Road, is located about 450 metres east of the flood relief bridge (see Figure 1.1).

Wakool River

The Wakool River is used by water vessels for recreation activities such as fishing. Department of Primary Industries (Fishing and Aquaculture) uses the Gee Gee Bridge site for regular fish surveys.

The Gee Gee Bridge truss span has a four metre clearance over normal water level.

An informal boat access point on the river is located on the northern river bank more than 50 metres downstream of the existing bridge.

6.6.2 Potential impacts

Construction

Changed traffic conditions

Changed traffic conditions on Noorong Road in the vicinity of construction activities could potentially lead to reduced safety for motorists. Short lane closures may cause minor traffic delays.

Increased traffic on local roads

Construction traffic volumes would be as described in section 3.3.5. Heavy vehicle movements would increase on Noorong Road by up to 100 per cent, depending on transport timing of materials and structures. Given the existing low usage of local roads, construction vehicle impacts on the local road network are expected to be low.

Access to private property

The proposal site intersects the driveway for the residence at 'Rest-down' (see Figure 1.1). During construction, access to the driveway would be blocked. The residents would be able to access the property using an alternative driveway from Nacurrie Road.

Wakool River access

Temporary exclusion zones in the Wakool River would be implemented around pier construction areas either side of the river. The river would remain partially open for water vessels while the new bridge is being built.

The proposal would result in temporary full river closures for water vessels when new bridge components are being craned into place and when the existing bridge is being demolished. Any full closures would be for short term intervals. Access for water vessels would generally remain open.

The informal boat access point downstream of the existing bridge would not be available to the public during construction. This is not expected to substantially affect river access as other access points to the river are available in the area.

Operation

Increase in heavy vehicle traffic

The proposal is expected to generate an increase in heavy traffic by providing a bridge suitable for higher mass limit vehicles and oversized vehicles.

The current heavy vehicle volume is about 67 vehicles per day. It is anticipated there would be a four per cent annual increase in heavy vehicle numbers and a predicted 30 per cent increase in heavy vehicle numbers after construction of the proposal (data provided by Murray River Council, 2015). The heavy vehicle volume would be likely to increase to about 98 vehicles per day. This volume is still relatively low, and Noorong Road is considered to have adequate carrying capacity for this heavy vehicle increase.

Access to private property

The driveway for the residence at 'Rest-down' would be shortened to allow for the proposed Noorong Road realignment. This would not affect access to the property.

Benefits

The proposal would improve the river crossing by removing traffic restrictions posed by the existing Gee Gee Bridge, enabling higher mass limit vehicles and oversized vehicles to use the bridge.

The proposal would also improve road safety by providing a new bridge that meets current road design standards.

6.6.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Traffic and access – general construction traffic impacts	• A detailed traffic management plan will be prepared in line with the 'Traffic Control at Work Sites Manual' (RTA 2010a) and Roads and Maritime's 'Specification G10 - Control of Traffic' • Water vessel management in the Wakool River during construction will	Project manager and contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	be included in the traffic management plan or will be subject to a separate management plan • The property owner and residents of 'Rest-down' will be notified of specific property access impacts and arrangements needed during construction.		
Traffic and access – construction impacts to traffic	• The community will be kept informed about construction and changes to road user access in line with the 'Community Engagement and Communication Manual' (Roads and Maritime 2012a). This may include through advertisements in the local media and prominently placed advisory notices or variable message signs.	Project manager and contractor	Construction
Traffic and access – construction impacts to property access	• Property access will be maintained at all times unless otherwise agreed with affected property owners. Where changes to access arrangements are necessary, owners and tenants will be advised and consulted on alternative access arrangements.	Project manager and contractor	Construction

6.7 Noise and vibration

A noise and vibration assessment of the proposal was carried out (GHD 2017c) and is provided in Appendix H. The outcomes of the assessment are summarised in this section.

6.7.1 Methodology

Overview

The study area for the noise and vibration assessment includes three sensitive receivers within 1.3 kilometres of the proposal site (see Figure 6.11).

Noise monitoring

Noise monitoring was carried out from 2 June to 10 June 2015 at the front boundary of the residence at 3357 Noorong Road, shown in Figure 6.11. Noise monitoring was carried out to determine background noise levels for the construction noise assessment and existing road traffic noise levels for the operational noise assessment noise modelling verification process.

Noise source emissions

The anticipated plant and equipment to be used during construction is shown in Table 6.5 with the corresponding noise emission sound power levels. Noise level data have been obtained from Australian Standard AS2436 – 2010 'Guide to noise and vibration control on construction, demolition and maintenance sites' and the 'Environmental Noise Management Manual' (RTA 2001). Other equipment may be used, however it is anticipated that this equipment would produce similar noise emissions.

Table 6.5: Construction plant and equipment sound power levels

Plant and equipment	Sound power level (dBA)
Excavators	108
Backhoe	104
Water carts	107
Hand tools (including welding equipment)	102
Saw-cutting	117
Profiler for milling	111
Asphalt paver	108
Rollers/compactors	108
Grader	110
Tipper trucks	107
Kerb machine	100
Road sweepers	104
Generators	98
Trenching machine	100
Under boring rig	111
Line marking truck	102
Semi-trailers and large delivery trucks	108
Piling	137

Construction noise modelling

Potential noise impacts on the surrounding sensitive receivers were predicted for each equipment item. Noise modelling was carried out using the CadnaA 4.4 computer program.

Construction vibration levels

Table 6.6 outlines typical vibration levels for different plant activities sourced from the Environmental Noise Management Manual (RTA 2001). Piling has not been included in the vibration assessment as the distance from the proposed piling works to the nearest receiver is over 400 metres.

Table 6.6: Typical vibration levels at distances (mm/s peak)

Plant item	Distance from source				
	10 metres	20 metres	50 metres	75 metres	100 metres
Roller (15 tonne)	7 to 8	4.0	1.6	1.1	0.8
Compactor (7 tonne)	5 to 7	3.5	1.4	0.9	0.7
Dozer	2.5 to 4	2.0	0.8	0.5	0.4
Backhoe	1.0	0.5	0.2	0.1	0.1
Pavement breaker	4.5 to 6	3.0	1.2	0.8	0.6

Operational road traffic noise modelling methodology

Road traffic noise has been assessed using a moving point source method with attenuation and propagation calculated with the ISO 9613-2, 'Acoustics attenuation of sound during propagation outdoors' algorithm. This method considers the number of pass-by movements, the speed and the L_{Aeq} noise source level.

Noise predictions were undertaken for the following cases:

- year 2017 'no build option' (traffic flow on the existing alignment for year opening)
- year 2027 'no build option' (traffic flow on the existing alignment 10 years after opening)
- year 2017 'build option' (proposed design for year opening)
- year 2027 'build option' (proposed design 10 years after opening).

The current and forecast daily traffic volumes on Noorong Road are shown in Table 6.7. The forecast traffic volumes have been extrapolated using a traffic growth factor of four per cent per annum, assuming a linear growth rate. Noise modelling has also assumed there would be a 30 per cent increase in heavy vehicles as a result of the new Gee Gee Bridge construction (data provided by Murray River Council, 2015).

Table 6.7: Current and forecast traffic volumes incorporated in modelling

Year	Data source	Daily traffic volume
2014	Traffic counts over a one month period.	203
2017	Year opening forecast assuming a linear growth factor of 4% per annum and a 30% increase in heavy vehicles.	239
2027	10 years after opening forecast assuming a linear growth factor of 4% per annum.	335

6.7.2 Existing environment

The proposal is located in a rural environment. The existing road traffic noise would be considered intermittent due to very low traffic volumes. The topography of the study area is relatively flat terrain.

Construction noise and vibration impacts have been assessed for three sensitive receivers (see Figure 6.11):

- R001 – Lot 41 DP756533, 3357 Noorong Road
- R002 – Lot 2 DP430998, Noorong Road
- R003 – Lot 1 DP 129621, 3400 Noorong Road.

Operational road traffic noise has also been assessed for receiver R001. Table 6.8 provides a summary of the noise monitoring results from the front boundary of the residence at 3357 Noorong Road. The noise monitoring results are typical of a remote rural area with low ambient levels influenced by road traffic noise.

Table 6.8: Summary of noise monitoring results at 3357 Noorong Road, dBA

Background noise descriptors			Road traffic noise descriptors		
$L_{A90(Day)}$	$L_{A90(Evening)}$	$L_{A90(Night)}$	$L_{Aeq(15hr)}$	$L_{Aeq(9hr)}$	$L_{A10(18hr)}$
7am to 6pm, Monday to Saturday; 8am to 6pm Sundays and public holidays	6pm to 10pm, Monday to Sunday and public holidays	10pm to 7am, Monday to Saturday; 10pm to 8am Sundays and public holidays	7am to 10pm weekdays	10pm to 7am weekdays	6am to 12am weekdays
31.5	30[1]	30[1]	58.3	53.7	58.6

Note 1: The rating background noise level is set at 30 dBA when background noise levels are measured to be below 30 dBA as per the INP Section 3.1.2.

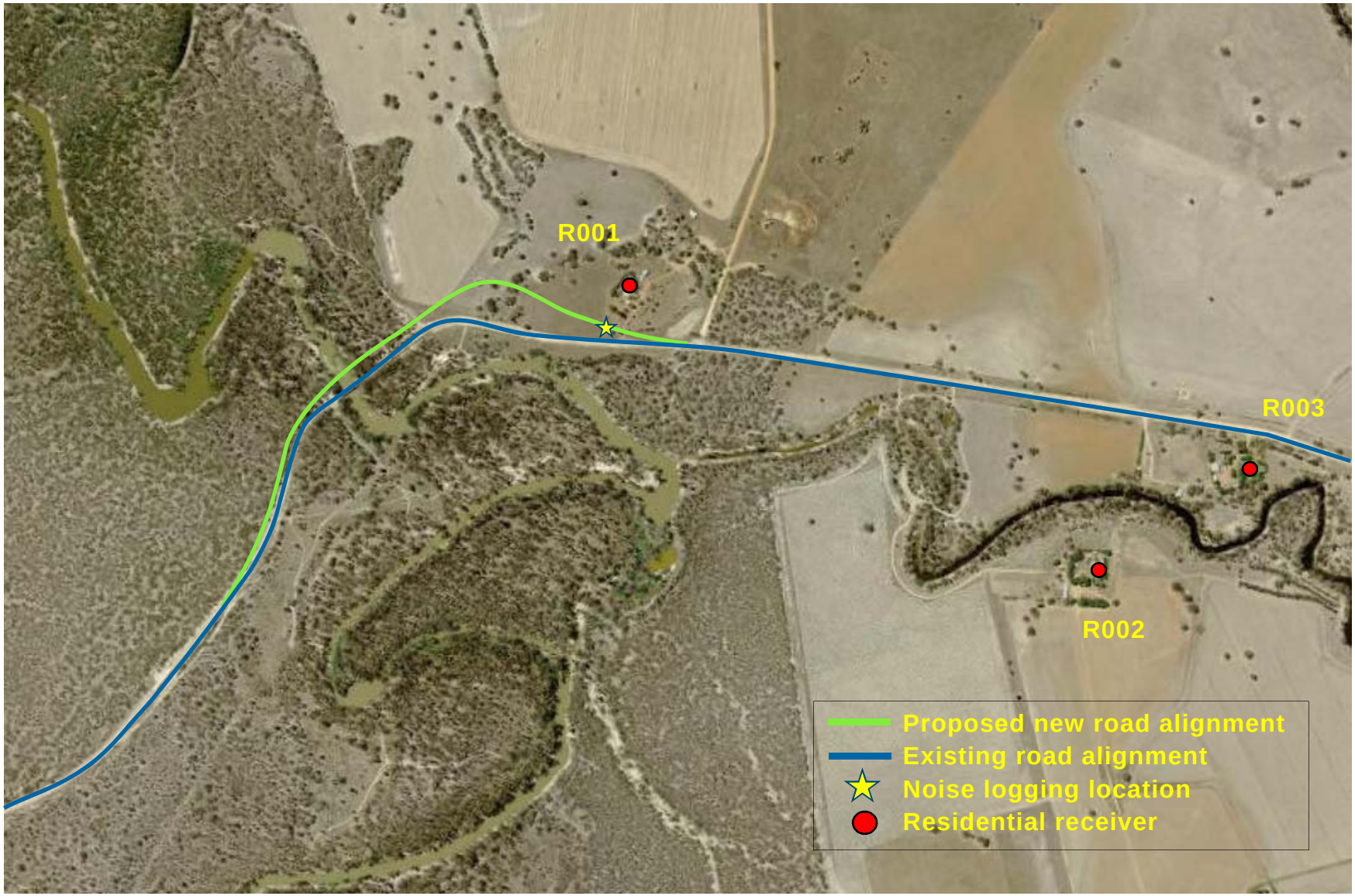

Figure 6.11: Noise sensitive receivers and noise monitoring location

6.7.3 Criteria

Construction noise criteria

Project specific construction noise criteria

The Interim Construction Noise Guideline (ICNG) (DECC 2009) provides guidance for assessing construction noise. The guideline recommends standard hours for construction activities as Monday to Friday 7am to 6pm, Saturday 8am to 1pm and no work on Sundays or public holidays.

Table 6.9 details the ICNG construction noise management levels at sensitive receivers. The noise management levels for each sensitive receiver are summarised in Table 6.10. The assessment point is 30 metres from the residence, or the resident boundary, whichever is the closest.

Table 6.9: Noise management levels at resident

Time of day	Management level $L_{Aeq(15min)}$
Recommended standard hours: Monday to Friday 7am to 6pm, Saturday 8am to 1pm and no work on Sundays or public holidays	Noise affected Rating background level plus 10 dBA
	Highly noise affected 75 dBA
Outside recommended standard hours	Noise affected Rating background level plus 5 dBA

Table 6.10: Project specific construction noise criteria, dBA

	Construction noise management level, $L_{Aeq\ (15min)}$					Sleep disturbance criteria[1] L_{Amax}
Land use	During standard hours		Outside standard hours			
	Noise affected	Highly noise affected	Day[2]	Evening[3]	Night[4]	Night[4]
Residence	40	75	35	35	35	60 to 65 dBA (External)

Note 1: External noise level based on RNP guidance and assuming windows partially open with 10 dBA reduction in noise from outside the building to inside the bedroom.

Note 2: Day hours - 7 to 8am and 1 to 6pm Saturday, 8am to 6pm Sunday and public holidays

Note 3: Evening hours - 6 to 10pm Monday to Sunday and public holidays

Note 4: Night hours - 10pm to 7am, Monday to Saturday; 10pm to 8am Sunday and public holidays

Sleep disturbance criteria

The ICNG states that where construction works are planned to extend over more than two consecutive nights, the analysis should include maximum noise levels and the extent and number of times the maximum exceeds the rating background levels.

The 'Industrial Noise Policy' application notes recommend that where the $L_{A1\ (1minute)}$ exceeds the $L_{A90\ (15minute)}$ by more than 15 dBA, a more detailed analysis is required. Further guidance for sleep disturbance is provided in the 'Road Noise Policy', which concludes, based on the research to date, that:

- maximum internal noise levels below 50 to 55 dBA are unlikely to awaken people from sleep
- one or two noise events per night, with maximum internal noise levels of 65 to 70 dBA, are not likely to affect health and wellbeing significantly.

For the proposal, the night time sleep disturbance criteria are assessed as being 60 to 65 dBA (external noise level).

Construction vibration criteria

Human comfort

Human comfort vibration criteria have been set with consideration to 'Assessing Vibration: A Technical Guideline' (DEC 2006). British Standard BS 6472 – 1992, 'Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)' is recognised by the guideline as the preferred standard for assessing the 'human comfort criteria'.

Typically, construction activities generate ground vibration of an intermittent nature. Intermittent vibration is assessed using the vibration dose value. Acceptable values of vibration dose are presented in Table 6.11 for sensitive receivers.

Humans are capable of detecting vibration at levels well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in British Standard, BS 5228.2 – 2009, 'Code of Practice Part 2 Vibration for noise and vibration on construction and open sites – Part 2: Vibration' and are shown below in Table 6.12.

Table 6.11: Human comfort intermittent vibration limits (BS 6427-1992)

Receiver type	Period	Intermittent vibration dose value ($m/s^{1.75}$)	
		Preferred value	Maximum value
Residential	Day (7am and 10pm)	0.2	0.4
	Night (10pm and 7am)	0.13	0.26
Offices, schools, educational institutes and places of worship	When in use	0.4	0.8

Table 6.12: Guidance on effects of vibration levels for human comfort (BS 5228.2-2009)

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

Structural damage

Currently, there is no Australian Standard that sets criteria for the assessment of building damage caused by vibration. Guidance of limiting vibration values is attained from reference to German Standard DIN 4150-3: '1999 Structural Vibration – Part 3: Effects of vibration on structure'.

Table 6.13 presents guideline values for the maximum absolute value of the velocity "at the foundation of various types of building. Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible."

A measured value exceeding those listed in Table 6.13 "does not necessarily lead to damage; should they be significantly exceeded, however, further investigations are necessary."

Table 6.13: Guideline values for short term vibration on structures

Line	Type of structure	Guideline values for velocity (mm/s)		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (eg listed buildings under preservation order)	3	3 to 8	8 to 10

Note 1: At frequencies above 100 Hz the values given in this column may be used as minimum values.

Operational road traffic noise criteria

Proposal specific operational noise criteria

Noise criteria are assigned to sensitive receivers using the Roads and Maritime 'Noise Criteria Guideline'. The 'Noise Criteria Guideline' provides guidance on how to apply the 'NSW Road Noise Policy'.

The operational traffic noise criteria calculated for receiver R001 using the 'NSW Road Noise Policy' and the 'Noise Criteria Guideline' are summarised in Table 6.14.

Table 6.14: Operational road traffic noise criteria

Receiver ID	$L_{Aeq(15hr)}$ (Day) dBA (7 am to 10 pm)	$L_{Aeq(9hr)}$ (Night) dBA (10 pm to 7 am)
R001	56	51

Operational sleep disturbance

The Road Noise Policy provides a literature review for the assessment of sleep arousal due to traffic noise, however does not set a sleep disturbance assessment criterion.

Sleep disturbance impacts are likely to depend on the following:

- maximum noise level of an event
- number of occurrences
- event duration
- level above background or ambient noise levels.

For continuous rather than intermittent traffic flow, the Environmental Noise Management Manual (RTA 2001) recommends L_{Amax} noise pass-by events should not exceed $L_{Aeq\ (1hr)}$ noise levels by more than 15 dBA. The Environmental Noise Management Manual advises that maximum noise levels can be used as a tool to prioritise and rank mitigation strategies, but should not be applied as a decisive criterion in itself.

6.7.4 Potential impacts

Construction

Noise

Table 6.15 shows that the majority of construction activities are predicted to exceed the construction noise management level of 40 dBA during standard construction hours at the closest sensitive receiver, R001.

Exceedances are also predicted to occur for receivers R002 and R003 during some of the construction activities, although these predictions do not take into account localised shielding or temporary barriers from other machinery and equipment. It is likely that actual noise levels would be lower than predicted as these levels are considered worst case.

No sensitive receivers are predicted to exceed the highly noise affected level of 75 dBA.

Table 6.15: Construction plant and equipment noise level at sensitive receivers, dBA

Construction equipment	Predicted sound pressure level range (minimum maximum), dBA		
	R001	R002	R003
Excavators	**42 - 62**	35 - 40	34 - 38
Backhoe	38 **- 58**	31 - 36	30 - 34
Water carts	**41 - 61**	34 - 39	33 - 37
Hand tools (ie welding equipment)	36 **- 56**	29 - 34	28 - 32
Saw-cutting	**51 - 71**	**44 - 49**	**43 - 47**
Profiler for milling	**45 - 65**	38 - **43**	37 - **41**
Asphalt paver	**42 - 62**	35 - 40	34 - 38
Rollers/compactors	**42 - 62**	35 - 40	34 - 38
Grader	**44 - 64**	37 - **42**	36 - 40
Tipper trucks	**41 - 61**	34 - 39	33 - 37
Kerb machine	34 **- 54**	27 - 32	26 - 30
Road sweepers	38 **- 58**	31 - 36	30 - 34
Generators	32 **- 52**	25 - 30	24 - 28
Trenching machine	34 **- 54**	27 - 32	26 - 30
Under boring rig	**45 - 65**	38 - **43**	37 - **41**
Line marking truck	36 **- 56**	29 - 34	28 - 32
Semi-trailers and large delivery trucks	**42 - 62**	35 - 40	34 – 38
Piling	**63**	**51**	**49**

Bold text indicates exceedances to the noise management levels during standard construction hours

Sleep disturbance

The ICNG states that “where construction works are planned to extend over more than two consecutive nights, the impact assessment should cover the maximum noise level from the proposed works”.

The ICNG acknowledges that based on the current level of understanding, no absolute noise level criteria have been established that correlate to an acceptable level of sleep disturbance. However, the Road Noise Policy provides that maximum

internal noise levels below 50 to 55 dBA are unlikely to cause awakening reactions and one or two events per night, with maximum internal noise levels of 65 to 70 dBA (inside dwellings) are not likely to significantly affect health and wellbeing. There is the potential for sleep disturbance impacts, with consideration to the Road Noise Policy sleep disturbance levels, if construction activities occur during the night-time period.

If out of hours work is required, there is the potential that a residential receiver (receiver R001) will experience noise that exceeds the construction noise management levels and sleep disturbance criteria.

Vibration

Building damage

Figures for predicted vibration levels presented in Table 6.6 indicate that buildings classified as dwellings or buildings of similar construction (DIN 4150-3 'line 2' buildings) within about 20 metres would experience vibration approaching the 5 mm/s PPV recommended limit.

The nearest residential receiver to construction activities is residential receiver R001, about 100 metres from the existing road and about 75 metres from the proposed new road alignment. This sensitive receiver is not expected to be impacted by vibration from construction work.

Human perception

Based on the activities and conservative estimates in Table 6.6, it is possible that construction vibration may be perceptible at distances up to 100 metres from the work, however this is likely to be a conservative estimate.

Operation

Noise

The day and night-time predicted receiver noise levels for the 'no-build option' and 'build option' for year 2017 and year 2027 are detailed in Table 3-9 and Table 3-10 of the noise and vibration assessment in Appendix H.

Day and night-time façade noise maps for the opening year 2017 and design year 2027 for the 'no build' and 'build' options are shown in Figure 3-2 to Figure 3-9 of the noise and vibration assessment in Appendix H.

The controlling criterion from the Noise Criteria Guideline is predicted to comply at the sensitive receiver R001 during the day time and night time periods. The noise level at the southern façade is predicted to have the largest increase, yet the increase is predicted to be less than 2 dBA. The cumulative limit, relative increase and acute noise level criteria have not been exceeded. Hence, noise mitigation measures are not required for the proposal.

Sleep disturbance

The road design, incorporating the new and redeveloped sections, is likely to reduce the maximum noise levels at the source. However, the road would be closer to receiver R001, potentially increasing the maximum noise level experienced at the receiver. A review of the traffic data for Noorong Road shows that the number of vehicles in the night time period is only four and consists mostly of light vehicles,

meaning that there would be minimal noise events. Additional assessment of maximum nose levels from operational road traffic is not therefore required.

6.7.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Noise and vibration – construction noise impacts	• A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify: - all potentially significant noise and vibration generating activities - feasible and reasonable mitigation measures to be implemented, taking into account Beyond the Pavement: urban design policy, process and principles (Roads and Maritime, 2014) - consultation arrangements with affected neighbours and sensitive receivers, including notification and complaint handling procedures - contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. • The sensitive receiver at the 'Rest-down' property will be notified at least 21 days before the start of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: - the project - the construction period and construction hours - contact information for project management staff - complaint and incident reporting - how to obtain further information.	Contractor	Pre-construction
Noise and vibration – construction noise impacts	• Design the construction compound layout so that primary noise sources are at a maximum distance from the 'Rest-down' residence, with solid structures (sheds, containers etc) placed between the residence and	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	noise sources (and as close to the noise sources as is practical) • Compressors, generators, pumps and any other fixed plant will be located as far away from the 'Rest-down' residence as possible and behind site structures • Material dumps, loading and unloading areas will be located as far as practical from the 'Rest-down' residence • Equipment will be selected to minimise noise emissions. Equipment will be fitted with appropriate silencers and be in good working order. Machines found to produce excessive noise compared to normal industry expectations will be removed from the site or stood down until repairs or modifications can be made • Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant where practicable • The final selection and design of noise mitigation measures will be carried out with consideration to best management and economically achievable practice during construction noise and vibration management plan development.		
Noise and vibration – construction noise from inappropriate practices	• Site inductions will be provided to train staff on ways to minimise construction noise impacts on-site. Responsible working practices include: - avoiding the use of loud radios - avoiding shouting and slamming doors - where practical, machines will be operated at low speed or power and switched off when not being used rather than left idling for prolonged periods - keeping truck drivers informed of designated vehicle routes, parking locations and delivery hours - minimising reversing	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	- avoiding dropping materials from height - keeping engine covers closed while equipment is operating.		
Noise and vibration – construction noise and vibration complaints	• Upon receipt of a noise complaint, monitoring will be carried out and reported as soon as possible • Attended compliance noise or vibration monitoring will be carried out to confirm the predicted noise or vibration levels upon receipt of a complaint. The ICNG guidelines state that complaint monitoring measurements should be taken at the complainant's location and the monitoring should cover the time of day when the impacts were reported to occur • In the case that exceedances of the relevant annoyance criteria levels listed in this report are detected in relation to the complaint, the situation will be reviewed in order to identify means to minimise impacts to residences.	Contractor	Construction

6.8 Aboriginal heritage

An Aboriginal heritage assessment was completed by Jacobs (2015). It is provided in Appendix J. The assessment findings are summarised below.

6.8.1 Methodology

The study area for the Aboriginal heritage assessment is provided in Figure 6.12. The Aboriginal cultural heritage investigations were carried out in line with Stage 2 of Roads and Maritime's Procedure for Aboriginal Cultural Heritage Consultation and Investigations (PACHCI) (2001).

Aboriginal heritage data used to help inform the archaeological sensitivity of the study area were obtained from a search of the OEH Aboriginal Heritage Information Management System (AHIMS) and from relevant reports and published works about the region's Aboriginal cultural heritage.

A predictive model was developed based on the AHIMS search results and previous local archaeological assessment reports to identify the most commonly expected site types.

Consultation was carried out with the Wamba Wamba Local Aboriginal Land Council (LALC) before the field survey.

A field survey was carried out on 28 May 2015 by a Jacobs archaeologist/heritage consultant, an Aboriginal Site Officer from Wamba Wamba LALC, and Roads and Maritime's Aboriginal Cultural Heritage Advisor for the South West region.

The survey team surveyed the study area on foot, spaced about 10 metres apart. All higher visibility or sub-surface exposure areas were inspected. All survey information (including landform, soil type, land surface and survey coverage) was recorded, features photographed and their locations plotted by GPS.

Black Box trees with scars were inspected during the field survey for cultural scarring, particularly an area of dense Black Box woodland on the northeast side of the current bridge. The Wakool River banks were inspected for signs of shell middens and oven mounds. A dune landform north-east of the existing Gee Gee Bridge was inspected for Aboriginal cultural material.

6.8.2 Existing environment

The predictive model prepared for the study area indicated that the most commonly expected Aboriginal heritage site types for the study area are scarred trees, earth mounds, shell middens, open campsites/surface scatters and burial sites.

No Aboriginal sites were discovered during the field survey, nor were any areas with potential archaeological deposits identified. None of the Black Box trees inspected were positively identified as having cultural scars. A large number of these trees were too young, or appeared to have suffered scar damage from contact with machinery. Closer inspection of a number of these trees also indicated that borer insects may have played a part in the scarring, as piles of sawdust were observed at most of the tree bases. A River Red Gum tree with a scar was identified outside the study area. This tree is a probable scarred tree, as there was some doubt about the scar being cultural. As the tree is outside the study area, it would not be affected by the proposal.

No indicators of shell middens or oven mounds were observed along the Wakool River banks. The banks have been eroded, therefore, if present, shell or oven mound material (burnt clay) should have been observed.

Inspection of the dune landform north-east of the existing Gee Gee Bridge did not reveal any indicators that Aboriginal cultural material was present. The dune is currently used for agricultural purposes and appears to be regularly ploughed. The interface between the dune and the floodplain landforms has the potential to be a sensitive area, as both landforms could have been used from this location. No evidence of the presence of Aboriginal cultural material was identified within the interface area.

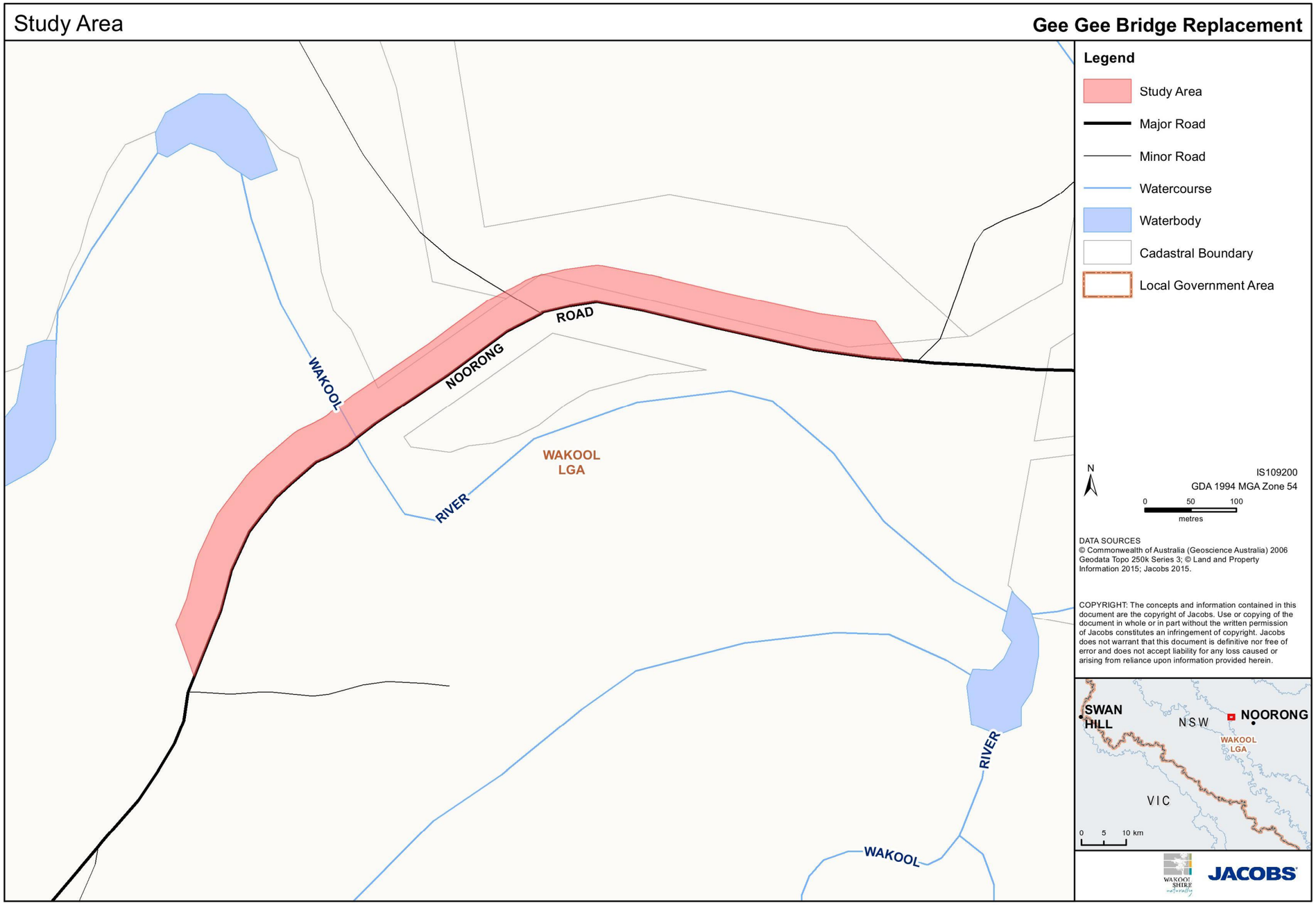

Figure 6.12: Aboriginal heritage study area

6.8.3 Potential impacts

As no Aboriginal cultural heritage sites were identified in the study area, it is unlikely that the proposal would impact on any Aboriginal cultural heritage sites.

6.8.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Aboriginal heritage – impacts on known sites of Aboriginal heritage significance	• An Aboriginal Heritage Management Plan (AHMP) will be prepared in line with the 'Procedure for Aboriginal cultural heritage consultation and investigation' (Roads and Maritime, 2012) and 'Standard Management Procedure - Unexpected Heritage Items' (Roads and Maritime, 2015) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The AHMP will be prepared in consultation with all relevant Aboriginal groups.	Project manager	Pre-construction
Aboriginal heritage – impacts on potential unknown sites of Aboriginal heritage significance	• As part of the site induction, all workers will be advised of their obligations in relation to Aboriginal heritage under the NPW Act and the 'Standard Management Procedure - Unexpected Heritage Items' (Roads and Maritime, 2015) • The 'Standard Management Procedure - Unexpected Heritage Items' (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place • Work will only re-start once the requirements of that Procedure have been satisfied.	Project manager and contractor	Construction

6.9 Landscape character and visual impacts

A landscape character and visual impact assessment was completed by the NSW Government Architect's Office (NSW GAO 2015b) (Appendix J) and is summarised below.

6.9.1 Methodology

The study area includes and considers all areas potentially impacted by the proposal. This includes areas of landscape value beyond the proposal site and any areas or vantage points with views towards the proposal.

The methodology used to complete the landscape and visual impact assessment included:

- inspecting the area during a site visit
- reviewing background documentation
- preparing the landscape character assessment using the 'Guideline for Landscape Character and Visual Impact Assessment' (Roads and Maritime 2013b)
- preparing the visual impact assessment using the 'Guideline for Landscape Character and Visual Impact Assessment' (Roads and Maritime 2013b)
- collaborating with the project team, including heritage architect, project manager, planner and engineers, to finalise the assessment and provide advice about the the new bridge's design and any landscape design issues impacting on the demolition and interpretation of the existing heritage listed bridge structure.

6.9.2 Existing environment

Overview

The study area is located in a predominantly agricultural region. The existing bridge corridor is bordered on both sides by the Murray Valley National Park. The river is occasionally used for fishing by local residents. The residence and sheds on the 'Rest-down' property north-east of Gee Gee Bridge are the only buildings in the area.

Noorong Road is a local road that connects Swan Hill in Victoria and Moulamein in NSW. Noorong Road is used by local traffic, as well as heavy vehicles travelling between states.

The study area is located along the Wakool River. The Wakool River is one of the major anabranches of the Murray River. The river has a mix of shallow, dry and pooling areas. The river is shown in Figure 6.13.

Figure 6.13: Wakool River downstream of the existing bridge

The landform next to the bridge rises steeply from the river bank. At the bridge crossing, the slope of the eastern river bank is generally more gentle than the western river bank. The land immediately behind the river banks is uneven and varied. Moving away from the river, the land is generally flat.

River Red Gums grow along the banks of the Wakool River. The species forms a continuous forest along each side of the river bank. The trees have a height of about 20 metres. The forest floor is generally very sparse, with little groundcover vegetation. Forest and woodland extend onto the floodplains next to the river.

Away from the river, agricultural land dominates the flat landscape, broken by stands of remnant trees.

Landscape character zones

A number of landscape character zones were identified in the study area. These zones each have a distinct character and spatial qualities that differentiate them from other zones.

The landscape character zones identified as part of this assessment are:
1. paddock including house and associated structures
2. Wakool River and river banks
3. forest and woodland.

Viewshed analysis

The land gently slopes down to the Wakool River on either side of the river. The river banks are sloped more steeply. The existing bridge approach roads are higher than the surrounding levels. The vegetation along the river is dominant. Forest and woodland hinder views across the landscape. Views of the existing bridge are limited as a result of this vegetation and the layout of the road.

The visual envelope map is shown in Figure 6.14. This map illustrates the extent of the area from which the proposal will be visible.

The viewing points for the proposed bridge are from Noorong Road, as well as the river.

The viewing points for the new road approaches are from the existing road, and the surrounding paddocks and national park (where not obscured by trees).

There is a cluster of buildings at the 'Rest-down' property, including a single house, north of the eastern extent of the proposal site. The house is screened by vegetation, which limits views to and from the road.

Viewpoints and sensitivity

Key viewpoints are shown in Figure 6.15. The viewpoints and sensitivity to the proposal are described in Table 6.16.

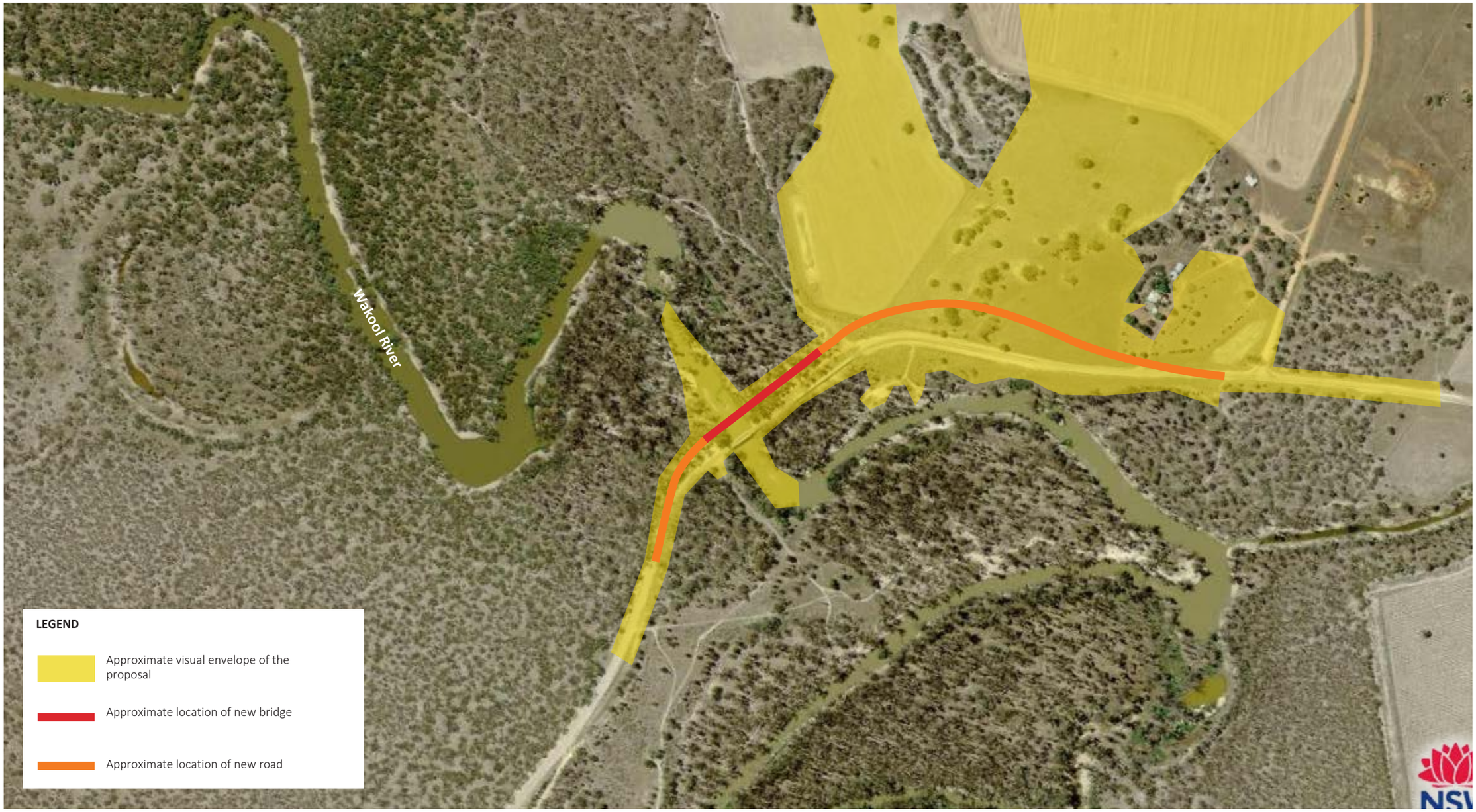

Figure 6.14: Visual envelope map

Source: SIX Maps 2015

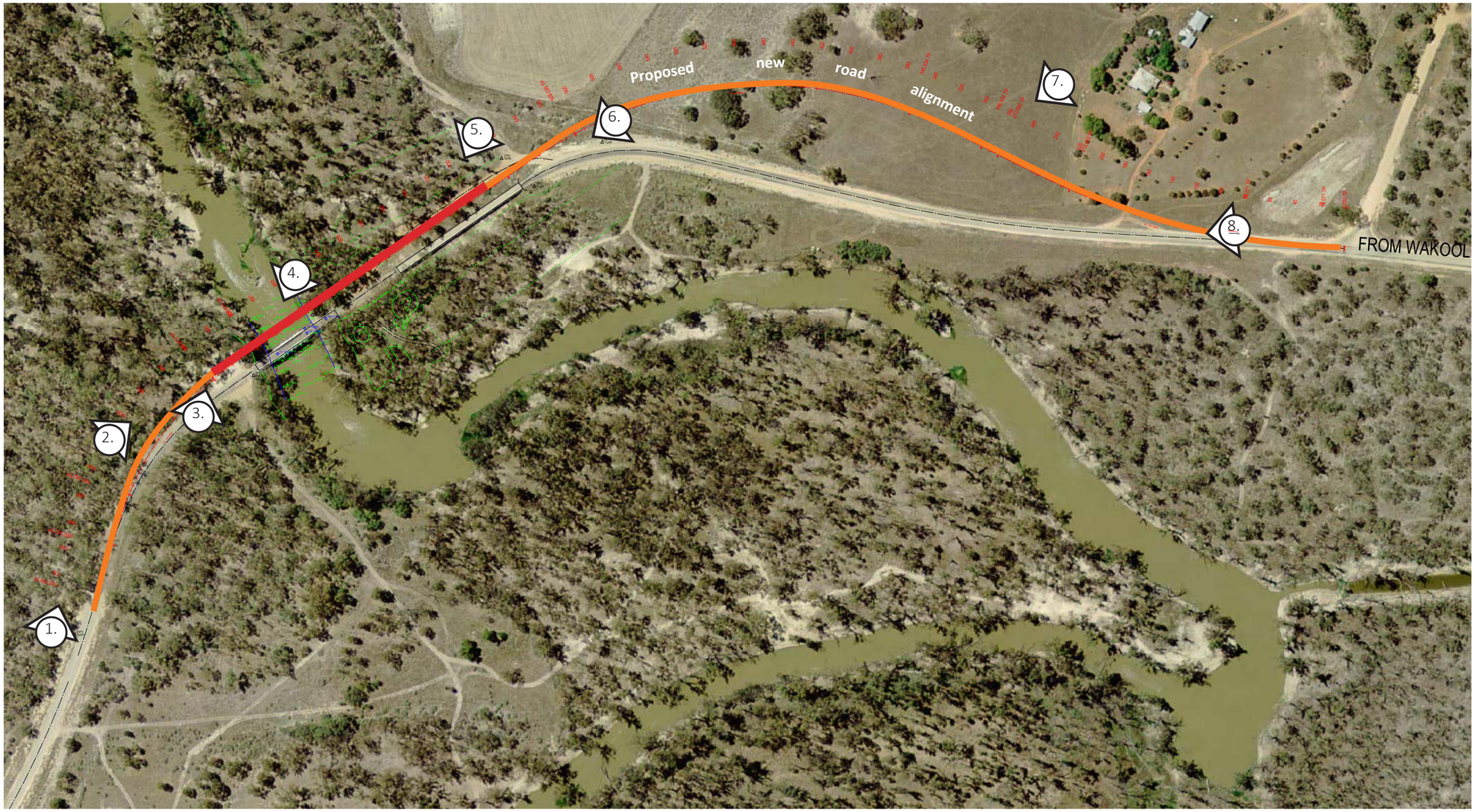

Figure 6.15: Key viewpoints

Source: Base plan Roads and Maritime, 2015

Table 6.16: Viewpoint description and sensitivity

Viewpoint	Description of setting	Sensitivity	Comments
1	Start of new road leading to south-western approach to the bridge.	Negligible	Determined by minor road realignment through forest and woodland setting.
2	View at curve to south-western approach to the bridge.	Moderate	Determined by forest/woodland and bridge approach road alignment. Loss of some forest and woodland.
3	View from top of river bank.	High	Determined by forest/woodland, bridge and approach road alignment, removal of existing bridge and abutments and erosion control method applied to the river banks.
4	View from top of river bank.	High	Determined by forest, bridge and approach road alignment, removal of existing bridge and abutments and erosion control method applied to the river banks.
5	View from junction of existing road and service road to start of bridge from northern side of river.	Moderate	Determined by location of new bridge, forest and existing service road.
6	View at curve of road to start of bridge.	Low	Determined by location of approach road.
7	View to new bridge approach road from rural dwelling – paddock.	Moderate	Determined by location of approach road through existing paddock.
8	View from the start of the new bridge approach road.	Moderate	Determined by location of approach road through existing paddock.

6.9.3 Potential impacts

Landscape character impact

The assessment of the impact of the proposal on each of the zones is provided in Table 6.17.

Table 6.17: Measurement of impact

Zone	Sensitivity of zone	Magnitude of impact	Overall level of impact	Comments
1	Low	Moderate	Low - moderate	**Paddock including house and associated structures** The bridge approach road relocation will bisect the existing paddock and be located closer to the existing house and associated structures.
2	Moderate	Moderate	Moderate	**Wakool River and river banks** Construction of the new bridge would require a number of trees to be removed and careful consideration of river bank erosion control methods. The bridge's design could positively contribute to the zone's landscape character. Levels of the bridge approaches would require careful consideration to ensure the road doesn't become dominant in the landscape and that fill batters are minimised.
3	Moderate	Low	Moderate - low	**Forest and woodland** The majority of the new bridge in this zone would be located along an existing service road on the north-eastern side of the river. Forest and woodland clearing will be required on the south-western side of the river. Levels of the bridge approaches will require careful consideration to ensure the road doesn't become dominant in the landscape and that fill batters are minimised.

Viewpoint impact assessment

The assessment of the likely visual impacts of the proposal on key viewpoints is provided in Table 6.18.

Table 6.18: Visual impacts of the proposal on key viewpoints

Viewpoint	Visual sensitivity	Magnitude of visual effect	Resultant rating of visual impact	Comments
1	Negligible	Negligible	Negligible	
2	Moderate	Moderate	Moderate	The visual impact would be moderate due to tree clearing and regrading required for the new bridge approach road.
3	High	Moderate	Moderate-high	The visual impact would be moderate-high due to tree clearing on the river bank, removal of the existing bridge and construction of the new bridge.
4	High	Moderate	Moderate-high	The visual impact would be moderate-high due to tree clearing on the river bank, removal of the existing bridge and construction of new bridge.
5	Moderate	Moderate	Moderate	The visual impact would be moderate due to tree clearing and construction of the new bridge.
6	Low	Low	Low	The visual impact would be low as the new bridge alignment would use the existing service track.
7	Moderate	Moderate	Moderate	The visual impact would be moderate from this viewpoint as the road would be relocated closer to the existing property.
8	Moderate	Moderate	Moderate	The visual impact would be low-moderate due to the road relocation and flat, sparsely treed landscape, which provides long vistas over the area.

The proposal would have a range of visual impacts on the landscape, rated from ‘negligible to high’. These impacts can be mitigated.

6.9.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Landscape and visual – impacts of the new bridge	• The proposed bridge will be designed in line with Roads and Maritime's bridge aesthetics guidelines (Roads and Maritime 2012b).	Project manager	Pre-construction
Landscape and visual – impacts of the new road	• Minimise levels and fill batters to bridge approaches where possible • Retain the extensive views over the flat landscape and ensure the road is not a dominant element in the landscape setting. Review the levels set for the new approach roads and minimise grading where possible.	Project manager and contractor	Construction
Landscape and visual – impacts of the bridge demolition	• Provide access to the original bridge site in line with the Statement of Heritage Impact • Revegetation will occur along the existing road after the bridges are demolished.	Project manager and contractor	Construction
Landscape and visual – impacts to river bank aesthetic values	• Maintain informal access to the river and river bank following construction.	Project manager and contractor	Construction
Landscape and visual – general visual impacts	• The work site will be left in a tidy manner at the end of each work day • Disturbed areas will be revegetated with locally native species following construction.	Project manager and contractor	Construction
Landscape and visual – impacts of the bridge demolition	• A viewing/rest area will be designed with the following principles: - retain the bridge abutment as a viewing point and opportunity to display interpretation - maintain access to the original bridge site - provide the opportunity to stop and view the original bridge site - provide vehicle parking - provide interpretation elements in line with Roads and Maritime's 'Timber Bridge Interpretation	Project manager	Post-construction

Impact	Environmental safeguards	Responsibility	Timing
	Guidelines' to illustrate the history of the bridge and local historic issues - re-use material from the original bridge where possible, for items such as seating, signage, shelters, balustrades, paths and wheelstops - ensure vehicle turning movements permit safe access to and from Swan Hill-Barham Road - provide safe and clear pedestrian routes.		

6.10 Property and land use

The study area for land use and property includes the proposed road reserve and the surrounding area in which land uses could be affected by the proposal.

6.10.1 Existing environment

Land use in the study area is dominated native forest and woodland conservation along the Wakool River in the Murray Valley National Park (see Figure 1.1). Murray Valley National Park was created in 2011. Before this, the national park was Noorong State Forest, which was historically logged.

Land in the north of the study area is used for agriculture, including cropping and grazing.

The Wakool River is used for recreation activities such as fishing. Department of Primary Industries (Fishing and Aquaculture) uses the Gee Gee Bridge site for regular fish surveys.

A residence is located on the property 'Rest-down' about 630 metres north-east of Gee Gee Bridge (see Figure 1.1).

6.10.2 Potential impacts

Construction

Land acquisition

Roads and Maritime would compulsorily acquire about 1.57 hectares of land owned by the NSW Minister administering the *National Parks and Wildlife Act 1974* from Lot 101, DP 914897. Roads and Maritime would also compulsorily acquire about 2.8 hectares of Council-owned land from the existing Noorong Road reserve (see Figure 3.4).

The road reserve acquired from Council would be transferred to the Minister administering the *National Parks and Wildlife Act 1974* in exchange for the land acquired for the new road. Ownership of the land acquired for the new road would then be transferred to Council.

The National Parks and Wildlife Service has indicated in-principle agreement to the land swap. It is unlikely that the proposal would have a substantial impact on land use by the National Parks and Wildlife Service.

The acquisition of land from Lot 101, DP 914897, owned by the NSW Minister administering the *National Parks and Wildlife Act 1974*, would affect the leaseholder's use of the land. The total property area is about 9.53 hectares. The leaseholder's total loss of land (including about 0.76 hectares severed by the proposed road) would be about 2.33 hectares, leaving a residual area of about 7.2 hectares. The loss of this small area of land is unlikely to substantially affect the leaseholder, who owns 'Rest-down'.

All property valuations, lease fees and acquisition payments would be carried out in line with Roads and Maritime's 'Land Acquisition Information Guide' (RTA 2011c) and the *Land Acquisition (Just Terms Compensation) Act 1991*.

Recreational and research use of the Wakool River

Construction may have a minor impact on boating activities on the Wakool River due to temporary exclusion zones, partial closures and temporary full closures of the river. This would affect recreational users of the river, and potentially use of the Gee Gee Bridge site by Department of Primary Industries (Fishing and Aquaculture) for regular fish surveys.

The proposal would result in temporary full closures of the river to water vessels, for example when new bridge components are being craned into place and when the existing bridge is being demolished. Any full closures would be for short term intervals. Water vessel access would generally remain open.

Access to the Wakool River immediately near the proposal site would be blocked during construction but river access at other locations nearby would remain available.

A reduction in the water quality of the Wakool River due to an influx of sediment, chemicals or fuels could potentially occur. This could affect recreational and research uses of the river. Impacts of the proposal relating to water quality have been addressed in section 6.4.

Amenity and access

Potential short term amenity and access impacts may occur to the 'Rest-down' residence during construction. These may include increased noise and vibration, increased truck movements on local roads associated with materials delivery, dust, temporary visual impacts and changes to access.

The extent of impacts and the measures that would be implemented to minimise traffic, noise, vibration, visual impacts and air quality during construction are outlined in sections 6.6, 6.7, 6.9 and 6.12.

Timely consultation and communication with the owner of 'Rest-down' would reduce potential inconvenience and disruption to the property owner and/or resident.

Operation

Amenity

In the longer term, the 'Rest-down' residence located near the proposal may experience greater levels of traffic noise and air emissions, and some visual

changes, potentially reducing the existing level of amenity. The extent of these impacts and the proposed management measures are outlined in sections 6.7, 6.9 and 6.12.

The noise impact assessment (see section 6.7) concluded that operational noise increases would be within acceptable levels.

The visual impact assessment (see section 6.9) concluded that the proposal would have a range of visual impacts on the landscape, rated from 'negligible to high', but that these impacts can be mitigated by implementing the specified safeguards.

Recreational use of the Wakool River

Two of the new Gee Gee Bridge piers would be constructed inside the Wakool River channel. Despite this, recreational water craft movement would not be substantially affected. Boats currently move between the piers of the existing bridge.

Vegetation would be removed as part of the proposal, which may affect the amenity of the environment for recreational users. This would be mitigated by revegetation of disturbed areas following construction (see section 6.9).

6.10.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Property and land use - property acquisition	• All property acquisition will be carried out in line with Roads and Maritime's 'Land Acquisition Information Guide' (RTA 2011c) and the *Land Acquisition (Just Terms Compensation) Act 1991* • The affected landowner and leaseholder will be consulted on an ongoing basis about the status and timing of acquisition.	Project manager	Pre-construction
Property and land use – impacts to Wakool River users	• Potentially affected recreational community groups that use the Wakool River will be notified before the start of work, in line with Roads and Maritime's 'Community Engagement and Communication Manual' (Roads and Maritime 2012a) • Department of Primary Industries will be contacted about river access before construction • Ensure construction activities do not limit safe access to the	Project manager and contractor	Pre-construction and construction

Impact	Environmental safeguards	Responsibility	Timing
	Wakool River during construction.		

6.11 Socio-economic

6.11.1 Existing environment

The proposal site is located on Noorong Road, about 37 kilometres east of Swan Hill in Victoria and about 48 kilometres north-west of Barham in NSW. Census data for Swan Hill has been used to provide demographic information relevant to the proposal, due to its close proximity.

The 2011 Census (ABS 2013) provides the following core demographic data about Swan Hill:

- at the time of the 2011 Census there were 9894 people in Swan Hill
- the number of dwellings was 4519, with an average household size of 2.3
- the proportion of people aged 19 years or under was 27.1 per cent
- the proportion of people aged 60 years or older was 23.9 per cent
- the median weekly household income was $881
- the proportion of households with two motor vehicles was 48 per cent.

The top employment industries for Swan Hill (ABS 2013) are provided in Table 6.19.

Table 6.19: Top employment industries for Swan Hill

Industry	Number employed	Percentage of people employed
Professionals	761	17.3
Managers	630	14.4
Technicians and trade workers	617	14.1
Clerical and administrative workers	563	12.8

Land use in the study area is typically characterised by conservation land use in Murray Valley National Park (previously Noorong State Forest) and agricultural activities in the north of the study area.

Noorong Road links Deniliquin in NSW and Swan Hill in Victoria. The route has been identified as a strategic freight route in NSW. It is also an alternative freight route between Wagga Wagga in NSW and Swan Hill. The road is therefore important to the local area's economy.

Higher mass limit vehicles and oversized vehicles (eg farm machinery) cannot use the existing Gee Gee Bridge. This has economic consequences for industries and local farm operations that would benefit from using the river crossing.

The bridge has a single traffic lane, with vehicles required to give way to oncoming traffic. This poses safety risks for motorists.

6.11.2 Potential impacts

Construction

Land acquisition

Minor social impacts would arise in association with land acquisition. The proposal would require acquisition of private property and no residential dwellings would be directly impacted. Land acquisition impacts are described in more detail in section 6.10.

Road users

There may be some minor changes to access during the construction period, which could potentially lead to inconvenience for motorists. These changes would likely be for short periods and would have only limited impacts. These impacts are assessed in section 6.6.

Benefits

The local area would experience a minor short-term increase in employment opportunities and procurement of local goods and services.

Operation

Benefits

The proposal would remove the traffic restrictions posed by the existing Gee Gee Bridge, enabling higher mass limit vehicles and oversized vehicles to use the bridge. This would provide economic benefits for the agricultural industry both locally and regionally.

The proposal would improve road safety by providing a new bridge that meets current road design standards. Demolishing the existing bridges would remove the cost associated with maintaining a heritage-listed bridge.

6.11.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Socio-economic – construction general community impacts	• The potentially affected property owner and residents of 'Rest-down' will be contacted before the start of work in line with Roads and Maritime's 'Community Engagement and Communication Manual' (Roads and Maritime 2012a). Residents will be notified via door knocks, newsletters or letter box drops providing information on the proposed	Project manager and contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	works, working hours and a contact name and number should any complaints wish to be registered • A complaints management procedure and register will be included in the construction environment management plan.		
Socio-economic – construction impacts on the community	• Local residents and road users will be kept regularly informed of construction activities.	Project manager and contractor	Construction

6.12 Air quality

6.12.1 Existing environment

The study area for the air quality assessment is defined as the area within 500 metres of the proposal site.

Sources of air pollution in the study area are likely to include:

- dust from vehicles travelling on unsealed roads, including Nacurrie Road and roads in the national park and private properties
- emissions from vehicles on Noorong Road and Nacurrie Road (although these would likely be minimal due to low traffic volumes)
- dust from agricultural activities
- smoke from paddock stubble burn-off in agricultural areas.

A National Pollutant Inventory search (DotE 2015c) on 29 June 2015 did not identify any air pollutant substances for the 2013 to 2014 reporting period for the Noorong area (postcode 2732). Diffuse emissions in the Murray-Darling basin include total nitrogen and total phosphorus, predominantly from cropping activities, which occur in the study area.

One sensitive receiver is located near the proposal site, a residence at ‘Rest-down’, 3357 Noorong Road (see Figure 1.1).

6.12.2 Potential impacts

Construction

During construction the following activities would potentially result in air quality impacts:

- vegetation clearing
- stripping topsoil
- windblown dust from exposed surfaces eg stockpiles, roads etc

- earthworks
- road construction
- Soil and material transport and handling
- vehicular dust from traffic movements on unpaved roads
- use of construction vehicles, generating exhaust fumes.

Potential air quality impacts during construction would predominantly be from dust generation. Dust generation could result in health impacts to nearby receivers.

The quantity of dust dispersed would depend on the dust generation rate and the drift of dust particles, which is influenced by atmospheric stability as well as wind speed and direction. Larger particles generally settle closer to the source while finer particles disperse over greater distances.

Dust settlement may impact the 'Rest-down' residential property. Air quality impacts as a result of dust generation are considered to be minor. They would be limited to the construction phase and would be minimised by the implementation of the safeguards and management measures outlined in section 6.12.3.

Machinery and other construction vehicles would emit exhaust fumes. Gaseous emissions are associated with the combustion of diesel fuel and petrol from vehicle movements, on-site plant operation and construction machinery. These sources would generate emissions of carbon monoxide, carbon dioxide, oxides of nitrogen, sulphur dioxide and trace amounts of non-combustible hydrocarbons.

The emissions rate and potential impact would depend on the number and power output of the engines, the quality of fuel used, engine condition and the intensity (engine speed) of use. A number of plant items would be in use at any given time. The volume of gaseous emissions would be influenced by the number and type of items that are running at full power or idling.

The impact of these emissions would be temporary (limited to the length and staging of construction) and are considered to be minor. Implementation of the safeguards and management measures outlined in section 6.12.3 would minimise these impacts.

Overall, potential air quality impacts during construction would be low and short-term in duration.

Operation

Air quality changes as a result of the proposal would be considered low. Although Noorong Road would be realigned 40 metres closer to the residence at 'Rest-down', and the proposal would result in a heavy vehicle volume increase of about 24 vehicles per day, the total traffic volume on Noorong Road would continue to be low (see section 6.6). The residence would be 65 metres from the realigned Noorong Road. The proposal is therefore unlikely to cause any substantial adverse air quality impacts at the residence.

During operation of the proposal, a small quantity of vehicle emissions would be generated during maintenance activities (which would be frequency and intensity dependent). Local air quality impacts would be considered very low overall.

6.12.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Air quality – general air quality impacts	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: • potential air pollution sources • air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • mitigation and suppression measures to be implemented • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces.	Project manager and contractor	Pre-construction
Air quality – dust management	• Exposed surfaces will be watered regularly to minimise dust emissions as necessary • During periods of high winds, dust generating activities will stop • Stabilisation of disturbed surfaces will take place as soon as practicable • Stockpiles or areas that may generate dust will be managed to suppress dust emissions in line with Roads and Maritime's (2015c) 'Stockpile Site Management Guideline' • All trucks will be covered when transporting dust generating material to and from the site.	Project manager and contractor	Construction
Air quality – other air emissions	• Plant and machinery will be fitted with emission control devices complying with Australian Design Standards where practicable • No burning of any materials will occur.	Project manager and contractor	Construction

6.13 Waste management

6.13.1 Policy setting

Roads and Maritime is committed to ensuring responsible management of unavoidable waste and to promoting the reuse of such waste through appropriate measures in line with the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act).

The resource management hierarchy principles in order of priority as outlined in the WARR Act are:

- avoidance of unnecessary resource consumption
- resource recovery (including reuse, reprocessing, recycling and energy recovery)
- disposal.

By adopting the above principles, Roads and Maritime encourages the most efficient use of resources and reduces cost and environmental harm in line with the principles of ecologically sustainable development, as outlined in section 8.2.2 of this REF.

6.13.2 Potential impacts

Construction

Typical construction waste

The proposal has the potential to generate waste from the following sources, some of which would be recycled or reused:

- green waste from vegetation clearing (native and introduced vegetation). Noxious weed material would be separated from native green waste
- excess spoil from excavation of material
- bridge components from demolition, including piers, decking, stringers, cross girders, butting blocks and timber footings
- small quantities of contaminated soils excavated from next to the flood relief bridge piers (piers AB-S5 to AB-S8), as described in section 6.4
- roadside materials (fencing, guide posts etc)
- general waste from staff (lunch packaging, portable toilets etc)
- chemicals and oils
- waste water from wash-down and bunded areas
- redundant erosion and sediment controls
- paper and office waste from site and management facilities.

The largest quantities of waste expected to be produced would be from excavation and clearing activities. The potential to reuse materials would be investigated during detailed design. Surplus excavated material (not contaminated) would be used on site as fill and in rehabilitation. Some of the trees removed would be re-used as fauna habitat in the study area. Mulched vegetation would be used in sediment erosion controls, stabilisation and rehabilitation where appropriate. There is the potential for excavated pavement to be recycled, depending on suitability.

Liquid and solid waste would be removed by tanker or truck and disposed of off-site at a facility that is licensed or approved to accept those wastes for storage, reuse or

disposal. Fuel and chemical storage areas would be bunded and protected in line with the specifications set out by OEH and WorkCover.

Any spoil material that cannot be used on site would be classified in line with the 'Waste Classification Guidelines' (EPA 2014) and disposed of at an approved materials recycling or waste disposal facility.

Materials not reused would be removed to a licensed or approved facility. Waste generation impacts at the site are considered to be low, and would be minimised.

Stockpiles would be managed to avoid causing pollution or contamination in line with the 'Stockpile Site Management Guideline' (RTA 2011a).

Contaminated waste

The contamination assessment (GHD 2017b) found that timbers in Gee Gee Bridge and the flood relief bridge have elevated levels of lead, arsenic, polycyclic aromatic hydrocarbons and chromium, as described in the section titled 'Bridge contamination' in section 6.4.2.

The posts, rails and kerbs on Gee Gee Bridge were found to not be recyclable due to flaking and chalking lead paint. These timbers are classified as hazardous waste.

All other bridge timbers in Gee Gee Bridge and the flood relief bridge are recyclable, but may require milling to remove the outer layers of contaminated timber to comply with Roads and Maritime's Acceptable Contaminant Residue Concentrations. If lead paint is removed from the timber, the paint residue would be classified as hazardous waste.

If these timbers are not recycled, they are pre-classified as general solid waste under 'building and demolition waste' (EPA 2014) (GHD 2017b). This includes timbers containing bonded lead based paint, such as the truss timbers. The truss timbers were observed to have possible lead paint under the surface coat.

Bridge timbers not sampled during the contamination assessment require further sampling and analysis to confirm these results.

Excavated soils from next to the flood relief bridge piers (AB-S5 to AB-S8) would be classified as restricted solid waste (see section 6.4).

Operation

Where the proposal is located away from the existing road alignment (ie in the north of the proposal site), it is likely that there would be an increase in litter associated with a typical road environment.

6.13.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Waste management – general impacts	• A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:	Project manager and contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	– measures to avoid and minimise project waste – classification of wastes and management options (re-use, recycle, stockpile, disposal) – statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions – procedures for storage, transport and disposal – monitoring, record keeping and reporting. • The WMP will be prepared taking into account the 'Environmental Procedure - Management of Wastes on Roads and Maritime Services Land' (Roads and Maritime, 2014) and relevant Roads and Maritime waste fact sheets.		
Waste management – contaminated waste	• The waste management plan will be prepared with reference to the contamination assessment and the contamination management plan and will provide details for managing contaminated waste from the bridges. This will include: – posts, rails and kerbs from Gee Gee Bridge, which will not be recycled and will be disposed of at a licensed facility – any lead paint waste removed from bridge timbers – any waste derived from removing outer timber layers containing other contaminants of concern in line with the RTA QA specification – Recycling of bridge timber – contaminated soils from next to the flood relief bridge piers (AB-S5 to AB-S8)	Project manager and contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	– any additional leachate sampling of soils to confirm their waste classification.		
Waste management – waste minimisation	• The evaluation and management of timber removed from the existing bridges must be in line with the requirements outlined in Roads and Maritime's 'QA specification – Recycling of bridge timber' (2011).	Project manager and contractor	Pre-construction and construction
Waste management – general impacts	• Resource management hierarchy principles will be followed: – avoid unnecessary resource consumption as a priority – recover resources as far as is practicable (including material re-use, reprocessing, recycling and energy recovery) – disposal is carried out as a last resort (in line with the *Waste Avoidance and Resource Recovery Act 2001*). • Staff site inductions will be carried out (and recorded) by a site supervisor to provide a thorough knowledge of all key environmental/safety issues, including waste disposal protocols • All wastes will be managed and disposed of in accordance with the Waste Classification Guidelines (EPA 2014) and the POEO Act • Stockpiles will be managed to avoid causing pollution or contamination in line with the 'Stockpile Site Management Guideline' (RTA 2011a) • Waste will not be burned at the site • Garbage receptacles will be provided and recycling of	Project manager and contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	materials encouraged. Rubbish will be transported to an appropriate waste disposal facility • All working areas will be maintained, kept free of rubbish and cleaned up at the end of each working day • A waste management register must be maintained to record the re-use, recycling, stockpiling or disposal of all waste sent off site, including test results, quantities and ultimate disposal or treatment method.		
Waste management – excess materials	• Excavated material and topsoil will be re-used on site for landscaping where feasible • Bulk project waste (eg excess fill) sent to a site not owned by Roads and Maritime (excluding EPA licensed landfills) for land disposal is to have prior formal written approval from the landowner, in line with Roads and Maritime's Environmental Direction No. 20 'Legal Off-site disposal of Bulk RTA Project Wastes' • Where appropriate, excess roadside materials will be disposed of in line with the following (in order): – transfer to nearby Roads and Maritime or council projects for immediate use – transfer to an approved Roads and Maritime or council stockpile site for future use during projects or routine maintenance – transfer to a Roads and Maritime or council approved site for re-use on a concurrent private/local government project	Project manager and contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	– disposal at an approved materials recycling or waste disposal facility – as otherwise provided for by the relevant waste legislation.		
Waste management – contaminated waste	• All hazardous waste, including loose lead paint, must be disposed of at a waste facility licensed to accept that type of waste and transported by a licensed hazardous materials transporter • If disturbed, contaminated soils from next to the flood relief bridge piers will be classified as restricted solid waste and will be disposed of at a facility appropriately licensed to receive these wastes, and will not be placed or re-used at the site. If additional leachate sampling demonstrates that these soils are general solid waste, they can be managed as such. If these soils are not disturbed, no management actions are required.	Project manager and contractor	Construction
Waste management – green waste	• Cleared weed-free vegetation will be chipped and re-used on-site as part of the proposed landscaping and to stabilise disturbed soils where possible. Weeds must be mulched separately and weedy mulch must not be re-used. Any trees to be removed will be re-used as milled timber wherever practicable • Green waste from weed species, or vegetation not considered appropriate for re-use on-site, will be removed and disposed of at an appropriately licensed facility.	Project manager and contractor	Construction

6.14 Hazards and risk

6.14.1 Existing environment

The existing hazards and risks in the study area are generally associated with operation of the existing road network.

6.14.2 Potential impacts

Construction

The proposal could potentially generate a bushfire through the operation of machinery and equipment in areas of long flammable grass. This could affect construction activities. Bushfire could cause danger to workers and motorists, and property, construction equipment and plant damage.

Safety risks are an inherent aspect of road construction activities. These risks would be managed by implementing workplace health and safety requirements.

The proposal has the potential to intercept utilities during earthworks. This risk would be managed by further investigation during detailed design, including 'Dial Before You Dig'.

Safety hazards would be associated with working over water during construction of the new Gee Gee Bridge and demolition of the existing bridges.

Other hazards and risks associated with construction include:

- spills, leakage or release of contaminants such as fuels, chemicals and hazardous substances such as timber waste containing lead paint and polycyclic aromatic hydrocarbons entering surface and groundwater or contaminating soils
- turbid runoff discharge, resulting in pollution of waterways
- encountering contaminated material during earthworks
- noise and vibration impacts
- spread of noxious weed material
- flooding of the proposal site during extreme rain events
- changed traffic conditions leading to incidents.

These potential impacts and safeguard issues have been addressed in other sections of this REF, as follows:

- soils, water quality and groundwater (refer section 6.4)
- noise and vibration (section 6.7)
- biodiversity (refer sections 6.2 and 6.3)
- hydrology and flooding (refer section 6.5)
- traffic and access (refer section 6.6)
- waste (refer section 6.13).

Construction risks would be temporary and appropriately managed with the relevant safeguards provided in the sections referenced above. Additional safeguards are listed in section 6.14.3.

Operation

Operational hazards and risks are those associated with the use of the proposed road, and with asset maintenance and management.

Hazards and risks associated with the operation of the existing road network in the study area include:

- vehicle incidents and consequent safety impacts
- damage to public and private property next to the proposal site (fences, structures etc) in the event of an incident.

Vehicle crashes are an inherent aspect of the operation of any road. Vehicle hazards and risks would be minimised primarily by constructing the proposal to meet current network safety and design standards, which would improve road safety.

The development of the proposal has considered operational hazards and risks that have been assessed (and safeguards and management measures provided) in earlier sections of this REF including:

- contamination of local soils, surface water (including the Wakool River) and groundwater due to fuel and oil spills during operation and maintenance activities (section 6.4)
- operational traffic noise (section 6.7)
- weed spread and establishment (section 6.2).

6.14.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Hazards and risk – general	• A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to: – details of hazards and risks associated with the activity – measures to be implemented during construction to minimise these risks – record keeping arrangements, including information on the materials present on the site, material safety data sheets and personnel trained and authorised to use such materials – a monitoring program to assess performance in managing the identified risks – contingency measures to be implemented in the event of	Project manager and contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	unexpected hazards or risks, including emergency situations • The HRMP will be prepared in line with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or OEH publications.		
Hazards and risk – bushfire	• The CEMP will include provisions to minimise the potential for ignition or spread of fire. This will include the preparation of a bushfire management plan. Consultation with the local Rural Fire Service will be carried out during the preparation of the plan.	Project manager and contractor	Pre-construction

6.15 Climate change

6.15.1 Policy setting

Climate change refers to the warming temperatures and altered climatic conditions associated with the concentration of greenhouse gases in the atmosphere. There is a need to understand climate change and the effect it could have on all existing and potential new projects and infrastructure. In NSW, responses to climate change are provided in various policy and guideline documents such as the 'NSW Greenhouse Plan' (NSW Government 2005b).

The Intergovernmental Panel on Climate Change produces global climate change projections. In Australia both the Commonwealth Scientific and Industrial Research Organisation and the Bureau of Meteorology have produced regional downscaled projections for Australia. OEH, in partnership with the Climate Change Research Centre at the University of New South Wales, developed regional climate projections and possible climate change impacts for NSW, based on global climate model outputs (OEH 2014). The projections have been developed for 'state planning regions' throughout NSW.

To address the challenge of climate change, Roads and Maritime has developed a climate change plan which includes actions to:

- reduce Roads and Maritime's carbon footprint
- help reduce the carbon footprint of NSW road transport
- adapt the Roads and Maritime road transport system to the impacts of climate change
- manage Roads and Maritime's transition to a low carbon economy.

Roads and Maritime also reports its greenhouse gas emissions and direct energy consumption annually to OEH in line with the NSW Government Sustainability Policy. The annual report includes information on greenhouse gas emissions from energy usage associated with the operation of Roads and Maritime properties, street lighting, traffic signals and vehicles.

6.15.2 Existing environment

Existing climate

The Swan Hill area receives an average annual rainfall of 303.5 millimetres. Rainfall is spread throughout the year but tends to reach a maximum in November with an average of 44.6 millimetres (BOM 2015).

The average monthly minimum temperature varies from 3.6 degrees celsius in July to 16.1 degrees celsius in February. The average monthly maximum temperature varies from 14.7 degrees celsius in July to 33.0 degrees celsius in January (BOM 2014).

Climate change

Long-term (1910-2011) observations for the Murray Murrumbidgee Region demonstrate that temperatures have been increasing since about 1950, with most of the temperature increase having occurred in the last two decades (OEH 2014).

The region is projected to continue to warm during the near future (2020-2039) and far future (2060-2079), compared to recent years (1990-2009). The warming is projected to be on average about 0.6°C in the near future, increasing to about 1.9°C in the far future. The number of hot days is projected to increase, while the number of cold nights is projected to decrease (OEH 2014).

The region currently experiences considerable rainfall variability from year to year and this variability is reflected in the projections. However, all of the models agree that spring rainfall will decrease in the future, mainly along the Murray River. Most models indicate that rainfall will increase in summer and autumn (OEH 2014).

Rainfall changes are also associated with changes in the extremes, such as floods and droughts, as well as secondary impacts such as water quality and soil erosion that occur as a result of changes to rainfall intensity.

6.15.3 Potential impacts

Construction

Construction impacts of the proposal on climate change would include the release of the following greenhouse gases as a result of the construction activities:

- carbon dioxide and nitrous oxide would be generated from liquid fuel use in plant and vehicles (diesel, petrol), and disposal and transport of materials
- atmospheric carbon dioxide may increase as a result of vegetation clearing (minor reduced uptake of carbon dioxide from the atmosphere, as well as decomposition of cleared vegetation)
- use of materials such as concrete that have high embodied energy content
- methane would be released from carbon based waste disposed of in landfill and from possible fugitive emissions from the natural gas use
- various greenhouse gas emissions would be associated with the extraction and production of materials used to construct the road

- on-site electricity usage.

Construction vehicles and equipment would be the main sources of emissions during construction.

Operation

With the construction of the new Gee Gee Bridge, the volume of heavy vehicles on Noorong Road is expected to increase by about 24 vehicles per day. Most of these vehicles would divert to Gee Gee Bridge as a more direct route than that which they currently use. The proposal is therefore likely to result in a reduction of greenhouse gas emissions.

A minimal amount of greenhouse gas emissions would be generated during maintenance activities (which would be frequency and intensity dependent).

6.15.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Climate change – greenhouse gas emissions during construction	• Material and waste transport will be scheduled to achieve full loads and to minimise vehicle trips • Materials will be transported from local suppliers, and surplus materials and wastes will be transported to local sites and facilities, wherever possible • Appropriately sized construction equipment, plant and vehicles will be used • Regular equipment servicing will be carried out to maintain optimal performance and to minimise down time (which can improve overall efficiency) • The layout of access, machinery and facilities will be designed to minimise movement and vegetation clearing • The use of alternative fuels and power sources for construction plant and equipment will be investigated and implemented, where appropriate • Energy efficiency and related carbon emissions will be considered in the selection of vehicles, plant and equipment.	Project manager and contractor	Construction

6.16 Cumulative impacts

6.16.1 Potential impacts

There is a requirement under clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* to take into account any cumulative environmental impacts with other existing or likely future activities.

The cumulative impacts of the proposal relate to the proposed removal of other timber truss bridges around NSW. The Roads and Maritime 'Timber Truss Bridge Conservation Strategy Submissions Report and Revised Conservation Strategy' identifies 22 heritage-listed timber truss bridges that would be removed around NSW and 27 that would be retained. Gee Gee Bridge is one of seven Dare truss bridges identified for removal. Under the strategy, six Dare truss bridges would be conserved as representative samples of this bridge type. The strategy has been prepared to maintain adequate representation of the different types of timber truss bridges around the state.

7 Environmental management

This chapter describes how the proposal would be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided with reference to environmental management plans and relevant Roads and Maritime QA specifications. A summary of site-specific environmental safeguards is provided as detailed in chapter 6 and the licence and/or approval requirements required before construction are also listed.

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A construction environmental management plan (CEMP) would be prepared to describe safeguards and management measures identified. These plans would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The plans would be prepared, reviewed and certified by a Roads and Maritime Environment Officer before construction of the proposal. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in line with the specifications set out in Roads and Maritime's QA Specification G36 'Environmental Protection (Management System)', Roads and Maritime QA Specification G38 'Soil and Water Management (Soil and Water Plan)' and Roads and Maritime QA Specification G40 'Clearing and Grubbing'.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7.1.

Table 7.1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing
G1	General	• All environmental safeguards must be incorporated within the following: - detailed design - contract specifications for the proposal - Construction Environmental Management Plan - CEMP sub plans: o erosion and sedimentation control plan o soil and water management plan o lead management plan o fauna management plan o weed management plan o construction noise and vibration management plan o traffic management plan o air quality management plan o waste management plan o emergency response plans including pollution incident response and flood evacuation plan o rehabilitation plan. - environmental work method statements.	Project manager	Pre-construction
G2	General	• A risk assessment must be carried out on the proposal in line with Roads and Maritime's Project Pack and Roads and Maritime risk assessment procedures to determine a works audit and inspection program. The recommendations of the risk assessment are to be implemented • A risk assessment review must be carried out after the initial audit or inspection to evaluate if the level of risk chosen for the project is appropriate • Any works resulting from the proposal and as covered by the	Project manager and regional environmental staff	Pre-construction After first audit

No.	Impact	Environmental safeguards	Responsibility	Timing
		REF may be subject to environmental audit(s) and/or inspection(s) at any time during their duration.		
G3	General	• The environmental contract specifications Roads and Maritime QA Specification G36 'Environmental Protection (Management System)', Roads and Maritime QA Specification G38 'Soil and Water Management (Soil and Water Plan)' and Roads and Maritime QA Specification G40 'Clearing and Grubbing' must be forwarded to the Roads and Maritime Environment Manager for review and approval at least 10 working days before the tender stage	Project manager	Pre-construction
G4	General	• A CEMP must be prepared and submitted for review and endorsement of the RMS Environment Manager before construction. As a minimum, the CEMP will address the following matters: - any statutory approval requirements needed for the activity to be carried out - details of how the project will implement the identified environmental safeguards outlined in the REF - development and implementation of issue-specific environmental management plans, and their inclusion within the CEMP - roles and responsibilities, including those of sub-contractors - communication requirements, including stakeholder and community liaison	Project manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		- induction and training requirements - procedures for monitoring and evaluating environmental performance, and for carrying out remedial actions - reporting requirements and record-keeping arrangements - emergency and incident management procedures - audit and review procedures.		
G5	General	• A contractual hold point must be maintained until the CEMP is reviewed and approved by the Roads and Maritime Environment Manager.	Project manager	Pre-construction
G6	General	• The Roads and Maritime Project Manager must notify the Roads and Maritime Environment Officer [South West Region] at least five days before work starts.	Project manager	Pre-construction
G7	General	• All businesses and residences likely to be affected by the proposed works must be notified at least five working days before the start of proposed activities. The notification will include details of the project, construction period and construction hours, contact information for project management staff, complaint and incident reporting, and how to obtain further information.	Project manager	Pre-construction
G8	General	• Environmental incidents, such as pollution spills and unauthorised vegetation clearing, must be reported and managed in line with Roads and Maritime's Environmental Incident Classification and Reporting Procedure.	Contractor	Pre-construction and construction

No.	Impact	Environmental safeguards	Responsibility	Timing
H1	Non-Aboriginal heritage – impacts to the existing Gee Gee Bridge	• A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the construction environmental management plan (CEMP). It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage. It will incorporate relevant heritage de-listing approval conditions. A revegetation strategy for the existing road corridor will be developed as part of a wider approach to compensate loss of heritage values through demolition. Murray River Council will be guided by Roads and Maritime, the National Parks and Wildlife Service and other stakeholders in appropriate and sympathetic remediation for the new bridge, and the strategy used will be integrated with landscape planning for the old bridge and road. This will include guidelines on how the landscaping of the area could be handled to combine interpretation, natural landscape regeneration, viewpoint, sightline and possibly trestle fragments close to the water line • Photographs of the bridge will be taken before demolition for archiving and research conducted for the Timber Truss Bridges book.	Project manager and contractor	Pre-construction
H2	Non-Aboriginal heritage – impacts to other sites	• The River Red Gum sawmill site will be protected by a physical barrier or fence as appropriate • The low level river crossing site will be identified on construction plans as an exclusion zone.	Project manager and contractor	Pre-construction
H3	Non-Aboriginal heritage – impacts to the	• Access will be provided to the site of the original bridge, with a viewing point and parking area,	Project manager	Post-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
	existing Gee Gee Bridge	on the southern side to make use of sightlines of the original bridge. On-site interpretation signage following the Roads and Maritime 'Timber Bridge Interpretation Guidelines' will be developed • Interpretation will focus on the bridge, but will also explore the local historical issues connected with agricultural transport and travelling stock routes. The interpretation strategy for Gee Gee crossing will be seen as part of a wider, planned approach that links all timber truss bridges in the area • Options for retention or re-use of timber and/or steel elements of the bridge in situ will be explored as a priority • Standard mitigation measures including archival photography, research for the Timber Bridges Book, and salvage and stockpile of timber for re-use in line with Roads and Maritime's 'Recycling of Timber Bridges' policy will be fully implemented.		
H4	Non-Aboriginal heritage – inadvertent impacts on heritage items	• As part of the site induction, all workers will be advised of their obligations in relation to heritage before working on the site and the guidelines to follow if unanticipated heritage items or deposits are located during construction.	Project manager and contractor	Construction
H5	Non-Aboriginal heritage – unanticipated archaeological finds	• The 'Standard Management Procedure - Unexpected Heritage Items' (Roads and Maritime 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered.	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		• Work will only re-start once the requirements of that procedure have been satisfied.		
TE1	Terrestrial ecology – loss of native vegetation habitat	• Native vegetation removal will be minimised during detailed design • A flora and fauna management plan will be prepared as part of the CEMP to minimise the ecological impacts of the proposal. The CEMP will incorporate measure outlined in the relevant guidelines of Roads and Maritime's 'Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects'. As a minimum this will include: – pre-clearing surveys will be undertaken in accordance with 'Guide 1: Pre-clearing process' – an exclusion zone plan will be implemented in line with 'Guide 2: Exclusion zones' and 'Guide 10: Aquatic habitats and riparian zones'. 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 'Guide 3: Re-establishment of native vegetation' – vegetation removal will be undertaken in accordance with 'Guide 4: Clearing of vegetation and removal of bushrock' • The flora and fauna management plan will address terrestrial and aquatic matters and include, but not necessarily be limited to: – plans for the construction site and adjoining area showing native vegetation, flora and fauna habitat, threatened species and endangered ecological communities	Project manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		– 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.		
TE2	Terrestrial ecology – impacts to native fauna	• The flora and fauna management plan will incorporate fauna protection measures outlined in the relevant guidelines of Roads and Maritime's Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects; including: – fauna will be managed in accordance with 'Guide 9: Fauna handling' – if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site the unexpected species find procedure in 'Guide 1: Pre-clearing process' 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: – 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	Project manager and contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		– 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 engaging an experienced bat handler to remove bats during the demolition of the bridge and notifying WIRES and/or a veterinarian to care for injured bats collected by the bat handler).		
TE3	Terrestrial ecology – spread of weeds	• A weed management plan will be prepared before construction, for implementation before, during and after the work, as detailed in 'Guide 6: Weed management' of the Biodiversity Guidelines. This will include management of Horehound in the proposal site.	Project manager	Pre-construction
TE4	Terrestrial ecology – loss of native vegetation habitat	• Native vegetation removal will be minimised during construction • All staff will be inducted and informed of the CEMP requirements, including the limits of vegetation clearing and vegetation areas to be retained.	Project manager and contractor	Construction
TE5	Terrestrial ecology – loss of woody debris habitat	• Woody debris will be re-used as detailed in the Biodiversity Guidelines 'Guide 5: Re-use of woody debris and bushrock'.	Project manager and contractor	Construction
TE6	Terrestrial ecology – impacts to	• If unexpected threatened fauna or flora species are discovered, work near the find will stop immediately	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
	threatened species	and follow Roads and Maritime's 'Unexpected Threatened Species Find Procedure" in RTA (2011) – 'Biodiversity Guidelines Guide 1: Pre-clearing process'.		
TE7	Terrestrial ecology – pathogen spread and establishment	• Measures for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be implemented, as detailed in RTA (2011) – 'Biodiversity Guidelines Guide 7: Pathogen management'.	Project manager and contractor	Construction
TE8	Terrestrial ecology – impacts to native fauna	• 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 'Wildlife Connectivity Guidelines for Road Projects' (RTA 2011).	Project manager and contractor	Post-construction
AE1	Aquatic ecology – impacts to fauna	• A flora and fauna management plan will be prepared as part of the CEMP to minimise the ecological impacts of the proposal.	Project manager and contractor	Pre-construction
AE2	Aquatic ecology – disturbance to aquatic habitats	• An exclusion zone plan will be implemented in line with RTA (2011b) – 'Biodiversity Guidelines Guide 2: Exclusion zones' and 'Guide 10: Aquatic habitats and riparian zones'. Exclusion zones will be established to prevent unnecessary clearing or disturbance of aquatic habitats • 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.	Project manager and contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
AE3	Aquatic ecology – disturbance to aquatic habitat	• Aquatic habitat will be protected in accordance with 'Guide 10: Aquatic habitats and riparian zones 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.	Project manager and contractor	Construction
AE4	Aquatic ecology – loss and disturbance of woody debris habitat	• Woody debris will be managed in line with RTA (2011b) – 'Biodiversity Guidelines Guide 10: Aquatic habitats and riparian zones' • Root boles from large felled trees will be placed in the Wakool River as habitat for aquatic fauna.	Project manager and contractor	Construction
AE5	Aquatic ecology – blockage of fish passage	• 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.	Project manager and contractor	Construction
S1	Soils and water quality – soil erosion, sedimentation and water quality	• A soil and water management plan (SWMP) must be prepared in line with Roads and Maritime's QA Specification G38 and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution associated with carrying out the activity, and describe how	Project manager and contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		these risks will be managed and minimised during construction • The SWMP will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms, and floods) and specific controls and follow-up measures to be applied in the event of wet weather and flood • A site specific erosion and sediment control plan will be prepared and implemented as part of the SWMP.		
S2	Soils and water quality – contamination	• The CEMP will include a contamination management plan, which must comply with the *Contaminated Land Management Act 1997*, 'Contaminated Land Management Guideline' (Roads and Maritime 2013a), 'Environmental Incident Classification and Reporting Procedure' (Roads and Maritime 2014a), and EPA guidelines on contaminated land management • The contamination management plan will provide for: – areas and structures of known contamination – unexpected contamination finds – any contamination caused during construction • The contamination management plan will include management of contaminated bridge timbers and will address the following: – a detailed risk assessment of lead paint risk during the demolition project. The risk assessment and recommended controls will assume that the lead based paint systems observed will be disturbed during demolition	Project manager and contractor	Pre-construction and construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		– all lead based paint systems observed flaking or chalking or likely to be disturbed by demolition or refurbishment works will be removed or over-painted at the site in accordance with the Australian Standard AS4361.2 1998 Guide to Lead Paint Management Part 1: Residential & Commercial Buildings – collection of any hazardous paint debris dislodged during work on Gee Gee Bridge to minimise the risk of it being dispersed – during demolition, and prior to removal, visual inspections of timber will be undertaken to ensure the classification as provided in this report is accurate. If classification is not considered accurate, then additional sampling and analysis will be conducted. Additional sampling and analysis of all non-sampled bridge elements, which have not been classified, will be conducted after demolition and prior to removal • Steps will be taken to avoid excavating soils next to the approach bridge piers (AB-S5 to AB-S8). Where excavation of these soils cannot be avoided, the excavated material will be managed as restricted solid waste • A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime 'Code of Practice for Water Management' (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency		

No.	Impact	Environmental safeguards	Responsibility	Timing
		services and relevant authorities (including Roads and Maritime and EPA officers).		
S3	Soils and water quality – groundwater	• The soil and water management plan will include measures to manage groundwater unexpectedly encountered during construction • The contractor will consider the beneficial uses, quality and quantity of groundwater when determining ongoing groundwater management.	Project manager and contractor	Pre-construction
S4	Soils and water quality – sedimentation	• Coffer dams will be installed around the new bridge piers in the Wakool River to minimise the sedimentation risk from river bed disturbance • Where construction activities have the potential to disturb the river banks, measures will be put in place to minimise soil erosion and sedimentation where practicable, such as: – laying geofabric on exposed soils and disturbed areas on the river bank – installing sediment netting down-slope of disturbed areas • Low lying areas of construction formations and excavations that collect stormwater or groundwater will be dewatered in line with the soil and water management plan and Technical Guideline: 'Environmental management of construction site dewatering' (Roads and Maritime 2011c) • Removing trees from river banks will be avoided wherever possible. Where tree removal is necessary, the stump and roots will be retained where possible to minimise river bank destabilisation.	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
S5	Soils and water quality – water contamination	• If required, specific training will be provided to personnel for refuelling procedures for static rigs on temporary platforms in the river and bunding of chemical storage areas • Carry out any refuelling of plant and equipment, chemical storage and decanting at least 50 metres away from aquatic habitats unless otherwise approved by the Principal • Storage locations will be located away from areas subject to flooding wherever practicable • Machinery will be checked daily for leaks of oil, fuel or other liquids • Control of dirty water will be managed on site to avoid release into drainage lines and/or waterways • Containment material will be used to capture/filter water used in vehicle wash-downs • Vehicle and plant wash downs and/or concrete truck washouts will be carried out within a designated bunded area with an impervious surface or will be carried out off site • Concrete wastes will be collected and disposed of at a licensed facility • Visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) will be carried out on a regular basis to identify any potential spills or deficient erosion and sediment controls. A record will be kept of these inspections • Emergency spill kits will be kept on site at all times • All staff will be inducted about incident and emergency procedures and made aware of	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		the locations of emergency spill kits • Should a spill occur during construction, the emergency response plan will be implemented, and Roads and Maritime's lead environment advisor contacted. The EPA will also be notified if necessary.		
S6	Soils and water quality – soil contamination and acid sulphate soils	• In the event that indicators of contamination or acid sulphate soils are encountered during construction (such as odours or visually contaminated materials), work in the area will cease until advice on appropriate management is obtained.	Project manager and contractor	Construction
S7	Soils and water quality – spills	• If a spill occurs during operation of the new road, maintenance contractors or staff will implement an incident response plan. Relevant agencies will be contacted to manage the spill and implement appropriate traffic control measures.	Council and maintenance contractors/staff	Operation
HF1	Hydrology and flooding – proposed works result in change to hydraulic conditions	• During detailed design, structures within waterways (such as culverts) will be sized and sited to minimise afflux.	Project manager and contractor	Pre-construction
HF2	Hydrology and flooding – hydrologic impact to Hydrometric Station No. 409062	• Water NSW will be notified of the proposal to allow adjustments to the hydrometric station's flow ratings: – before start of construction – when the new Gee Gee bridge and approach roads are built – when the existing road and bridges are demolished.	Project manager	Pre-construction and construction
HF3	Hydrology and flooding – construction risk of impact	• Weather and flood warnings will be monitored and plans established for each construction	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
	on the floodplain function during a flood event	stage to minimise flooding impacts • In the event of a flood warning, equipment and blockages on the floodplain will be removed wherever possible.		
T1	Traffic and access – general construction traffic impacts	• A detailed traffic management plan will be prepared in line with the 'Traffic Control at Work Sites Manual' (RTA 2010a) and Roads and Maritime's 'Specification G10 - Control of Traffic' • Water vessel management in the Wakool River during construction will be included in the traffic management plan or will be subject to a separate management plan • The property owner and residents of 'Rest-down' will be notified of specific property access impacts and arrangements needed during construction.	Project manager and contractor	Pre-construction
T2	Traffic and access – construction impacts to traffic	• The community will be kept informed about construction and changes to road user access in line with the 'Community Engagement and Communication Manual' (Roads and Maritime 2012a). This may include through advertisements in the local media and prominently placed advisory notices or variable message signs.	Project manager and contractor	Construction
T3	Traffic and access – construction impacts to property access	• Property access will be maintained at all times unless otherwise agreed with affected property owners. Where changes to access arrangements are necessary, owners and tenants will be advised and consulted on alternative access arrangements.	Project manager and contractor	Construction
N1	Noise and vibration – construction noise impacts	• A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the	Contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify: - all potentially significant noise and vibration generating activities - feasible and reasonable mitigation measures to be implemented, taking into account Beyond the Pavement: urban design policy, process and principles (Roads and Maritime, 2014) - consultation arrangements with affected neighbours and sensitive receivers, including notification and complaint handling procedures - contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. • The sensitive receiver at the 'Rest-down' property will be notified at least 21 days before the start of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: - the project - the construction period and construction hours - contact information for project management staff - complaint and incident reporting - how to obtain further information.		
N2	Noise and vibration – construction noise impacts	• Design the construction compound layout so that primary noise sources are at a maximum distance from the 'Rest-down' residence, with solid structures (sheds, containers etc) placed between the residence and noise sources	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		(and as close to the noise sources as is practical) • Compressors, generators, pumps and any other fixed plant will be located as far away from the 'Rest-down' residence as possible and behind site structures • Material dumps, loading and unloading areas will be located as far as practical from the 'Rest-down' residence • Equipment will be selected to minimise noise emissions. Equipment will be fitted with appropriate silencers and be in good working order. Machines found to produce excessive noise compared to normal industry expectations will be removed from the site or stood down until repairs or modifications can be made • Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant where practicable • The final selection and design of noise mitigation measures will be carried out with consideration to best management and economically achievable practice during construction noise and vibration management plan development.		
N3	Noise and vibration – construction noise from inappropriate practices	• Site inductions will be provided to train staff on ways to minimise construction noise impacts on-site. Responsible working practices include: - avoiding the use of loud radios - avoiding shouting and slamming doors - where practical, machines will be operated at low speed or power and switched off when	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		not being used rather than left idling for prolonged periods - keeping truck drivers informed of designated vehicle routes, parking locations and delivery hours - minimising reversing - avoiding dropping materials from height - keeping engine covers closed while equipment is operating.		
N4	Noise and vibration – construction noise and vibration complaints	• Upon receipt of a noise complaint, monitoring will be carried out and reported as soon as possible • Attended compliance noise or vibration monitoring will be carried out to confirm the predicted noise or vibration levels upon receipt of a complaint. The ICNG guidelines state that complaint monitoring measurements should be taken at the complainant's location and the monitoring should cover the time of day when the impacts were reported to occur • In the case that exceedances of the relevant annoyance criteria levels listed in this report are detected in relation to the complaint, the situation will be reviewed in order to identify means to minimise impacts to residences.	Contractor	Construction
AH1	Aboriginal heritage – impacts on known sites of Aboriginal heritage significance	• An Aboriginal Heritage Management Plan (AHMP) will be prepared in line with the 'Procedure for Aboriginal cultural heritage consultation and investigation' (Roads and Maritime, 2012) and 'Standard Management Procedure - Unexpected Heritage Items' (Roads and Maritime, 2015) and implemented as part of the CEMP. It will provide specific guidance on measures and	Project manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		controls to be implemented for managing impacts on Aboriginal heritage. The AHMP will be prepared in consultation with all relevant Aboriginal groups.		
AH2	Aboriginal heritage – impacts on potential unknown sites of Aboriginal heritage significance	• As part of the site induction, all workers will be advised of their obligations in relation to Aboriginal heritage under the NPW Act and the 'Standard Management Procedure - Unexpected Heritage Items' (Roads and Maritime, 2015) • The 'Standard Management Procedure - Unexpected Heritage Items' (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place • Work will only re-start once the requirements of that Procedure have been satisfied.	Project manager and contractor	Construction
L1	Landscape and visual – impacts of the new bridge	• The proposed bridge will be designed in line with Roads and Maritime's bridge aesthetics guidelines (Roads and Maritime 2012b).	Project manager	Pre-construction
L2	Landscape and visual – impacts of the new road	• Minimise levels and fill batters to bridge approaches where possible • Retain the extensive views over the flat landscape and ensure the road is not a dominant element in the landscape setting. Review the levels set for the new approach roads and minimise grading where possible.	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
L3	Landscape and visual – impacts of the bridge demolition	• Provide access to the original bridge site in line with the Statement of Heritage Impact • Revegetation will occur along the existing road after the bridges are demolished.	Project manager and contractor	Construction
L4	Landscape and visual – impacts to river bank aesthetic values	• Maintain informal access to the river and river bank following construction.	Project manager and contractor	Construction
L5	Landscape and visual – general visual impacts	• The work site will be left in a tidy manner at the end of each work day • Disturbed areas will be revegetated with locally native species following construction.	Project manager and contractor	Construction
L6	Landscape and visual – impacts of the bridge demolition	• A viewing/rest area will be designed with the following principles: - retain the bridge abutment as a viewing point and opportunity to display interpretation - maintain access to the original bridge site - provide the opportunity to stop and view the original bridge site - provide vehicle parking - provide interpretation elements in line with Roads and Maritime's 'Timber Bridge Interpretation Guidelines' to illustrate the history of the bridge and local historic issues - re-use material from the original bridge where possible, for items such as seating, signage, shelters, balustrades, paths and wheelstops - ensure vehicle turning movements permit safe access to and from Swan Hill-Barham Road	Project manager	Post-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		- provide safe and clear pedestrian routes.		
P1	Property and land use - property acquisition	• All property acquisition will be carried out in line with Roads and Maritime's 'Land Acquisition Information Guide' (RTA 2011c) and the *Land Acquisition (Just Terms Compensation) Act 1991* • The affected landowner and leaseholder will be consulted on an ongoing basis about the status and timing of acquisition.	Project manager	Pre-construction
P2	Property and land use – impacts to Wakool River users	• Potentially affected recreational community groups that use the Wakool River will be notified before the start of work, in line with Roads and Maritime's 'Community Engagement and Communication Manual' (Roads and Maritime 2012a) • Department of Primary Industries will be contacted about river access before construction • Ensure construction activities do not limit safe access to the Wakool River during construction.	Project manager and contractor	Pre-construction and construction
SE1	Socio-economic – construction general community impacts	• The potentially affected property owner and residents of 'Rest-down' will be contacted before the start of work in line with Roads and Maritime's 'Community Engagement and Communication Manual' (Roads and Maritime 2012a). Residents will be notified via door knocks, newsletters or letter box drops providing information on the proposed works, working hours and a contact name and number should any complaints wish to be registered • A complaints management procedure and register will be included in the construction environment management plan.	Project manager and contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
SE2	Socio-economic – construction impacts on the community	• Local residents and road users will be kept regularly informed of construction activities.	Project manager and contractor	Construction
AQ1	Air quality – general air quality impacts	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: • potential air pollution sources • air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • mitigation and suppression measures to be implemented • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces.	Project manager and contractor	Pre-construction
AQ2	Air quality – dust management	• Exposed surfaces will be watered regularly to minimise dust emissions as necessary • During periods of high winds, dust generating activities will stop • Stabilisation of disturbed surfaces will take place as soon as practicable • Stockpiles or areas that may generate dust will be managed to suppress dust emissions in line with Roads and Maritime's (2015c) 'Stockpile Site Management Guideline' • All trucks will be covered when transporting dust generating material to and from the site.	Project manager and contractor	Construction
AQ3	Air quality – other air emissions	• Plant and machinery will be fitted with emission control devices complying with Australian Design Standards where practicable • No burning of any materials will occur.	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
W1	Waste management – general impacts	• A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to: – measures to avoid and minimise project waste – classification of wastes and management options (re-use, recycle, stockpile, disposal) – statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions – procedures for storage, transport and disposal – monitoring, record keeping and reporting. • The WMP will be prepared taking into account the 'Environmental Procedure - Management of Wastes on Roads and Maritime Services Land' (Roads and Maritime, 2014) and relevant Roads and Maritime waste fact sheets.	Project manager and contractor	Pre-construction
W2	Waste management – contaminated waste	• The waste management plan will be prepared with reference to the contamination assessment and the contamination management plan and will provide details for managing contaminated waste from the bridges. This will include: – posts, rails and kerbs from Gee Gee Bridge, which will not be recycled and will be disposed of at a licensed facility – any lead paint waste removed from bridge timbers – any waste derived from removing outer timber layers containing other contaminants of concern in line with the RTA QA specification – Recycling of bridge timber	Project manager and contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		– contaminated soils from next to the flood relief bridge piers (AB-S5 to AB-S8) – any additional leachate sampling of soils to confirm their waste classification.		
W3	Waste management – waste minimisation	• The evaluation and management of timber removed from the existing bridges must be in line with the requirements outlined in Roads and Maritime's 'QA specification – Recycling of bridge timber' (2011).	Project manager and contractor	Pre-construction and construction
W4	Waste management – general impacts	• Resource management hierarchy principles will be followed: – avoid unnecessary resource consumption as a priority – recover resources as far as is practicable (including material re-use, reprocessing, recycling and energy recovery) – disposal is carried out as a last resort (in line with the *Waste Avoidance and Resource Recovery Act 2001*). • Staff site inductions will be carried out (and recorded) by a site supervisor to provide a thorough knowledge of all key environmental/safety issues, including waste disposal protocols • All wastes will be managed and disposed of in accordance with the Waste Classification Guidelines (EPA 2014) and the POEO Act • Stockpiles will be managed to avoid causing pollution or contamination in line with the 'Stockpile Site Management Guideline' (RTA 2011a) • Waste will not be burned at the site • Garbage receptacles will be provided and recycling of	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		materials encouraged. Rubbish will be transported to an appropriate waste disposal facility • All working areas will be maintained, kept free of rubbish and cleaned up at the end of each working day • A waste management register must be maintained to record the re-use, recycling, stockpiling or disposal of all waste sent off site, including test results, quantities and ultimate disposal or treatment method.		
W5	Waste management – excess materials	• Excavated material and topsoil will be re-used on site for landscaping where feasible • Bulk project waste (eg excess fill) sent to a site not owned by Roads and Maritime (excluding EPA licensed landfills) for land disposal is to have prior formal written approval from the landowner, in line with Roads and Maritime's Environmental Direction No. 20 'Legal Off-site disposal of Bulk RTA Project Wastes' • Where appropriate, excess roadside materials will be disposed of in line with the following (in order): – transfer to nearby Roads and Maritime or council projects for immediate use – transfer to an approved Roads and Maritime or council stockpile site for future use during projects or routine maintenance – transfer to a Roads and Maritime or council approved site for re-use on a concurrent private/local government project – disposal at an approved materials recycling or waste disposal facility	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		– as otherwise provided for by the relevant waste legislation.		
W6	Waste management – contaminated waste	• All hazardous waste, including loose lead paint, must be disposed of at a waste facility licensed to accept that type of waste and transported by a licensed hazardous materials transporter • If disturbed, contaminated soils from next to the flood relief bridge piers will be classified as restricted solid waste and will be disposed of at a facility appropriately licensed to receive these wastes, and will not be placed or re-used at the site. If additional leachate sampling demonstrates that these soils are general solid waste, they can be managed as such. If these soils are not disturbed, no management actions are required.	Project manager and contractor	Construction
W7	Waste management – green waste	• Cleared weed-free vegetation will be chipped and re-used on-site as part of the proposed landscaping and to stabilise disturbed soils where possible. Weeds must be mulched separately and weedy mulch must not be re-used. Any trees to be removed will be re-used as milled timber wherever practicable • Green waste from weed species, or vegetation not considered appropriate for re-use on-site, will be removed and disposed of at an appropriately licensed facility.	Project manager and contractor	Construction
HR1	Hazards and risk – general	• A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to: – details of hazards and risks associated with the activity	Project manager and contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		– measures to be implemented during construction to minimise these risks – record keeping arrangements, including information on the materials present on the site, material safety data sheets and personnel trained and authorised to use such materials – a monitoring program to assess performance in managing the identified risks – contingency measures to be implemented in the event of unexpected hazards or risks, including emergency situations • The HRMP will be prepared in line with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or OEH publications.		
HR2	Hazards and risk – bushfire	• The CEMP will include provisions to minimise the potential for ignition or spread of fire. This will include the preparation of a bushfire management plan. Consultation with the local Rural Fire Service will be carried out during the preparation of the plan.	Project manager and contractor	Pre-construction
CC1	Climate change – greenhouse gas emissions during construction	• Material and waste transport will be scheduled to achieve full loads and to minimise vehicle trips • Materials will be transported from local suppliers, and surplus materials and wastes will be transported to local sites and facilities, wherever possible • Appropriately sized construction equipment, plant and vehicles will be used • Regular equipment servicing will be carried out to maintain optimal performance and to minimise	Project manager and contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		down time (which can improve overall efficiency) • The layout of access, machinery and facilities will be designed to minimise movement and vegetation clearing • The use of alternative fuels and power sources for construction plant and equipment will be investigated and implemented, where appropriate • Energy efficiency and related carbon emissions will be considered in the selection of vehicles, plant and equipment.		

7.3 Licensing and approvals

If a contractor carries out an activity requiring approval from an authority, it is the contractor's responsibility to obtain the necessary approval. The licences and approvals that may be required for the proposal are summarised in Table 7.2.

Table 7.2: Summary of licensing and approvals required

Requirement	Timing
Section 170(A)(1) of the Heritage Act requires Roads and Maritime to provide written notice to the NSW Heritage Council for transferral or demolition work of any items listed on an Section 170 register.	Not less than 14 days before the start of demolition work.
Authorisation under the *National Parks and Wildlife Act 1974* is required for temporary construction access through the Murray Valley National Park next to the proposal site.	Before any construction vehicle access in the Murray Valley National Park.
Notification to the Minister for Primary Industries under section 199 of the FM Act for potential dredging or reclamation work.	Before any work in the Wakool River.
A Section 219 permit from Department of Primary Industries (Fishing and Aquaculture) would be required for obstruction to fish passage in Wakool River.	Before any work in the Wakool River.

Requirement	Timing
Extraction of water from the Wakool River would require a water supply work approval under section 90 of the *Water Management Act 2000*. It would be the responsibility of the contractor to obtain the licence. A licence would be required under section 91F of the *Water Management Act 2000* if the proposal involves extracting groundwater from any excavations.	Before extraction of water or groundwater.

8 Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

8.1 Justification

The proposal is considered to be consistent with a number of strategies or plans, including:

- Timber Truss Bridge Conservation Strategy
- NSW 2021: A Plan to Make NSW No 1
- NSW State Infrastructure Strategy 2012-2032
- Roads and Maritime 2020 Strategy
- NSW Long Term Transport Master Plan
- Murray-Murrumbidgee Regional Transport Plan
- NSW Freight and Ports Strategy 2013
- National Land Freight Network Strategy
- Draft Murray Regional Strategy.

Gee Gee Bridge provides important access across the Wakool River for the local community and the regional agricultural industry. Noorong Road links Deniliquin in NSW and Swan Hill in Victoria. The route has been identified as a strategic freight route in NSW. It is also an alternative freight route between Wagga Wagga in NSW and Swan Hill.

The existing bridge and flood relief bridge do not meet current road design standards, and pose a number of traffic restrictions.

The proposal would provide access across the Wakool River for higher mass limit vehicles and oversized vehicles, with benefits for the regional economy. The proposal would also improve road safety by meeting current road design standards.

There would also be a number of adverse environmental impacts as a consequence of the proposal. Where possible, impacts would be avoided or minimised through the design process and site-specific safeguards.

On balance, it is considered that the adverse environmental impacts of the proposal are outweighed by the beneficial and that the proposal is therefore justified.

8.2 Objects of the EP&A Act

8.2.1 Summary of the proposal against the objects of the EP&A Act

Table 8.1 provides a summary of the proposal against the objects of the EP&A Act.

Table 8.1: Objects of EP&A Act

Object	Comment
5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The proposal would remove about 2.1 hectares of native vegetation and listed fauna habitat on the floodplain of the Wakool River. The proposal would acquire about 1.57 hectares of land from a rural property, which is unlikely to substantially affect the property owner or the leaseholder. The proposal would minimise demands on water resources by using water from the sediment basins wherever possible. The proposal would have amenity impacts (noise, air quality and visual) during construction. These impacts would be minimised with the implementation of safeguards. The proposal would provide access across the Wakool River for higher mass limit vehicles and oversized vehicles, with benefits for the regional economy. The proposal would also improve road safety by meeting current road design standards.
5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.	Roads and Maritime is carrying out consultation and environmental investigations required to properly plan and develop the proposal without undue impacts on the local economy. The proposal would benefit the regional economy by supporting traffic movement and transport across the Wakool River and by improving safety for all road users.
5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.	Roads and Maritime would consult with all utility providers about potential protection and relocation of utilities near the proposal, and would continue to consult with these providers during the detailed design phase and construction.
5(a)(iv) To encourage the provision of land for public purposes.	The proposal involves work for the purpose of a road, which is for a public purpose.

Object	Comment
5(a)(v) To encourage the provision and co-ordination of community services and facilities.	The proposal is located in a rural environment. No community services or facilities would be affected by the proposal.
5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	The proposal would remove 2.1 hectares of native vegetation, and would potentially impact 17 listed bird species, five listed mammal species, three listed fish species and one listed ecological community. Habitat loss would include 13 hollow-bearing trees. The proposal is unlikely to have a significant impact on any listed biota, as detailed in section 6.2 and 6.3.
5(a)(vii) To encourage ecologically sustainable development.	Ecologically sustainable development is considered in section 8.2.2 below.
5(a)(viii) To encourage the provision and maintenance of affordable housing.	Not relevant to the proposal.
5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.	Not relevant to the proposal.
5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.	Roads and Maritime and Council have carried out consultation for the proposal as described in chapter 5. This has included consulting with stakeholders, including government stakeholders, and the community, including the Aboriginal community. Issues raised during consultation in relation to the proposal have been addressed during the environmental planning and assessment process. This REF has been placed on public display for further consultation and public comment.

8.2.2 Ecologically sustainable development

Australia's 'National Strategy for Ecologically Sustainable Development 1992' defines ecologically sustainable development as "using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased".

The principles of ecologically sustainable development have been incorporated into the concept design and environmental assessment of the proposal. The integration of these principles is discussed below.

The precautionary principle

This principle states that “if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation”.

Evaluation and assessment of alternative options have aimed to reduce the risk of serious and irreversible environmental impacts. The community has been given opportunity to comment on the proposal and a range of specialist studies were carried out for key issues to provide accurate and impartial information to help evaluate options.

The detailed assessment of potential environmental impacts in the preparation of the concept design has sought to minimise impacts on the natural amenity of the study area, while maintaining engineering feasibility and safety for all road users.

This process has enabled the impacts of the proposal to be predicted within a reasonable degree of certainty. All predictions, however, contain a degree of variability, which reflects the variable nature of the environment. Where there has been any uncertainty in the prediction of impacts throughout the environmental impact assessment process, a conservative approach was adopted to ensure the worst case scenario was predicted in the assessment of impacts. A number of safeguards have been proposed to minimise potential impacts. These safeguards would be implemented during construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty.

A construction environment management plan would be prepared before construction starts. This requirement would ensure the proposal achieves a high level of environmental performance.

Intergenerational equity

The principle states, “the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations”.

The proposal would benefit future generations by ensuring the proposal does not have long-term adverse environmental impacts and by ensuring that potential impacts are minimised by implementing appropriate safeguards. This would ensure the proposal is consistent with the principle of intergenerational equity.

Conservation of biological diversity and ecological integrity

This principle states that the “conservation of biological diversity and ecological integrity should be a fundamental consideration”.

An assessment of the existing local environment has been carried out in order to identify and manage any potential impacts of the proposal on local biodiversity. The proposal is unlikely to have a significant impact on any listed species, populations or ecological communities. This is detailed in section 6.2. Detailed design and implementation of safeguards and management measures would aim to minimise biodiversity impacts. On this basis, the conservation of biological diversity and ecological integrity has been a fundamental consideration in the assessment of the proposal.

Improved valuation, pricing and incentive mechanisms

This principle requires that "environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems."

The REF has examined the environmental consequences of the proposal and identified safeguards and management measures for areas which have the potential to experience adverse impacts. Requirements imposed in terms of implementation of these safeguards and management measures would result in an economic cost to Roads and Maritime. The implementation of safeguards and management measures would increase both the capital and operating costs of the proposal. This signifies environmental resources have been given appropriate valuation.

The concept design for the proposal has been developed with an objective of minimising potential impacts on the surrounding environment. This approach would also be applied to the detailed design.

All contractors engaged by Roads and Maritime are to abide by the environmental standards and procedures established by Roads and Maritime, and are to factor environmental management measures (such as waste management) into the cost of their work.

8.3 Conclusion

Roads and Maritime proposes to build a new Gee Gee Bridge over the Wakool River, about 33 kilometres east of Swan Hill.

The proposal would provide access across the Wakool River for higher mass limit vehicles and oversized vehicles, with benefits for the regional economy. The proposal would also improve road safety by meeting current road design standards.

The proposal is subject to assessment under Part 5 of the EP&A Act. This REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity. This has included consideration of conservation agreements and management plans under the *National Parks and Wildlife Act 1974*, joint management and biobanking agreements under the *Threatened Species Conservation Act 1995*, wilderness areas, critical habitat, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants.

The proposal as described in this review of environmental factors best meets the proposal objectives but would still result in environmental impacts. These relate to the demolition of Gee Gee Bridge, removal of native vegetation and listed fauna habitat from the Wakool River floodplain, and potential impacts on the local

community, including noise, land acquisition, visual impacts, changed access and air quality.

Adverse environmental impacts would be minimised by implementing the safeguards and management measures outlined in this review of environmental factors. On balance, it is considered that the adverse environmental impacts of the proposal are outweighed by the beneficial effects and that the proposal is therefore justified.

This review of environmental factors concludes that the proposal is unlikely to have a significant impact on any threatened species, populations or ecological communities or their habitats, listed under the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994* and therefore a species impact statement is not required.

This review of environmental factors finds that the proposal is unlikely to have a significant environmental impact and therefore an Environmental Impact Statement is not required. Approval from the Minister for Planning and Infrastructure under Part 5.1 of the *Environmental Planning and Assessment Act 1979* is not required.

The proposal is unlikely to affect Commonwealth land or have a significant impact on any matters of national environmental significance and therefore a referral under the *Environment Protection and Biodiversity Conservation Act 1999* to the Australian Government Department of the Environment and Energy is not required.

9 Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Reuben Robinson
Senior Environmental Scientist
GHD Pty Ltd
Date: 30 June 2017

I have examined this review of environmental factors and the certification by Reuben Robinson of GHD Pty Ltd and accept the review of environmental factors on behalf of Roads and Maritime Services.

Dean Howard
Project Manager
Roads and Maritime Services South West Region
Date: 30 June 2017

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Terms and acronyms used in this REF

Term / Acronym	Description
Acid sulfate soils	Soils and sediments containing iron sulfides, most commonly pyrite. When exposed to air due to drainage or disturbance, these soils produce sulfuric acid, often releasing toxic quantities of iron, aluminium and heavy metals. Acid sulfate soils are generally confined to coastal areas, although they can occur at inland locations where there is poor drainage.
AHIMS	Aboriginal Heritage Information Management System
Biota	The flora and fauna of a region
CEMP	Construction Environmental Management Plan
Chainage	The distance of a point along a control line, measured from a datum point.
Construction Environmental Management Plan	A site or proposal specific plan developed to ensure that appropriate environmental management practices are followed during the construction and/or operation of a proposal.
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Culvert	One or more subsurface adjacent pipes or enclosed channels for conveying surface water or a stream below a road.
Cumulative impact	An impact created by accumulation or successive additions of individual impacts, which may not themselves be substantial.
Cut	The depth from the natural surface of the ground to the construction level.
dB(A)	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies
dbh	Diameter at breast height
DECC	Department of Environment and Climate Change, now OEH (see below)
DECCW	NSW Department of Environment, Climate Change and Water, now OEH (see below)
Decibel [dB]	The units that sound is measured in.

Term / Acronym	Description
'Do nothing' option	This assumes that Gee Gee Bridge is not replaced and assumes existing road conditions and networks remain unchanged.
DotEE	Australian Department of the Environment and Energy
Earthworks	All operations involved in loosening, removing, depositing, shaping and compacting soil or rock
Ecologically sustainable development	Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
EIS	Environmental Impact Statement
ENMM	Roads and Maritime's Environmental Noise Management Manual 2001, Practice Notes vii – Roadworks Outside of Normal Working Hours (ENMM)
Environment	For the purpose of the REF, environment incorporates physical, biological, heritage, cultural, economic and social aspects.
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
Fill	One or more of the following: 1. The depth from the subgrade level to the natural surface. 2. That portion of road where the formation is above the natural surface. 3. The material placed in an embankment.
Flood relief bridge	A bridge designed to minimise the flood impacts of a development by allowing flows to pass through the development.
Floodway	Land that is identified as carrying active flood flows associated with waterways and open drainage systems.
FM Act	Fisheries Management Act 1994

Term / Acronym	Description
Fragment	Land that is identified as carrying active flood flows associated with waterways and open drainage systems.
GHD	GHD Pty Ltd
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
km/h	Kilometres per hour
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{Aeq(15hr)}$	The L_{Aeq} noise level for the period 7 am to 10 pm.
$L_{Aeq(9hr)}$	The L_{Aeq} noise level for the period 10 pm to 7 am.
$L_{Aeq(1hr)}$	The highest hourly L_{Aeq} noise level during the day and night periods.
LALC	Local Aboriginal Land Council
L_{Amax}	The maximum sound level recorded during the measurement period.
Land use	The type of development existing or permitted in an area whether it be industrial, commercial, residential, recreational or a combination of some or all of these different uses.
LEP	Local Environmental Plan
LGA	Local government area
Likely	Taken to be a real chance or possibility.
Locality	The area within a 10 kilometre radius of the proposal.
Lot	A part (consisting of one or more pieces) of any land (except a road, a reserve, or common property) shown on a plan, which can be disposed of separately and includes a unit or accessory unit on a registered plan of strata subdivision and a lot or accessory lot on a registered cluster plan.
NPW Act	National Parks and Wildlife Act 1974
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PACHCI	RTA Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Term / Acronym	Description
POEO Act	Protection of the Environment Operations Act 1997
Proposal	The proposed replacement of Gee Gee Bridge, including construction of the new bridge and approach roads, and demolition of the existing Gee Gee Bridge and flood relief bridge.
Proposal site	The area required for the construction of the proposal, including construction activities and construction vehicle access.
QA Specifications	Specifications developed by Roads and Maritime for use with roadworks and bridgeworks contracts let by Roads and Maritime Services.
Rating background level	The overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).
Receiver	Any person, as well as a residence, business or facility, with the potential to be affected by an environmental impact (eg noise or air quality).
REF	Review of environmental factors
Road reserve	A road reserve is a legally described area within which facilities such as roads, footpaths, and associated features may be constructed for public travel. It is the total area between boundaries shown on a cadastral plan.
Roads and Maritime Services	Roads and Maritime Services is the proponent for the Gee Gee Bridge REF. Roads and Maritime Services is the NSW state government department responsible for the environmental assessment on the proposal.
RTA	NSW Roads and Traffic Authority. The RTA now forms part of Roads and Maritime Services.
SEPP	State Environmental Planning Policy
Study area	The area identified for assessing the potential impacts of the proposal relating to a specific discipline. Generally the study area is defined as the area of impact and any additional areas that are likely to be affected by the proposal, either directly or indirectly.
Threatened species	A species specified in Schedule 1 Part 1 (endangered species), Part 4 (presumed extinct) and Schedule 2 (vulnerable species) of the TSC Act, in Schedule 4 (endangered species), 4A (critically endangered species) and Schedule 5 (vulnerable species) or under the EPBC Act.

Term / Acronym	Description
TSC Act	*Threatened Species Conservation Act 1995*
Unlikely	Taken to be an unlikely or remote possibility of occurring.

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