Gunnedah second road over rail bridge

Preliminary Concept Options Report

MAY 2013
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Executive summary

Background

Roads and Maritime Services (RMS) has commissioned Kellogg Brown & Root Pty Ltd (KBR) to undertake the development and assessment of concept options for the Gunnedah second road over rail bridge project.

With major coal development occurring in the Gunnedah basin, the length and frequency of coal trains has been increasing, causing extended delays at the existing New Street level crossing. With delays expected to continue and increase in the future, RMS and the Gunnedah Shire Council (GSC) are committed to identifying a grade separated crossing that will improve both local and through traffic efficiency. By elevating road traffic to cross at a different level (grade) to the rail line, crossing delays at New Street will be eliminated.

The objectives of this project are to achieve the following outcomes:

- Provide a grade separated crossing of the rail line to facilitate a Higher Mass Limit (HML) route through Gunnedah.
- Improve local traffic efficiency.
- Improve road safety.
- Improve road transport productivity, efficiency and reliability of travel.
- Minimise the impact on the natural, cultural and built environment.
- Provide value for money.

This report documents the process and methodology used to shortlist the preliminary concept options to be taken forward for further investigation and assessment during the next stage of the project.

Community consultation to date

Two initial community drop-in sessions were held on 10 December 2012, staffed by RMS and KBR and attended by about 50 people. The drop-in sessions were designed to provide background information on the project and allow community members the opportunity to provide suggestions and to identify key areas of concern at an early stage. Attendees were given a copy of the first community update, which included an overview map of the study area. The top four issues identified during these sessions were:

- Traffic congestion.
- Pedestrian safety.
- Impact on the community.
- Impact on property.
Preliminary concept options development

A total of 19 preliminary concept options were developed, using a wide range of alignments across the study area and a combination of inputs from the broader project team, community suggestions, RMS and other key stakeholders.

These preliminary concept options can be divided into three general road corridors based on their horizontal alignment:

- New Street – options using the same alignment as the existing level crossing.
- Behind Mill – options to the west of the heritage listed Gunnedah Maize Mill.
- Farrar Road – options via Farrar Rd instead of directly to the Oxley Highway.

Technical and environmental investigations and constraints

Preliminary technical and environmental investigations have been undertaken by KBR and its specialist sub-consultants to identify likely constraints and opportunities within the study area.

These technical papers, including a series of constraints maps, were prepared to help assess the preliminary concept options and to ensure all potential constraints are considered and addressed as part of the concept option development.

The study area is located to the east of the Gunnedah Central Business District (CBD) and is subject to a number of constraints, including the following:

- The heritage listed Gunnedah Maize Mill (also known as Meggitts Flour Mill) is located in the middle of the study area.
- Blackjack Creek is an identified floodplain that becomes inundated during large storms and backwater flooding from the Namoi River.
- Vegetation mapped as the NSW-listed Endangered Ecological Community, White Box yellow box Blakely's red gum woodland as well as potential koala migration corridors are located in the middle of the study area.
- Pedestrian and cyclist connectivity between residential areas south of the railway line and the business district north of the railway line needs to be addressed.
- ARTC vertical clearance requirements for doublestacking create a bridge deck some 8.9 m higher than the existing rail line.
- The visual and spatial relationship between Pensioners Hill, the floodplain and built vertical elements are features that characterise the town.

Assessment of preliminary concept options

An initial review of the 19 options removed several that either did not meet the minimum design requirements or objectives of the project.

Nine options were retained for detailed assessment at the Internal Technical Workshop held on 13 February 2013. This workshop was attended by 22 representatives from the project team, RMS and Gunnedah Shire Council.

The assessment of these options was undertaken with consideration given to the project objectives and the key constraints of the study area identified above and in detail in this report.
Shortlisted options for further consideration

Following assessment of the preliminary concept options, three (3) were shortlisted to be taken forward for further investigation and assessment. These are:

- Option 1C (also known as option A).
- Option 4 (also known as option B).
- Option 5 (also known as option C).

These options are shown in Figure 1 on the following page.

What happens next

Following announcement and community consultation on the shortlist of preliminary concept options, further technical and environmental investigations will be undertaken to provide more detailed information on each option’s relative performance.

The shortlisted options will be assessed using the developed multi criteria analysis (MCA) assessment methodology to allow transparent and objective decisions to be made.

The investigations and assessment will be documented in the Concept Options Report as part of the next stage of this project. When completed, this report will be publicly exhibited and distributed for community comments and input.

Feedback received from the community, together with the results of detailed investigations and outcomes of the Value Management Workshop will be used to identify a recommended concept option.

Feedback from the display of the preferred option will then be considered before a decision and formal announcement is made by RMS and the Minister on the preferred location for the second road over rail bridge at Gunnedah.
Figure 1 - Shortlisted preliminary concept options
## Glossary of terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>Annual average daily traffic</td>
</tr>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>AHD</td>
<td>Australian Height Datum, a common national plane of level approximately equivalent to the height above sea level</td>
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<tr>
<td>AHIMS</td>
<td>Aboriginal Heritage Information Management System</td>
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<tr>
<td>AM peak</td>
<td>Morning traffic peak period, that is, from 7 am to 9 am</td>
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<tr>
<td>ARI</td>
<td>Average recurrence interval, the average or expected value of the periods between exceeding a given rainfall total accumulated over a given duration</td>
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<tr>
<td>ARTC</td>
<td>Australian Rail Track Corporation</td>
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<tr>
<td>Austroads</td>
<td>Austroads is the association of Australian and New Zealand road transport and traffic authorities</td>
</tr>
<tr>
<td>BCR</td>
<td>Benefit-cost ratio</td>
</tr>
<tr>
<td>BOM</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td>CBD</td>
<td>Central business district</td>
</tr>
<tr>
<td>CMA</td>
<td>Catchment Management Authority</td>
</tr>
<tr>
<td>DDA</td>
<td>The Australian Government’s Disability Discrimination Act 1992</td>
</tr>
<tr>
<td>DP&amp;I</td>
<td>NSW Department of Planning and Infrastructure</td>
</tr>
<tr>
<td>EEC</td>
<td>Endangered ecological community</td>
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<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
</tr>
<tr>
<td>EPA Act</td>
<td>Environmental Planning and Assessment Act 1979</td>
</tr>
<tr>
<td>EPBC Act</td>
<td>Environment Protection and Biodiversity Conservation Act 1999</td>
</tr>
<tr>
<td>EPL</td>
<td>Environmental Protection Licenses</td>
</tr>
<tr>
<td>HML</td>
<td>Higher Mass Limits (HML) is a nationally agreed scheme that permits approved heavy vehicles to operate with additional mass on certain types of axle groups, on a restricted road network and subject to specified conditions</td>
</tr>
<tr>
<td>HPAA</td>
<td>High Pedestrian Activity Area</td>
</tr>
<tr>
<td>LALC</td>
<td>Local Aboriginal Land Council</td>
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<tr>
<td>LEP</td>
<td>Local environmental plan</td>
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<tr>
<td>LGA</td>
<td>Local government area</td>
</tr>
<tr>
<td>MCA</td>
<td>Multi Criteria Assessment</td>
</tr>
<tr>
<td>MNES</td>
<td>Matter of National Environmental Significance</td>
</tr>
<tr>
<td>mtpa</td>
<td>Million tonnes per annum</td>
</tr>
<tr>
<td>NPV</td>
<td>Net Present Value</td>
</tr>
<tr>
<td>OEH</td>
<td>The Office of Environment and Heritage</td>
</tr>
</tbody>
</table>
PEP Protection of the Environment Policies
PM Peak Afternoon traffic peak period, that is, from 3 pm to 5 pm
POEO Protection of the Environment Operations
REF Review of Environmental Factors
RMS NSW Roads and Maritime Services
RVC Regional Vegetation Communities
RNP Road Noise Policy
SEPP State Environmental Planning Policy
SIS Species Impact Statement
SEWPAC Department of Sustainability, Environment, Water, Population and Communities
1 Introduction

1.1 Project background

Roads and Maritime Services (RMS) has commissioned Kellogg Brown & Root Pty Ltd (KBR) to undertake the development and assessment of concept options for the Gunnedah second road over rail bridge project.

Gunnedah is situated in northern NSW, 80 km west of Tamworth. The town is bisected by the Hunter Valley Rail Corridor, which separates the town centre and business district in the north from the growing residential areas in the south. The Dr P.H Stanley Bridge on Abbott Street (Oxley Highway), known locally and referred to here as the Abbott Street bridge, is currently the only grade separated crossing of the railway line in Gunnedah.

The Abbott Street bridge was constructed in 1941 and is not suitable for use by wide vehicles including Higher Mass Limit vehicles. Gunnedah Shire Council (GSC) has also advised that Kamilaroi Highway on Conadilly Street is not used by heavy and oversized vehicles.

The existing New Street level crossing, Barber Street, Warrabungle Street, Bloomfield Street and Boundary Road are currently used as an alternative oversized heavy vehicle route for vehicles travelling on the Oxley Highway through Gunnedah. When coal trains pass through town this route becomes blocked at the level crossing by through traffic and local traffic.

With major coal development occurring in the Gunnedah basin, the length and frequency of coal trains has been increasing, causing extended delays at the nearby level crossings. With delays expected to continue and increase in the future, RMS and the GSC are committed to identifying a grade separated crossing that will improve both local and through traffic efficiency.

For several years the GSC has been lobbying for the second road over rail crossing, improve traffic flow during train passage through town. However the option to widen this bridge is not economical. Options previously considered included the railway relocation away from the town and a highway town by pass, both not feasible due to prohibitive costs.

In August 2011 a meeting was held between RMS and GSC and established that a second crossing of the rail line via the Warrabungle St alignment would likely be the most practical and feasible location.

The study area has been determined to meet the project objectives of GSC, RMS, the community and the Bridges for the Bush announcement by the NSW Government (see Figure 1.1).
1.2 Purpose of the report

The purpose of this Preliminary Concept Options Report is to document and summarise the project processes, methodology, technical and environmental investigations used to shortlist the preliminary concept options. This report:

- Describes the existing traffic situation and identifies issues and constraints in relation to constructing a grade separated crossing in the vicinity of the existing New Street level crossing, within the boundaries of the study area.
- Describes the existing environment in the Gunnedah area and identifies issues and constraints in the vicinity of the study area.
- Describes the 19 preliminary concept options identified within the study area.
- Documents the assessment method and process of shortlisting the preliminary concept options to be taken forward for further community consultation, engineering and environmental investigations.
- Outlines the next steps for identifying the preferred option for a grade separated crossing of the existing railway line.

1.3 Assumptions and limitations

This report is intended to provide information on the existing environment, issues and constraints related to the short listing of preliminary concept options to provide a second grade separated crossing over the existing railway line at Gunnedah.

This report has been developed based on the outcomes of desktop studies, community consultation, and site visits.
As the process for identifying a preferred option progresses, additional investigations, field work and assessment will be carried out to complement the work undertaken to date and further refine the identified constraints within the study area.
2 Project strategic context, need and objectives

2.1 Strategic context

The overarching policies and strategic documents relevant to the second road over rail bridge and to the Gunnedah local government area are:

- NSW Long Term Transport Master Plan (TfNSW, September 2012).
- Bridges for the Bush initiative (NSW Government 2012).
- Gunnedah Community Strategic Plan 2012-2022 (Gunnedah Shire Council 2011).
- Australian Rail Track Corporation (ARTC) 2012-2021 Hunter Valley Corridor Strategy (ARTC June 2012).

These documents are discussed below.

2.1.1 NSW 2021: A Plan to Make NSW Number One

*NSW 2021: A Plan to Make NSW Number One* (NSW Government, 2011) presents the NSW Government’s strategy to move the State forward over the next 10 years. It is based on five principal strategies with underlying goals. The five strategies are to:

1. Rebuild the economy – restore economic growth and establish NSW as the ‘first place in Australia to do business’.
2. Return quality services – provide the best transport, health, education, policing, justice and family services, with a focus on the customer.
3. Renovate infrastructure – build the infrastructure that makes a difference to both our economy and people’s lives.
4. Strengthen our local environment and communities – improve people’s lives by protecting natural environments and building a strong sense of community.
5. Restore accountability to Government – talk honestly with the community, return planning powers to the community and give people a say on decisions that affect them.

The NSW 2021 goals relevant to transport under the plan are to reduce travel times, grow patronage on public transport by making it a more attractive choice, improve customer experience with transport services and improve road safety.

The provision of the second Gunnedah road over rail bridge would support the NSW 2021 plan transport goals by reducing travel times, improving local and through traffic efficiency and improving road safety throughout the Gunnedah locality.

2.1.2 NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* was released in December 2012 to address key transport challenges that face the State over the next 20 years and put the customer at the centre of everything NSW does in transport.

The Master Plan is principally focused on six key transport challenges. These six challenges have been identified by looking at the transport system from the perspective of the customer and the multi-modal journeys that are made:

- Integrating modes to meet customer needs.
- Getting Sydney moving again.
- Sustaining growth in Greater Sydney.
• Providing essential access to regional NSW.
• Supporting efficient and productive freight.
• Statewide actions.

The proposed Gunnedah second road over rail bridge project is directly referenced as part of the State Government’s ‘Bridges for the Bush’ Program and has already received government funding.

2.1.3 Bridges for the Bush Initiative

The *Bridges for the Bush* initiative is a commitment from NSW Government to improve road freight productivity by replacing or upgrading bridges over the next five years at 17 key locations in regional NSW (see Figure 2.1).

The NSW road network is critical to the movement of freight in Australia. Half the nation’s road freight and three quarters of all interstate road freight journeys are on NSW roads. With the road freight task predicted to nearly double by 2030, significant investment in the NSW road network is required to meet the demand for increased access of larger, safer and heavier freight vehicles.

*Bridges for the Bush* includes replacing or upgrading five key priority Higher Mass Limit (HML) deficient bridges on state managed roads and 12 timber truss bridges on state, regional and local roads.

The *Bridges for the Bush* initiative will enhance freight productivity in country NSW. It is an investment in critical infrastructure to remove a number of significant freight pinch points or bottlenecks on the state road network and to improve the safety and reliability of some old bridge structures. The replacement or upgrade of five HML deficient bridges alone will remove 8,000 heavy vehicle trips from the freight task each year. This will save the state more than $200 million in economic, social and environmental costs over the next 30 years.

The provision of the Gunnedah second road over rail bridge will remove the only remaining HML deficient bridge on the Oxley Highway. It will deliver continuous 660 kms for HML traffic.
2.1.4 NSW Strategic Land Use Plan – New England North West

Strategic Land Use Plan – New England North West (NSW Government 2012) highlights that a major driver for the project in its current location is the predicted economic growth within the New England North West Region. The township of Gunnedah is a connecting point for a number of roads in the New England North West Region, particularly into the areas which are to be supporting the growing mining industry in the future.

Gunnedah has an important role to play in providing the connecting infrastructure to support this industry and to provide the associated social and housing services. The provision of the Gunnedah second road over rail bridge would support this strategy for the Gunnedah locality.

2.1.5 Gunnedah Community Strategic Plan 2012-2022

Gunnedah Community Strategic Plan 2012-2022 (Gunnedah Shire Council 2011) stakeholder consultation highlighted a number of key values and issues for the Gunnedah Shire. Key community values which have been discussed in relation to this project and the region include:

- A strong sense of belonging within local neighbourhoods.
- Concern regarding the adequacy of existing infrastructure to support development.
- Desire for progress and development and the management and maintenance of infrastructure.
- Improved traffic flows and safe access for pedestrians and cyclists using local roads.
- Access to community facilities, including childcare, preschool, aged care and health services.
• A high level of satisfaction with trees in neighbourhoods in the Gunnedah township, however, noting the desire for more trees and more methods to improve waterway quality.
• The highest use of sporting facilities, neighbourhood parks and recreational areas are for those located within the Gunnedah township.
• The provision of affordable housing is a priority issue in the Gunnedah Community Strategic Plan 2012 – 2022. It is recognised by Council and the community that affordable and accessible housing is needed to encourage young people to remain in Gunnedah to assist in strengthening the workforce.

These values tie in directly or indirectly with the project objectives and contribute to the development of the assessment criteria for the project.

2.1.6 Australian Rail Track Corporation 2012-2021 Hunter Valley Corridor Strategy

Australian Rail Track Corporation (ARTC) 2012-2021 Hunter Valley Corridor Strategy (ARTC June 2012) is the latest edition of its annual planned infrastructure enhancement strategies. ARTC has been releasing annual strategy updates, setting out how it planned to ensure that rail corridor capacity in the Hunter Valley would stay ahead of coal demand.

In the above edition, export coal volumes are predicted to rise from 151 million tonnes per annum (mtpa) in 2012 to 235 mtpa in 2016.

The provision of the second Gunnedah road over rail bridge seeks to assist ARTC in addressing these impacts.

2.2 The need for a grade separated crossing

The Abbott Street bridge is currently the only grade separated crossing of the railway line in Gunnedah, and is not suitable for use by Higher Mass Limit vehicles.

The existing New Street level crossing, Barber Street, Warrabungle Street, Bloomfield Street and Boundary Road are currently used as an alternative oversized heavy vehicle route for heavy vehicles travelling on the Oxley Highway and Kamilaroi Highway through Gunnedah. The New Street level crossing also carries local traffic between Gunnedah’s CBD to the north of the railway to the residential areas south of the line.

All oversized heavy vehicles (excluding HML vehicles) currently using the local road network are individually permitted by GSC.

The increased length and frequency of freight trains due to major coal developments in the Gunnedah basin, has led to frequent extended closures of the New Street level crossing for train passage, causing significant delays for motorists and pedestrians. With delays expected to continue to increase in the future, there is a need to improve both local and through traffic efficiency.

2.3 Project purpose and objectives

2.3.1 Project purpose

To identify and select a preferred concept option for a second grade separated crossing of the existing railway line in the vicinity of the New Street level crossing.
2.3.2 Project objectives

The key project objectives for this project have been established by RMS in collaboration with key stakeholders for this project. They are:

- Provide a grade separated HML route through Gunnedah.
- Improve local traffic efficiency.
- Improve road safety.
- Improve road transport productivity, efficiency and reliability of travel.
- Minimise the impact on the natural, cultural and built environment.
- Provide value for money.

2.3.3 Supporting objectives

To assist in achieving these objectives, the following supporting objectives have been developed:

Provide a grade separated HML route

- Provide a compliant engineering design.
- Provide a grade separation with minimum complexity in construction, including site access and staging works.
- Provide a design which requires minimum ongoing operation / maintenance works and minimises the Work Health and Safety (WHS) risk for maintenance personnel.

Improve local traffic efficiency/ transport productivity and reliability

- Increase network capacity.
- Improve traffic flow.
- Reduce traffic durations / delay.

Improve road safety

- Minimise vehicle conflict points.
- Provide suitable and safe pedestrian and cycle routes.

Minimise the impact on the natural, cultural and built environment

- Minimise visual impact.
- Minimise ecological impact.
- Minimise impact on heritage.
- Minimise noise and air quality impact.
- Minimise impact on drainage/ water quality/ flooding.
- Minimise impact on property.
- Minimise impact on social environment.

Provide value for money

- Provide a design that is affordable and within the capital budget for the project.
- Provide a justifiable benefit / cost ratio for the life of the structure.
3 Community involvement and feedback

3.1 Public participation

KBR has developed and agreed with RMS a Public Participation Plan that outlines communication activities to inform and consult external stakeholders and the broader community in relation to the development and assessment of concept options.

This chapter describes the community interactions to date and community feedback and issues obtained from the community drop-in sessions conducted in December 2012.

3.2 Community interactions to date

The community interactions that have taken place are summarised here, with references given to sources of more detailed information.

- A project email, 1800 phone number and reply paid mailing address were established, to allow easy and free access to the project team.
- A letterbox drop took place in November 2012, inviting all residents of the Gunnedah township to attend one of two community drop-in sessions held on Monday 10 December from 11am-2pm, and 5pm-8pm.
- The community drop-in sessions were staffed by RMS and KBR personnel and attended by approximately 50 people. 40 signed in and provided contact details for further project updates, and 14 filled out formal feedback forms. Attendees were given a copy of the first community update, which included the overview map of the study area shown in Figure 3.1.
- All community input gathered through the sessions and other channels has been entered into the Darzin stakeholder database and shared with the project team to assist in the development of the project.
- An Early Feedback Summary report was developed and posted on the RMS website.
- Following the drop-in sessions, letters were sent out thanking participants for their feedback and explaining that there would be opportunities for further input at future drop-in sessions. These letters enclosed a copy of the Early Feedback Summary report (refer to Appendix C), to demonstrate how community input was being captured and utilised.
- Similar letters were sent to property owners within the study area explaining that there would be opportunities for further input at future drop-in sessions and that they would be invited to individual face-to-face meetings to discuss the project and any impacts in more detail.
- In addition to these planned activities, there have been 31 phone conversations with members of the public, and eight emails exchanged through the project email address. All have been replied to promptly within the agreed timeframes and their content recorded in the database.
3.3 Community feedback and issues

All community feedback has been welcomed and considered alongside other factors in developing the preliminary concept options.

From the December 2012 community drop-in sessions, the top four issues identified were:

- Traffic congestion.
- Pedestrian safety.
- Impact on the community.
- Impact on property.

The complete breakdown of community feedback received at the drop-in sessions is illustrated in Figure 3.2 below.

![Figure 3.1 Map of project study area](image)

**Figure 3.2** Key issues from December 2012 community drop-in session (Source: RMS)
Participants provided helpful details about current traffic patterns and where queuing is a problem. Further discussion on community feedback has been provided in the Early Feedback Summary report contained in Appendix C.

Further public participation activities will take place in May 2013. Dates will be published on the RMS website, letters sent to previous participants, and advice to the wider Gunnedah community. Drop-in sessions will be held to discuss the preliminary options and seek feedback. Face-to-face meetings are proposed with property owners within the study area. The drop-in sessions will also be advertised in local newspapers.
4 Existing traffic and transport situation

This section summarises the outcomes of the preliminary traffic and transport investigations undertaken.

4.1 Existing New Street level crossing

Increased mining in the Gunnedah basin has led to an increase in rail movements through Gunnedah, with up to 1200 m long trains every 23 minutes. Further increases are expected in the next 10 years as more mining operations are established. The Dr P.H Stanley Bridge on Abbott Street is the only grade separated crossing over the railway line to form part of the Oxley Highway, a State Highway (SH11) that links central NSW towns such as Gilgandra, Coonabarabran and Tamworth with the coastal towns of Wauchope and Port Macquarie. However, the Dr P. H. Stanley Bridge is structurally inadequate for HML vehicle loadings and has insufficient width between kerbs for heavy vehicle passage.

Many Gunnedah residents live south of the railway line while the business district is based in the north of the railway line. With the regular closure of the at-grade crossings to allow train passage, pedestrians who do not have access to a vehicle experience significant delays.

To reduce delays to local and through traffic, to improve pedestrian safety and increase opportunities for community participation, a new grade separated crossing is required.

4.2 Existing road network

The key features of the existing road network in Gunnedah relevant to this project are shown in Figure 4.1 below and discussed in the following sections.

![Figure 4.1 Existing Gunnedah road network with average daily traffic volumes](Source: GTA)
4.2.1 Oxley highway (Conadilly Street, Abbott Street, South Street, Mullaley road)

The Oxley Highway is one of the key east-west rural highways in northern NSW, and connects the central NSW towns of Gilgandra, Coonabarabran, Gunnedah and Tamworth with the coastal centres of Wauchope and Port Macquarie. The Oxley Highway is a classified State Highway (SH11) which travels through the centre of Gunnedah via Conadilly Street, Abbott Street, South Street and Mullaley Road. Conadilly Street functions as the main retail street for the town of Gunnedah.

There are roundabouts at the New Street and Marquis Street intersections with Oxley Highway. All other cross intersections are ‘Give Way’ controlled in favour of the Highway route, except for Conadilly Street and Anzac Parade.

4.2.2 Kamilaroi Highway (Conadilly Street, Boggabri Road)

The Kamilaroi Highway is a classified State Highway (SH29) and key rural highway in northern and western NSW which connects the New England Highway at Willow Tree (southeast of Gunnedah) with the rural towns of Gunnedah, Boggabri, Narrabri, Wee Waa, Walgett and Bourke. The Kamilaroi Highway travels through the centre of Gunnedah via Conadilly Street and Boggabri Road. It partly shares this route with the Oxley Highway.

The Kamilaroi Highway carries approximately 7,000 vehicles per day. Its intersection at Marquis Street is signal controlled. There are roundabouts at the Chandos Street and Elgin Street intersections. All other intersections are ‘Give Way’ controlled in favour of the Highway, including Abbott Street.

Conadilly Street forms the ‘main street’ and features several pedestrian crossings and angled car parking. Between the two roundabouts there is a 40km/h High Pedestrian Activity Area (HPAA).

4.2.3 Local road network

Barber Street

Barber Street is a local road located in the centre of Gunnedah aligned in a north-west / south-east direction. Barber Street is subject to a 50 km/h posted speed limit and features a 20m wide carriageway within a road reserve approximately 30m wide, with a mix of both restricted and unrestricted kerbside parking permitted on both sides.

Warrabungle Street

Warrabungle Street is a local road located in the centre of Gunnedah aligned in a north-east/ south-west direction. Warrabungle Street is subject to a 50 km/h posted speed limit and features a 20m wide carriageway within a road reserve approximately 30m wide with unrestricted kerbside parking permitted on both sides. Warrabungle Street has been used to provide an alternative access through town for heavy vehicles travelling on the Oxley Highway to the west of Gunnedah.

The Kamilaroi Highway and Warrabungle Street intersection is ‘Give Way’ controlled in favour of the highway, using signs and line-marking.

New Street

New Street is a local road west of the centre of Gunnedah and is aligned in a north-south direction. New Street is subject to a 50 km/h posted speed limit and features one
of the two existing at-grade railway crossings in the town of Gunnedah. According to the 7 day traffic volume data from GSC recorded in 2010, approximately 5000 vehicles cross the New Street level crossing each day.

View Street

View Street is a local road located south-west of the centre of Gunnedah aligned in a north-south direction. View Street is subject to a 50km/h posted speed limit.

4.3 Crash history

This chapter is a summary of vehicle crash data from RMS for the urban area of Gunnedah for the five year period to June 2012.

A total of 110 vehicle crashes were reported in Gunnedah during a five year period to June 2012, 56 of which caused injuries to a total of 69 people. There were no fatal crashes within the urban area of Gunnedah during the five year period examined (see Figure 4.2 below).

The outcomes of analysis of the crash data are:

- 34% of crashes occurred at intersections.
- 5% of crashes involved heavy vehicles.
- 14% of crashes were rear-end type accidents.
- 27% of crashes occurred on Conadilly Street (town centre).

![Figure 4.2 Gunnedah five year crash data (Source: RMS)](image-url)
4.4 Public transport

Rail services

Gunnedah is located on the Central to Moree line of the North Western Country Link rail network and is served by two passenger train services per day - one to Moree and one to Central Station, Sydney.

Gunnedah railway station is located on Railway Street, south of Gunnedah town centre.

Bus services

Gunnedah is served by two public bus services (see Figure 4.3), 451 - South and West Gunnedah and 452 - South and East Gunnedah. Both of these routes are operated by Hopes Coaches and have a frequency of three AM services and three PM services on weekdays with no services on weekends. The 451 route uses the New Street level crossing.

Gunnedah is served by a daily weekday coach service to Narrabri, Baan Baa and Boggabri (route 457E).

Figure 4.3 Gunnedah bus route map (Source: RDANI)

Pedestrian infrastructure within the centre of Gunnedah is well established, with paved footpaths provided on both sides of Conadilly Street between Wentworth Street and
Rosemary Street; and along Marquis Street from the CBD to the hospital, high school and TAFE.

In the residential areas on the southern side of the railway line, gravel footways are generally provided in New Street and View Street in the vicinity of the level crossing.

Four pedestrian crossings have been provided across the railway line in Gunnedah at the following locations:
- Abbott Street Bridge – grade separated with paved footpaths on both sides.
- New Street – at grade crossing with gravel footpath on east the side.
- Marquis Street – at grade crossing with paved footpaths on both sides.
- Carroll Street – at grade crossing with gravel footpath on the west side.

During traffic surveys in March 2013, the pedestrian crossing at Marquis Street was observed to be the busiest, with the following pedestrian counts observed over a seven day period:
- Abbott Street Bridge – 37 pedestrians (AM Peak) and 17 pedestrians (PM Peak).
- New Street – 5 pedestrians (AM Peak) and 11 pedestrians (PM Peak).
- Marquis Street – 40 pedestrians (AM Peak) and 19 pedestrians (PM Peak).

Pedestrian counts are illustrated in Figure 4.4 below.

Figure 4.4 Pedestrian traffic survey 19-26 March 2013 (Source: GTA)

4.5 Bicycle infrastructure

Figure 4.5 illustrates that there is currently no dedicated bicycle or shared path in the vicinity of the study area. However, a connected bicycle loop is proposed for the Gunnedah township that connects the existing bicycle tracks on the south side of the railway line with the Namoi River on the northern side of the tracks (see Figure 4.5 below).

GSC advises the completion of the link between Barker Street and the skate park on View Street has been deferred pending the location of the second road over rail bridge.
The View Street / New Street corridor is a key link to this proposed recreational bicycle trail.

**Figure 4.5** Existing and future Gunnedah bicycle network
(Source: Gunnedah Shire Council)
5 Existing environment and constraints

5.1 Landscape and urban character

This section summarises the landscape and visual constraints that are associated with a second grade separated crossing of the railway line.

5.1.1 Landscape context

The landscape setting of the study area is defined by the following three key elements shown in Figure 5.1:

- Pensioners Hill.
- Floodplain.
- Township.

![Figure 5.1 Gunnedah landscape setting (Source: KI Studio)](image)

**Pensioners Hill**

Pensioners Hill rises sharply above the town and defines the western edge of the township. Panoramic views are attained from the Hill top look out area over the town and beyond.

**Floodplain**

The floodplain forms a distinctive, strong green lush cordon along the western edge of town that highly contrasts with the otherwise relatively semi-arid landscape.

**Township**
The township is characterised by low built form elements from which a few vertical buildings protrude. This is further emphasised by the flat and low lying topography of the town.

The intersection of New Street and Oxley Highway create a gateway setting as the entry point into town from the southwest. This entry point is defined by a roundabout directly adjacent to the floodplain, and has a strong visual and spatial relationship with the two vertical built form elements, the Gunnedah Maize Mill and the silos.

This visual relationship is considered significant as it interfaces with both the floodplain and township and provides a strong sense of arrival that partly defines the impression of the town.

**Streets**

The following streets are considered to have a strong presence in the vicinity of the study area.

- Kamilaroi Highway / Conadilly Street as the main street through the CBD.
- Oxley Highway / Mullaley Road / South Street.
- View Street / Wandobah Road.
- Railway Avenue.
- Warrabungle Street.

5.1.2 Visual and spatial

The following key spatial and visual elements have been identified within and around the study area.

**Pensioners Hill**

Pensioners Hill provides a strong backdrop for the township and is a significant landform that visually contains the western edge of the town.

**Streetscapes**

There are three significant streetscapes in the vicinity of the study area:

- Railway Parade has a unique character due to its planted median with date palms.
- South Street, together with the railway corridor, defines the southern edge of the town centre. Its strong rows of trees create a legible marker that reflects the town’s structure.
- The portion of the Kamilaroi Highway within the CBD provides a strong sense of identity for Gunnedah.

**Buffer zones**

The floodplain, combined with Wandobah Reserve and the Showground create an extensive buffer zone that articulates the northern from the southern side of town. This buffer zone accentuates the entry point into town. A proposed sensitive buffer zone has been identified that is considered critical for the development and identification of options. This zone incorporates the floodplain, Gunnedah Maize Mill, silos, Railway Avenue and parts of South Street / View Street.
Built form

The following built form elements have a dominant presence due to the vertical character to act as navigating tools, enhancing the legibility and way-finding within the town centre.

- The town hall.
- The silos.
- The Gunnedah Maize Mill.

![Key visual and spatial elements in the study area (Source: KI Studio)](image)

**Figure 5.2** Key visual and spatial elements in the study area (Source: KI Studio)

5.2 Planning and zoning

This section summarises the land use and planning requirements that apply to the selection of a preferred second grade separated crossing of the railway line at Gunnedah. The complete technical paper is located in Appendix D.

5.2.1 Planning controls framework

The current Gunnedah second road over rail bridge project is defined as an ‘activity’ under Section 110, Part 5 of the *Environmental Planning and Assessment Act 1979* (EPA Act).

As such, the project will be assessed under Part 5 of the EPA Act. The level of the project’s impact on sensitive environmental features will determine the level of environmental assessment required. A Review of Environmental Factors (REF), Environmental Impact Statement (EIS) or Species Impact Statement (SIS) may
therefore be required. The project will also require an approval under Section 112 from the determining authority which in this case is also the proponent of the activity.

As part of the environmental assessment under Part 5 of the EPA Act, the project may require consideration of, and approvals, permits and licenses under other State environmental legislation. The relevant legislation is summarised in Table 5.1 below.

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Responsible Authority</th>
<th>Aspect of Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisheries Management Act 1994</td>
<td>Minister for Primary Industries (Fisheries NSW, Department of Primary Industries)</td>
<td>Conserve biological diversity of fish and marine vegetation and promote ecologically sustainable development and activities. Permits for dredging or reclamation and any waterway barrier works or weirs.</td>
</tr>
<tr>
<td>Native Vegetation Act 2003</td>
<td>Local Catchment Management Authority (Namoi CMA) and the Minister for Environment and Heritage (Office for Environment and Heritage)</td>
<td>Permits for clearing of native vegetation. Section 25 exemptions apply to this project</td>
</tr>
<tr>
<td>Threatened Species Conservation Act 1995</td>
<td>Minister for the Environment and Heritage (NSW EPA)</td>
<td>7 Part test and license to interfere with threatened species, populations and ecological communities.</td>
</tr>
<tr>
<td>Water Management Act 2000</td>
<td>Minister for Water, (Office of Water, Department of Primary Industries)</td>
<td>To protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality.</td>
</tr>
</tbody>
</table>
5.2.2 Commonwealth legislative framework

The following two Commonwealth legislations apply to this project:
- Commonwealth Native Title Act 1993.

Under the EPBC Act, an action will require approval from the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) if the action has, will have, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES).

Further technical ecological studies may identify impacts to MNES which may require referral and approval under the Commonwealth EPBC Act. Section 5.6 of this report discusses the current ecological assessment in further detail.

The Commonwealth Native Title Act 1993 provides recognition for the rights and interests over land and water by Australian Indigenous people under traditional laws and customs. A search of the National Native Title Tribunal registers undertaken as part of the Indigenous heritage constraints (refer to Section 5.5) analysis will identify if there are any current registered claims or any determined claims of native title over the Project area.

Given the extent of public lands and the presence of leasehold lands in the study area, Native title may still exist over parts of the study area.
5.2.3 Relevant State Environmental Planning Policies

The following three State Environmental Planning Policies apply to this project:

- State Environmental Planning Policy (infrastructure) 2007 (Infrastructure SEPP).
- State Environmental Planning Policy No.44 Koala habitat protection (SEPP No. 44).
- State Environmental Planning Policy Rural Lands 2008 (Rural Lands SEPP).

The Infrastructure SEPP provides a consistent planning regime for infrastructure and the provision of services across NSW. It allows greater flexibility in locating key infrastructure and facilities. Clause 94 of this policy applies to this project and allows development of road infrastructure facilities on behalf of a public authority without consent on any land.

SEPP No. 44 encourages conservation and management of natural vegetation areas that provide habitat for koalas to ensure free-living populations are maintained over their present range. This policy applies to 107 local government areas, however, does not apply to this project as local government consent and approval is not required for works to proceed.

The Rural Lands SEPP aims to facilitate the orderly and economic use and development of rural lands for rural and related purposes. This policy applies to the Gunnedah local government area and sets out several planning principles to be considered as part of the progression and development of options for assessment.

5.2.4 Local planning instruments

The Gunnedah Local Environmental Plan 2012 is the relevant planning scheme for the project study area. The land use zoning and relevant local policies are of interest to development principles but the project will not be determined by Council under this local planning instrument.

Land use zoning and development

The project study area is comprised of the following land use zones:

- B5 Business Development.
- SP2 Infrastructure.
- IN1 General Industrial.
- RE1 Public Recreation.
- RU1 Primary Production.

Within all of these zones, development for the purpose of constructing roads is ‘permitted without consent’, with the exception of SP2, which would typically require consent.

However, the provisions of the Infrastructure SEPP outlined in Section 5.2.3 allow activities on behalf of government authorities outside the determination of Council.

5.2.5 NSW regional infrastructure policies and directives

The following two NSW Regional Infrastructure policies and directives are relevant to this project:

- NSW 2021: A plan to make NSW number one (NSW 2012 plan).
- NSW long term transport master plan.

The NSW 2012 plan is a strategy document aimed at moving the state forward over the next 10 years. Its goals relevant to transport are to reduce travel times, grow patronage...
on public transport by making it a more attractive choice and to improve road safety. The NSW long term master plan aims to address key transport challenges that face NSW over the next 20 years and puts the customer at the centre of everything NSW does with respect to transport planning. This project is directly referenced in this plan as part of the ‘Bridges for the Bush’ program.

5.3 Socio-economic constraints

This section summarises the social and economic constraints that apply to the selection of a preferred second grade separated crossing of the railway line at Gunnedah. The complete technical paper is located in Appendix E.

The socio-economic background profile and analysis provided forms Stage 1 of a future full social impact assessment, which will occur in later stages of the project.

5.3.1 Social

The profile of the existing social environment in Gunnedah is based on review and assessment of several data sources, including the following:

- Publically available GSC reports and website information.
- Desktop study of aerial photography, maps and other sources.
- Demographic data from the Australian Bureau of Statistics (ABS) 2011 Census.
- Feedback from the initial consultation with community and businesses in December 2012.
- Consultation with GSC.

Population characteristics

The following key elements of Gunnedah’s demographic profile are summarised below:

- In 2011, the Gunnedah Local Government Area (LGA) had a total population of 12,066 with the following age breakdown:
  - 27.6% aged less than 20 years.
  - 16.1% aged between 20 – 34 years.
  - 25.5% aged between 35 – 54 years.
  - 30.4% aged over 55 years.
- The median age of the population is 40 years.
- The Gunnedah LGA has an indigenous population of 11.3% which is significantly higher than the NSW average of 2.5%. Contrastingly, only 11.8% of the population were born overseas, which is significantly lower than the NSW average of 31.4%.

Population growth

The population in Gunnedah has risen naturally by approximately 5% between Census measurements in 2006 and 2011. However, a large portion of the population is beginning to enter the later stages of life.

The Gunnedah Community Strategic Plan 2012-2022 highlights that retention of younger people within the shire is a key issue, with job shortages contributing to their desire to leave the region and seek opportunities elsewhere.

Public transport usage

Public transport usage rates are very low in the Gunnedah LGA. This is reflected in the low number of services provided each day.
Approximately 0.4% of the population take public transport to or from work, which is significantly below the NSW average of 13.8%. Contrastingly, 5.2% of the population walk to work, which is above the NSW average of 4.1%.

**Housing**

Gunnedah is generally characterised by low density, detached housing, which makes up 90.2% of the total dwellings in the local government area.

Approximately 72.5% of the population live in a multiple person household, whereas 27.5% live in a single person household, slightly above the NSW average of 24.2%.

Of the 4,487 dwellings in the Gunnedah LGA, 37.9% are fully owned, 28.4% are being purchased and 29.8% are rented.

A key issue for the community is a shortage of affordable and accessible housing for all types of incomes and families. This need has been identified in the Gunnedah Council Community Strategic Plan 2012-2022 to facilitate population growth, retention of younger generations and to provide an improvement in accessibility to essential services and aged care for the older generations.

**Key community facilities, services and events**

There are several educational, health and recreational facilities located within the Gunnedah LGA. Key facilities within the vicinity of the study area likely to be most impacted by the project are discussed below.

The Gunnedah Showground area is managed by the Gunnedah Show Society and GSC and includes a number of facilities, including the Longmuir Fields, Kennel Club and the showgrounds themselves.

The Gunnedah Show has been at its present location since 1888 and is celebrating 125 years in 2013. Events are held regularly at the showground and 28 user groups from the Gunnedah community utilise the facilities.

Wandobah Reserve is a publically accessible park located in the south-east corner of the study area and is home to Gunnedah’s skate park.

**Community values**

The following key community values have been identified as part of previous consultation works:

- A strong sense of belonging within local neighbourhoods.
- Concern regarding the adequacy of existing infrastructure to support development.
- Desire for progress and development and the management and maintenance of infrastructure.
- Improved traffic flows and safe access for pedestrians and cyclists using local roads.
- Access to community facilities, including childcare, preschool, aged care and health services.
- A high level of satisfaction with trees in neighbourhoods in the Gunnedah township, however, noting the desire for more trees and more methods to improve waterway quality.
- The highest use of sporting facilities, neighbourhood parks and recreational areas are for those located within the Gunnedah township.
5.3.2 Economic

Business activity

The township of Gunnedah is where the majority of retail, commercial and manufacturing businesses is located within the Shire, with the key industries that contribute to the local and regional economy being agricultural, coal mining and a growing industry of coal seam gas exploration.

The majority of commercial businesses are situated within a few blocks of Conadilly Street, which passes into the study area.

An established light industrial area is also located adjacent to the study area on Farrar Road, and includes a range of businesses such as the following:

- self storage.
- gardening and maintenance.
- mining services.
- electrical services.
- manufacturing products.
- engineering services.
- furniture sales.

Employment, labour force and income

Employment rates within the Gunnedah LGA are consistent with averages across NSW. Approximately 59.8% of people are engaged in full time employment, 28.8% are engaged in part time employment and 6.0% are unemployed.

There is a shortage of local jobs within Gunnedah Shire, as there are 5,226 working residents compared to only 4,635 local jobs. This means approximately 11% of the population do not work within the LGA.

Economic values and trends

Key economic values and trends derived through local and regional strategic plans include the following:

- Encouraging economic growth in the Shire of Gunnedah is a key aim of Council in order to create a diverse economic base and to support the growing and aging population.
- Growth is required in health and aged care services, retail and commercial sectors as well as being planned in tourism.
- There is a regional skills shortage, particularly in professional areas.
- There is a labour surplus in areas such as drivers and operators, labourers and technicians, which are jobs typically undertaken by younger people under 25.
- The agricultural industry is experiencing a declining labour force, while the mining industry is increasing.

5.3.3 Key project socio-economic issues

The following social and economic issues are relevant to the study area and will be considered as part of the next stage of the project, to ensure that appropriate mitigation measures are developed to minimise potential impacts.

- Access and passing trade to businesses within the local area. This is particularly relevant to the Gunnedah Maize Mill, Hope’s Fuel Supplies and others nearby within the study area.
• Property values, including influences from aesthetics and visual impacts.
• Direct property impacts, such as loss of housing through acquisitions and changes to local hydrology.
• Amenity based impacts on the community, residences and businesses relating to noise and air quality during both construction and operation.
• Existing and planned bus and cyclist routes which pass through the study area.
• Pedestrian movements, particularly the needs of the elderly and disabled.
• Journey to work movements, models and routes through the study area.
• Indirect impacts on the local road network and community within Gunnedah township as a result of increased heavy vehicle traffic.
• Vegetation and modification of waterways, in accordance with the principles of Ecological Sustainable Development.

The likelihood and severity of these potential impacts will be dependent upon the preferred option chosen. By assessing and considering each of the potential environmental and community impacts further during the next stage of the project, any anticipated negative impacts are unlikely to be significant and the project would expect to result in an overall positive benefit to the township of Gunnedah.

5.4 Indigenous heritage

This section summarises the preliminary desktop and field investigations and assessment of potential items of Indigenous heritage significance in the vicinity of the study area.

Desktop assessment

Initially, a desktop assessment was undertaken of the relevant heritage databases covering the study area in order to identify any potential issues. The results of the desktop assessment are shown below in Table 5.2.

<table>
<thead>
<tr>
<th>Name of Database Searched</th>
<th>Date of Search</th>
<th>Type of Search</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Heritage Database</td>
<td>05.04.2013</td>
<td>Gunnedah NSW</td>
<td>No places on the search are within the study area</td>
</tr>
<tr>
<td>NSW Heritage Office State Heritage Register and State Heritage Inventory</td>
<td>05.04.2013</td>
<td>Gunnedah LGA</td>
<td>One place (Meggitt Ltd Flour Mill) is within the study area.</td>
</tr>
<tr>
<td>National Native Title Claims Search</td>
<td>05.04.2013</td>
<td>Gunnedah LGA</td>
<td>Native Title Claim of the Gomeroi People (Tribunal File No: NC2011/006) currently covers a large portion of north-western NSW, including the township of Gunnedah.</td>
</tr>
<tr>
<td>Source Description</td>
<td>Date</td>
<td>Coordinates</td>
<td>Findings</td>
</tr>
<tr>
<td>--------------------</td>
<td>------</td>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td>Department of Sustainability, Environment, Water, Population and Communities (SEWPC) Protected Matters (EPBC Act) Database; <a href="http://www.environment.gov.au/erin/ert/epbc/index.html">http://www.environment.gov.au/erin/ert/epbc/index.html</a></td>
<td>05.04.2013</td>
<td>Gunnedah LGA</td>
<td>None of the Aboriginal places on the RNE occur near the study area.</td>
</tr>
<tr>
<td>Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS)</td>
<td>05-09-2012</td>
<td>Lat, Long From : 150.218, -31.00145 - Lat, Long To : -30.96434, 150.27997 with a Buffer of 1000 metres centred on the study area</td>
<td>21 AHIMS sites within the search area (Refer to Appendix H)</td>
</tr>
<tr>
<td>Local Environment Plan</td>
<td>05.04.2013</td>
<td>Gunnedah LEP of 2012</td>
<td>One place (Meggitt Ltd Flour Mill) listed in Schedule 5 of the LEP is within the study area.</td>
</tr>
<tr>
<td>S170 RTA Heritage and Conservation Register <a href="http://www.rta.nsw.gov.au/environment/heritage/heritageconservreg/index.html?elid=2">http://www.rta.nsw.gov.au/environment/heritage/heritageconservreg/index.html?elid=2</a></td>
<td>05.04.2013</td>
<td>Northern Region</td>
<td>No places on the search are within the study area</td>
</tr>
</tbody>
</table>

Of the 21 sites identified within an approximate 10 square km area centred on the study area, none fell within 3 km radius from the centre of the study area. An assessment of the landscape context, including existing disturbance, presence of remnant vegetation and proximity of waterways are relevant to assist in the likely potential to identify items not previously discovered.

The study area has been heavily impacted by previous agricultural use and urban development for roads, rail line and flood management. This, combined with the extensive clearing of native vegetation and the present ground cover of regularly mown grasses, result in a low potential for the discovery of intact Indigenous sites within the study area. From the initial desktop assessment and predictive model developed a range of potential indigenous sites were highlighted:

- Open sites, close to permanent / temporary water.
- Isolated finds.
- Scarred or carved trees.
- Grinding grooves in sandstone rock.
The location identified during the desktop assessment as the area with highest potential for the discovery of archaeological items, was near the Gunnedah Showground.

As noted in Table 5.2, a Native Title Claim by the Gomeroi People exists over the Gunnedah LGA and the entire study area. This will be investigated further once a concept design has been selected and the project footprint is known.

Field investigations

A detailed ground-truthing exercise in accordance with the current OEH guidelines was undertaken which did not identify any sites of Indigenous significance present within the study area. The area near the Gunnedah showground was assessed to be low lying and subject to inundation pre-history, resulting in it being unsuitable for European occupation, which has led to its substantial modification. Thus the survey also identified that no area within the study area is likely to contain undetected Indigenous sites and objects.

Further archaeologist assessment is not required and as such Indigenous heritage presents no constraint to the proposed works. Management measures for the protection of unidentified objects during construction will be developed in later stages of the project and a clearance letter for the project has been prepared.

5.5 Non-indigenous heritage

This section summarises the preliminary desktop investigations and a site assessment of potential items of non-Indigenous heritage significance in the vicinity of the study area.

A desktop assessment using heritage databases was undertaken to identify any items or places of potential non-indigenous heritage significance within the study area as shown in Table 5.2.

A search of the Australian Heritage Database revealed eight items of heritage within the Gunnedah area; however, none are located within the study area.

A search of the State Heritage Register and Inventory revealed one item of State listed heritage significance within the Gunnedah LGA; however, this was not located within the study area. A further 32 sites were listed on the Inventory, of which the Gunnedah Maize Mill is listed due to it being on the GSC LEP 2012.

Review of databases and information supplied indicates the primary item of non-Indigenous heritage significance relevant to the current project is the (formerly Bruntons) Gunnedah Maize Mill. It is listed on the Gunnedah LEP 2012 as ‘Meggitts Flour Mill’. A previous heritage assessment was undertaken by NSW Public Works (DPWS) in 2012. The investigation undertaken as part of this constraints analysis sought to expand on the previously unassessed aspects.

The site inspection in March 2013 identified that the Mill and the grounds are the only heritage places within the study area. Two additional features (which were not previously inspected in 2012) within the mill precinct were inspected; the interior of the Mill building and a brick spoon drain within the mill grounds.

Based on the site inspection and photographic evidence in reference to the location of the closest preliminary options, the assessment concluded that there is no
archaeological potential for the survival of structural remains or cultural deposits relating to the former Mill in the north western corner of the site.

The newly identified drain feature has been assessed as having no heritage significance based on its date and not being part of the original Mill complex, regardless of its location within the curtilage of the Mill. The heritage assessment also concluded that subsequent to the inspection of the interior of the mill, the Gunnedah Maize Mill does not meet State Heritage criteria for state heritage listing. Thus none of the preliminary options would require a Section 140 excavation permit application to the Heritage Council.

Any option to develop a road over rail bridge in proximity to the Mill site will impact on significant views to the heritage item and therefore the preferred option should consider retaining screening trees and open space to the west of the Mill, avoid hard edges and provide sympathetic landscaping (as recommended in DPWS 2012).

The preferred option should aim to conserve the heritage values of the mill by retaining as much of the historic curtilage as possible and considering the bulk and footprint of the proposed structure. Consultation would be required with GSC and further assessment in the form of a Statement of Heritage Impact (SoHI) would be required once the preferred option is determined.

![Image of Gunnedah Maize Mill]

**Figure 5.3 Gunnedah Maize Mill**

### 5.6 Ecology

This section summarises the preliminary desktop and field investigations undertaken by OzArk EHM Pty Ltd between January and April 2013 to identify potential ecological constraints within the study area. The investigations are ongoing, with a full technical paper to be provided in the next phase of the project.

A preliminary desktop investigation was undertaken utilising searches of a number of key resources as per in Table 5.3 and aerial photography interpretation of the study area and surrounds.

These resources were used to determine the likely threatened flora, fauna and ecological communities present within the study area. This initial assessment forms was the basis of the preliminary field investigations undertaken to verify the potential constraints in the study area.
The likelihood of occurrence of threatened flora, fauna and Endangered Ecological Communities (EEC) is assessed in Section 5.6.3 and the desktop database search results of salient resources are summarised in Table 5.3 below.

**Table 5.3: Summary of desktop database search results.**

<table>
<thead>
<tr>
<th>Name of database searched</th>
<th>Date of search</th>
<th>Type of search</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSEWPaC Register of Critical Habitat</td>
<td>24.2.13</td>
<td>National search: Register of Critical Habitat</td>
<td>Critical Habitat as classified by DSEWPaC does not occur in the study area</td>
</tr>
<tr>
<td>NSW Wildlife Atlas. Data License agreement</td>
<td>24.2.13</td>
<td>Search criteria : Public report of all valid records of threatened (listed on TSC Act), Commonwealth listed, CAMBA listed, JAMBA listed or RoKAMBA listed entities in Gunnedah LGA</td>
<td>Search returned a total of 1,089 records of 147 species. The Koala, Blue-lobed Grass and the Spotted-tailed Quoll have been recorded within a one kilometre radius of the study area.</td>
</tr>
<tr>
<td>Department of Primary Industries Noxious Weeds Database <a href="http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed">http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed</a></td>
<td>24.2.13</td>
<td>Gunnedah LGA</td>
<td>The NSW DPI lists approximately 100 Noxious Weeds in the Gunnedah LGA. Any listed weed has potential to be recorded in the study area.</td>
</tr>
<tr>
<td>NSW Legislation website: SEPP 44: Koala Habitat Protection <a href="http://www.legislation.nsw.gov.au/fragview/inforce/epi%2B5%2B1995%2Bcd%2B0%2BSEPP44">http://www.legislation.nsw.gov.au/fragview/inforce/epi%2B5%2B1995%2Bcd%2B0%2BSEPP44</a></td>
<td>24.2.13</td>
<td>Schedule 1: LGAs listed and Schedule 2: Feed Trees listed</td>
<td>SEPP 44 does not apply under Part 5 of the EP&amp;A Act (Refer to Section 5.2 of this report). The intention of SEPP44 has been considered. Gunnedah LGA is listed within Schedule 1 of this SEPP.</td>
</tr>
<tr>
<td>Office of Environment and Heritage (OEH) Key Threatening Processes. <a href="http://www.environment.nsw.gov.au/threatenedspecies/aboutKTPSinNSW.htm">http://www.environment.nsw.gov.au/threatenedspecies/aboutKTPSinNSW.htm</a></td>
<td>24.2.13</td>
<td>NSW Key Threatening processes website search</td>
<td>There are currently 37 key threatening processes listed under the TSC Act. Those relevant to the project will have mitigation measures recommended where required during the next investigation phase.</td>
</tr>
</tbody>
</table>
Office of Environment and Heritage (OEH) Koala regional or Sub Regional Corridors 29.4.13 NSW Koala regional and Sub Regional Corridors, Koala Plans of Management. There are no areas currently mapped as Koala wildlife corridors within the study area. Once the Gunnedah Koala Plan of Management has been publicly released corridors will be updated in future investigations.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) Key Threatened Processes http://www.environment.gov.au/biodiversity/threatened/ktp.html 24.2.13 EPBC Key Threatening processes website search There are currently 20 key threatening processes listed under the EPBC Act. Those relevant to the project will have mitigation measures recommended where required during the next investigation phase.

Bird Life Australia (Important Bird Areas [IBA]) http://www.birdlife.org/datazone/site/search 24.2.13 Map search of IBA regions for Australia No IBAs occur in or are nearby to the study area.

Atlas of Living Australia http://biocache.ala.org.au/explorer/your-area?lat=33.11077814509428&lon=148.41198754223212&taxon=Amphibians 24.2.13 Centered on the Project Site with a one kilometre radius Two threatened species are listed as occurring: Lobed Bluegrass (Bothriochloa biloba) is immediately found (within 200 meters) of the study area. Koala (Phascolarctos cinereus), seven records in the study area, 49 within one kilometre and 188 records on the NSW Wildlife Atlas database within the locality (10 kilometre square radius).

Department of Primary Industries Fisheries Database 24.2.13 Gunnedah LGA Search returned 9 recordings of catfish within Namoi River (not within study area).

Further to this initial assessment, relevant Commonwealth and State resources were consulted namely the NSW Recovery Plan for the Koala (Phascolarctos cinereus) (DECC 2008), the Interim Koala referral advice for proponents (DSEWPaC 2012) and the National Koala Conservation and Management Strategy 2009-2014 (NRMMC2009) to provide preliminary guidance for the next phase of investigations. The Gunnedah Koala Plan of Management, which is currently under review by GSC, will also be consulted when publically available as part of the next phase of investigations.

5.6.1 Study area

The study area for the project is discussed earlier in this report. For the purposes of the ecological investigations, a wider area is required to identify constraints which may be present in the study area transiently, such as Migratory or Terrestrial Fauna species. This wider area is reflected in the search parameters in Table 5.3 and as discussed in Section 5.6.3.

Prior to European disturbance the vegetation in the study area would have been consistent with the vegetation of the Liverpool Alluvial Plains landscape (OEH 2012). This landscape was comprised of open grasslands; Plains Grass (Austrostipa aristiglumis), Panicum sp., Windmill Grass (Chloris truncata) and Blue Grass (Dichanthium sericeum) on black earths with occasional Myall (Acacia pendula), White Box (Eucalyptus albens), Yellow Box (Eucalyptus melliodora), Bimble Box (Eucalyptus populnea) and Wilga (Geijera parviflora). River Red Rum (Eucalyptus camaldulensis) which is associated with the Namoi River (OEH 2012).
In general, the study area has been extensively modified through vegetation clearing and drainage works for urban purposes and has been disturbed from its natural state by weed encroachment, replanting and development. Blackjack Creek, an ephemeral creek, with intermittent flows from urban stormwater, traverses the study area. No groundwater dependant ecosystems have been identified within the study area, following NSW DPI Risk assessment guidelines for groundwater dependant ecosystems.

During the preliminary investigations undertaken to date, ‘Core Koala Habitat’ has not been positively identified in the study area, however, habitat as classified within the SEPP 44 definition is located in the region broadly, as breeding females have been recorded in the Gunnedah Township and recent sightings and evidence of Koala presence generally has been recorded (DECC 2008). Under the SEPP 44 definition, an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population. Further investigations will be undertaken once the Gunnedah Koala Plan of Management has been finalised, as part of the next phase of the project.

However, as noted earlier in this report, SEPP44 does not strictly apply to the project and as the Koala is both a state (TSC Act) and nationally (EPBC Act) listed Threatened Species, it is pertinent to also consider the Commonwealth advice. The federal interim koala referral advice for proponents (DSEWPaC 2012) was also consulted and the preliminary investigations indicate that the Koala habitat in the study area is likely to be ‘Habitat Critical to the survival of the listed species’ as per the advice. Further assessment against this advice will be undertaken during the next phase of the project to confirm this.

5.6.2 Existing environment and constraints

In order to describe the ecological constraints of the study area in more detail for the purposes of this assessment, it has been divided into six vegetation areas as shown in Figure 5.4. The vegetation was also classified into descriptions in accordance with the OEH BioMetric vegetation types and correlated with threatened ecological communities listed under the TSC Act and the EPBC Act.

The descriptions of the six vegetation areas surveyed together with the constraints within each area are as follows:
Area 1 - Wandobah reserve and the Gunnedah showground

Description
This area is characterised by cleared exotic grassland and a channel section of Blackjack Creek. Where trees occur within Wandobah Reserve, they were planted in the late 1980s to early 1990s and consist of a mixture of native and exotic trees. Approximately 35 trees within the Gunnedah Showground and along View Street are part of old growth remnants. The predominant remnant species is the Bimble/Poplar Box (Eucalyptus populnea subs. populnea).

The understory vegetation, where present in this area, is predominately exotic. The area has been extensively modified for drainage and development and disturbed by weed encroachment, rubbish dumping and mowing.

The vegetation is consistent with the Biometric Vegetation ID NA185 ‘Poplar Box grassy woodland on alluvial heavy clay soils in the Brigalow Belt South Bioregion (Benson 101)’ and is in a degraded state.

No ground water dependent ecosystems were identified within the study area following NSW DPI Risk assessment guidelines for groundwater dependent ecosystems (May 2012). No TSC Act Endangered Ecological communities (EEC) or EPBC Act listed Threatened Ecological Communities (TEC) were identified within Area 1.

Constraints

Vegetation constraints - Biometric Vegetation ID NA185 ‘Poplar Box grassy woodland on alluvial heavy clay soils in the Brigalow Belt South Bioregion (Benson 101)’ is in a degraded state.

There are no further TSC or EPBC Act vegetation constraints associated with Area 1.

Fauna constraints - Vegetation in this area, in particular, in Wandobah Reserve is considered to provide interconnecting habitat with Koala habitat elsewhere in Gunnedah and environs and provides a movement corridor or intermittent habitat for fauna generally as shown on Figure 5.5 and discussed further in Section 5.6.3. Poplar Box is a listed feed tree on SEPP44, removal of the trees would remove fodder and resisting habitat for the species.

Stags, cracks and fissures in dead trees and limbs, as well as, hollows in the old growth trees are assumed to be habitat for threatened microbats. It is not considered that listed arboreal reptiles would be recorded in this area, whilst it is possible that listed hollow dependent birds have potential to utilise tree hollows in the area for breeding it is considered ‘unlikely’.

Removal of old growth hollow bearing trees within Gunnedah Showground may reduce habitat for hollow dependant fauna. Mature trees in this area provide roosting habitat for medium-sized parrots, marsupials and owls. No listed owl breeding habitat has been identified in Area 1.
**Area 2 - North of the Oxley highway, west of View Street, south of the rail line**

**Description**

This area contains approximately 100 trees, predominately Yellow Box (*Eucalyptus melliodora*). The Blackjack Creek area predominately contains Eucalypts, planted in the late 1980s to early 1990s. More mature trees Yellow Box (*Eucalyptus melliodora*), planted 40 to 50 years ago are found on the western edge of Blackjack Creek, adjacent to the Farrar Road industrial properties. None of the trees in this area were identified as hollow bearing or possessed stags suitable for fauna habitat. The area has been extensively modified and does not contain any old growth vegetation.

The ground layer surveyed consisted primarily of exotic species and the banks of Blackjack Creek have been heavily sculpted, with no aquatic communities present, apart from the aquatic plant *Typha* (commonly known as Bulrush or Cumbungi). No ground water Dependent Ecological communities were identified in this area, however, one TSC Act EEC, the **White Box - Yellow Box - Blakely’s Red Gum Grassy Woodland** has been identified. No EPBC Act TECs were identified.

The vegetation most closely resembles the Biometric Vegetation ID NA239 ‘Yellow Box woodland on sandy loam soils on alluvial plains mainly in the Darling Riverine Plain Bioregion (Benson 83)’, as the ground layers are in a degraded state.

**Constraints**

**Vegetation constraints** - The community as shown on Figure 5.4 below, can be classified as an EEC under the NSW TSC Act. This community despite being planted meets the definitions of the in the NSW Scientific Committee Final Determination for **White Box - Yellow Box - Blakely’s Red Gum Grassy Woodland.**
Figure 5.4 – Study area vegetation areas
**Fauna constraints** - Vegetation provides connectivity for Koalas along Blackjack Creek to the Namoi River as shown on Figure 5.5. This connectivity is related to the vegetation in Wandobah Reserve (Area 1) and it is likely that Koala's use both areas to travel through to access mature feeding habitat in other areas. Vegetation in Area 2 is not considered suitable long-term term habitat for Koalas to rest, as the majority of the trees are young (circa 20 to 30 years) and the animals could easily be disturbed.

**Area 3 - North of the Oxley highway, east of View street south of the rail line**

**Description**

This area forms part of the ARTC rail yards. A row of young planted Eucalypts trees were observed from a distance as well as exotic grasses and weeds within the area. The area is not considered to fall within the classification of any BioMetric vegetation ID.

**Constraints**

*Vegetation constraints* - There are no notable constraints relating to vegetation within this area as habitat for listed species, populations or communities have not been identified. No ground water dependant ecosystems TSC Act EECs or EPEC Act TECs were identified within Area 3.

*Fauna constraints* – There are no notable constraints relating to fauna within Area 3 as habitat for listed species, populations or communities have not been identified.

**Area 4 - North of the rail line either side of Blackjack Creek and Gunnedah Maize Mill**

**Description**

This area contains approximately 40 planted predominately exotic trees behind houses along Warrabungle Street, noted to be approximately 30 to 40 years old. The area has been extensively modified, cleared and disturbed by development, the presence of weeds and dumping of rubbish. The area is not considered to fall within the classification of any BioMetric vegetation ID. No aquatic species or communities are present, other than the aquatic plant Typha. No ground water dependant ecosystems or EECs were identified within the Area 4.

**Constraints**

*Vegetation constraints* - There are no notable constraints relating to vegetation within this area as habitat for listed species, populations or communities have not been identified. No ground water dependant ecosystems, TSC Act EECs or EPEC Act TECs were identified within Area 4.

*Fauna constraints* – The open ground and isolated trees in Area 4 provide connectivity for Koalas along Blackjack Creek to the Namoi River from Areas 1 and 2.
Areas 5 and 6 - Two urban areas

The vegetation present in these two areas includes planted street and garden trees and shrubs. The areas are not considered to fall within the classification of any BioMetric vegetation ID.

Constraints

Vegetation constraints - There are no notable constraints relating to vegetation within this area as habitat for listed species, populations or communities have not been identified. No ground water dependant ecosystems, TSC Act EECs or EPEC Act TECs were identified within Area 5 and 6.

Fauna constraints – There are no notable constraints relating to fauna within Area 5 and 6 as habitat for listed species, populations or communities have not been identified.

5.6.3 Ecological constraints corridor

The ecological constraints corridor identified for the study area is based on the preliminary investigations and is shaded in pink on Figure 5.4. Concept options which pass through this area in general would require further investigation and assessment of impacts under the TSC Act and EPBC Act.

The identified constraints are mainly associated with the EPBC Act and TSC Act listed Koala and discussed in more detail below.

Fauna species

A total of 40 terrestrial fauna species were identified during the field survey. This included 34 bird species (four introduced), three mammal species (one introduced) and three reptile species. Of these species, one threatened species, the Koala (*Phascolarctos cinereus*) was identified through visual assessment and observation of scats under approximately one in ten trees in Areas 1 and 2 (Spot Assessment Technique (SAT)). AnaBat detection was undertaken and no threatened microbats were recorded along the drainage lines existing culverts. Threatened microbats were assumed to be present in Area 1 (Gunnedah Showground) in mature Poplar Box due to suitable habitat.

No amphibians were heard calling or detected in Blackjack Creek. This waterway has recognized salinity issues, this combined with levels disturbance and unsuitable habitat limits potential for listed frogs to be recorded.

Koalas

In general, Koalas have a preference to move along drainage lines and within vegetated areas (DECC 2008). Koalas feed on a small number of primary and secondary trees, which are primarily eucalypts and these species vary on a local and regional scale (OEH 2012). Supplementary food trees may include other non-eucalypts, as an additional or seasonal food resource.

To assist in understanding the relationship of the Namoi Catchment Management Authority (CMA) Regional Vegetation Types (RVTs) to Koala Habitat (as shown in Figure 5.5), Koala Habitat can be considered in terms of primary, secondary and tertiary habitats (DECC 2008) and primary, secondary food trees and supplementary
trees, as defined for the 'Northern Tablelands Koala Management Area' in the NSW Recovery Plan for the Koala (OEH 2012).

The arrows shown on Figure 5.5 to the north and north-east of the study area, in thick black, represent movements within Primary Koala Habitat, along the Namoi River riparian vegetation corridor. The Namoi River provides important drought refuge for the species as it is dominated by a SEPP 44 feed tree species, the River Red Gum (*Eucalyptus camaldulensis*). It is a permanent water source and provides opportunities for the species to disperse along the rivers banks.

**Figure 5.5 Koala movement corridors**

Smaller black arrows on Figure 5.5 represent movements between Secondary Koala Habitat, where the areas mapped have feed tree species such as Poplar Box Grassy Woodlands and White Box Grassy Woodlands, both listed SEPP 44 feed tree species. The larger the area of vegetation mapped, the more important it becomes as habitat for the Koala. For example, the mapped areas of 'White Box - pine Silver-leaved Ironbark shrubby open forest' near the state forest to the south of the study area and to the south-west of the study area, represent areas in which the Koala may move to and from the Namoi River riparian vegetation corridor and to and from other State and local conservation reserves outlined in red on Figure 5.5. The study area is a pathway connecting Koalas to larger remnants. All vegetation communities mapped in Figure 5.5 are dominated by SEPP 44 Schedule 2 feed tree species, these remnants are also comprised of feed tree species in the *National Koala Conservation and Management*

Other areas shown on Figure 5.5 are mapped as 'Derived Grassland with Paddock Trees', are areas where there are paddock trees which are likely to be Secondary feed or supplementary tree species. Movement corridors are known to occur in these cleared landscapes, in order to move between other areas which comprise Primary or Secondary feed trees. Paddock trees are noted as 'habitat that is considered critical to the survival of the koala' under the Interim Koala Referral Guidelines for proponents (DSEWPaC 2012). The study area whilst mainly ‘urban’ possesses both paddock trees and remnant habitat too small to have been mapped by the CMA. However, this is yet to be further investigated and will require further assessed in relation to the project concept options during the next phase.

Land tenure is also an important consideration related to the management of Koala wildlife corridors. Reserves marked on Figure 5.5 are protected for the conservation of their natural resources. Local reserves form an important role linking the river through the study area to the Blackjack State Forest and other regional reserves south of the study area.

During the field survey of the study area, one Koala was recorded in a Bimble/Poplar Box Tree in Area 1, on the eastern side of View Street, near the Oxley Highway. Within Area 1 and 2 the field investigation found evidence of use of trees by Koalas, namely scratches on trees and scats. All scats found by SAT searches in the study area were old, with no fresh scats located. The scratches on trees were minimal indicating a low population density / usage of the study area in Area 2.

As noted above, the vegetation present in Area 1 and Area 2 predominately serves as a movement corridor for the Koala between areas of primary and higher quality secondary Koala habitat. Old growth trees in the Gunnedah Showground and along View Street provide suitable resting and foraging habitat. Koala evidence observed in Area 2 also supports the theory that a transient population only utilises the EEC as part of the movement corridor and opportunistic feeding (refer below).

The vegetation in Area 1 and 2 is relevant to the Koala as it provides places to rest and feed temporarily. At present there are no non-traversable barriers between these areas. Should a concept option be constructed within Area 1, 2 and 4, further detailed investigation would be required to determine the potential impacts upon the Koala and the habitat values present.

Other threatened fauna

Listed threatened microbats were not recorded during Anabat detection. As the survey effort to date was focussed on culverts / drainage lines other areas are yet to be assessed. Thus it has been assumed that threatened microbats are present in Gunnedah Showground in Area 1 within the old growth Poplar Box Trees. It was also noted during the survey that the dead trees in Area 1 provide potential habitat for arboreal reptiles but they are unlikely to occur due to its disturbance history and location within an urban area. Tree hollows suitable for hollow dependent birds were observed but none were considered as unlikely to provide breeding habitat for the regions listed species. To provide a higher degree of confidence, further investigation to confirm the presence of these species and potential impacts would be undertaken in
later stages of the ecological investigations should a concept option be selected that potentially impacts upon the old growth trees in Area 1.

Endangered Ecological Communities (EECs)

Of the vegetation surveyed in Area 2, 0.9 hectares in three areas (0.1, 0.3 and 0.5 ha) of planted vegetation can be classified as part of the TSC Act listed *White Box – Yellow Box – Blakely’s Red Gum Endangered Ecological Community* in ‘Low Condition’. However, the community does not meet the listing criteria for the EPBC Act listed *White Box – Yellow Box – Blakely’s Red Gum Endangered Ecological Community and Derived Native Grasslands*, as the continuous area containing the ecological community (that is, the patch in the study area surveyed) does not have a predominately native understory.

A concept option within the study area located in Area 2, potentially impacting upon the vegetation mapped as *White Box – Yellow Box – Blakely’s Red Gum EEC*, would require further ecological assessment in the form of a seven-part test of significance (as per Section 5A of the EP&A Act), to assess the significance of the activity upon the EEC.

Flora species

A total of 94 flora species were identified during the field survey, including six species of listed Noxious Weeds. One Weed of National Significance on the DSEWPaC federal list, the *African Boxthorn*, was identified in the study area. While Noxious Weeds do not pose a constraint in the study area, they will require management during the construction of the project.

The field investigation did not identify any threatened flora species nor any potential habitat for threatened flora species under the TSC or EPBC Acts. It is unlikely that habitat for these species would occur due to historical and present disturbance from slashing, clearing and exotic species, thus they do not pose a constraint within the study area.

5.6.4 Conclusion

The ecological constraints corridor identified in the study area is shown in Figure 5.4. Should a concept option be selected within the ecological constraints corridor, further survey and assessment would be required under the TSC and/or EPBC Acts to assess the potential impacts of the project on:

- **Area 1**
  - Koala movement corridors
  - Koala feed and resting habitat in the old growth trees in the Gunnedah Showground and along View Street
  - Any Threatened Fauna present in the old growth Bimble/Poplar Box trees and dead trees in the Gunnedah Showground and along View Street.

- **Area 2**
  - The mapped presence of the TSC Act listed EEC, *White Box – Yellow Box – Blakely’s Red Gum Endangered Ecological Community*
  - Koala movement corridor and temporary resting habitat.

- **Area 4**
  - Koala movement corridors.
5.7 Flooding

The desktop study has been undertaken to identify existing flooding conditions and constraints in the vicinity of the study area. The following data has been used as the basis for this assessment:

- Gunnedah Local Environmental Plan 2012 flood extents map.
- Blackjack Creek Flood Study completed by Lyall & Associates Consulting Engineers in 2005.

Figure 5.6 below illustrates the approximate extent of the 100 year ARI flood event within the study area.

![100 year ARI flood extents in study area](image)

**Figure 5.6** 100 year ARI flood extents in study area

5.7.1 Existing flooding conditions

The Blackjack Creek drains runoff from a catchment area of approximately 24 km² to the Oxley Highway over a length of 8 km between the upper reach catchment boundary to the cross drainage structures at the Oxley Highway. The creek then discharges to the floodplain of the Namoi River.

The Oxley Highway cross drainage system consists of 12 box culverts with a total width of 33.7m and height of 1.5m.

The waterway channel between these culverts and the existing railway viaduct over Blackjack Creek consists of a 30m wide grassed trapezoidal floodway. The railway
viaduct consists of a series of culverts with a total width of approximately 24m height of 2.5m.

A rectangular concrete culvert is also located under New Street near the Oxley Highway roundabout and drains an additional 3.2 km² of catchment area to the east of Blackjack Creek.

5.7.2 Flooding constraints and impact assessment

The Flood Planning Map (FLD_005AA) in the Gunnedah Local Environmental Plan 2012 has been used to estimate the flood extents for this project. The flood extents represent the level of a 100 year ARI flood event plus the addition of a 0.5m freeboard.

Road embankments within the watercourse are likely to result in flood impacts. Additional crossings with appropriate flow capacity would be required under any proposed road to minimise / avoid increases in flood level.

A viaduct design across the floodplain and the existing railway may be required if flood impacts are unavoidable and critical. Bridge structures within the watercourse may interrupt the water flow and potentially increase the risk of inundation of the surrounding properties and areas of the Gunnedah town centre and upstream afflux.

Flood impacts will be investigated in further detail during the next stage of this project.

5.8 Noise and vibration

There are several residential properties, businesses and other community facilities that have the potential to be directly or indirectly impacted by noise as a result of this project.

Although construction noise impacts will be an issue that needs consideration, the assessment of preliminary options within the study area will focus on operational traffic noise and will be guided by the NSW Government EPA’s Road Noise Policy (RNP).

The noise and vibration impacts of the changed traffic conditions during operation and construction will be assessed for the listed noise sensitive users in accordance with the RNP assessment criteria (both day and night) for the maximum levels of traffic noise, such as from a heavy vehicle pass-by event.

Ambient noise surveys have been conducted to determine existing noise levels.

5.9 Geotechnical constraints

This section summarises the preliminary desktop investigations and assessment of potential geotechnical constraints in the vicinity of the study area. The complete technical paper is located in Appendix F. The following key information has been identified:

- Limited geotechnical information is available in this area, particularly at depths below 2.4m. The depth to rock is unknown at this stage.
- The study area is not within a risk area for Acid Sulphate Soils, though is within an area of high salinity and aggressive, shallow groundwater conditions.
- Blackjack Creek presents a notable engineering constraint. The depth of bedrock or competent strata within it, to support foundations, is not known, and may exceed 10m. There is potential for material within the creek to be susceptible to settlement if
loaded by structures or embankments. This will be explored in detail before a bridge
design is proposed.
- Beyond the Blackjack Creek watercourse soils are considered likely to be suitable to
  support road construction at grade, although some localised filling and subgrade
  treatment, such as removal or improvement, may be required.
- The risk of contaminated soils exists within the study area including the use of
  unknown material in the filling of light industrial / commercial sites, the possible
  inclusion of asbestos in the building's structures, the potential for hydrocarbon
  contamination around the two fuel depots on Railway Avenue and potential
  hydrocarbon, heavy metals and other contamination within the rail corridor.

5.10 Engineering constraints

This section summarises the critical design requirements and constraints that have
been considered in developing the preliminary concept options. The designs have been
developed to generally comply with the following:
- RMS Supplements to Austroads Guides (2009).

5.10.1 Design requirements

Table 5.4 below provides a summary of the key design criteria used in developing the
geometric alignments for the preliminary concept options.

Table 5.4  Key road design criteria

<table>
<thead>
<tr>
<th>Design Criteria</th>
<th>Design Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal Alignment – Design Speed</td>
<td>60 km/h</td>
</tr>
<tr>
<td>Vertical Alignment – Design Speed</td>
<td>60 km/h</td>
</tr>
<tr>
<td>Crest ‘K’ Parameter</td>
<td>9.3</td>
</tr>
<tr>
<td>Sag ‘K’ Parameter</td>
<td>6</td>
</tr>
<tr>
<td>Lane width</td>
<td>3.5m</td>
</tr>
<tr>
<td>Maximum Vertical Grade</td>
<td>10%</td>
</tr>
</tbody>
</table>

The maximum allowable vertical grade is a significant constraint for this project as it
dictates the overall extent and footprint of each concept option. This is particularly
critical given that the study area is confined to the immediate vicinity of the existing
New Street level crossing.

A value of 10% has been nominated by RMS to conform to its Road Access
Performance Based Standard with a Level 3 designation. This allows a heavy vehicle
to commence forward motion on a 10% grade.

More comprehensive design work, including superelevation design, safety barrier
design, earthworks, retaining walls, sight distance checks, pavement widening and
aquaplaning checks will be considered during the next stage of the project.

The following sketch (Figure 5.7) illustrates the typical road cross section forming the
basis for the preliminary concept options, based on RMS design criteria for this project.
Figure 5.7  Typical road cross section for preliminary concept option development

5.10.2 Utilities

Existing utilities and services in the vicinity of the study area were identified from the following sources:
- Dial Before You Dig search across the study area.
- GSC.
- Topographic survey undertaken for RMS by Moultrie Group.

Table 5.5 below summarises the results of the preliminary investigation works to date.

<table>
<thead>
<tr>
<th>Utilities</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water rising main</td>
<td>The 500 mm diameter water rising main and a smaller main pipe run along View Street to Warrabungle Street via the floodplain in the study area behind the Mill. This main will need to be either protected or relocated if impacted by any preliminary concept options. Given its size, it is considered a notable constraint to all options that take a similar alignment behind the Mill.</td>
</tr>
<tr>
<td>Water main</td>
<td>The 100 mm and 150 mm diameter water mains were identified under Railway Street, Warrabungle Street, Barber Street, Stockman Close, New Street and the floodplain. Due to the relatively small sizes of the pipes, these are considered only a minor constraint and can be easily relocated if required.</td>
</tr>
<tr>
<td>Sewer</td>
<td>The 150 mm and 225 mm diameter sewer mains were identified under Railway Street, Warrabungle Street, Barber Street, Stockman Close, New Street and the floodplain. Due to the relatively small sizes of the pipes, these are considered only a minor constraint and can be easily relocated or protected if required.</td>
</tr>
<tr>
<td>Electrical &amp; Telecommunications</td>
<td>Telstra cables, electrical poles and underground earth wires were identified in the vicinity of the study area. Due to the relatively simple relocation works involved, it is a minor constraint.</td>
</tr>
<tr>
<td>Stormwater</td>
<td>Stormwater pipes and pits along local streets were identified in the vicinity of the study area. Due to the relatively small sizes of the pipes, and the fact that road improvements will require upgrades to the stormwater network as part of the works, this is considered a very minor constraint.</td>
</tr>
</tbody>
</table>
Figure 5.8 below illustrates the location of utilities within the study area.

![Existing utilities in study area](image)

**Figure 5.8** Existing utilities in study area

With the exception of the 500mm diameter water rising main, the impacts of utilities are unlikely to be significant.

5.10.3 ARTC

The ARTC is responsible for the operation of the Hunter Valley Rail Corridor that runs through the study area. The requirements of ARTC dictate the nature of the grade separated crossing being investigated under this project.

There are three primary engineering constraints that ARTC have mandated for any crossing of their railway line. They are:

- Provision is to be made for the future expansion of the railway line from a single track configuration to a double track configuration, with a further allowance for a vehicle access road along the length of the tracks.
- A vertical clearance is to be provided that will allow ARTC to double stack containers on its trains in the future. This requires a minimum clear distance of 7.1m from the top of the rail line to the underside of the bridge deck.
- ATRC has advised that the alternative to construct the overbridge to comply with single stacking clearances (5.15m) may be available for the project. This would be
conditional on future costs to raise the bridge being carried by RMS. At this stage of the project all designs, impacts, cost estimates, etc reflect the double stacking clearances.

Based on these requirements, a minimum horizontal clearance of 17m will be required across the railway line.

The structural depth of the bridge has been assumed as 1.75m for HML vehicles. As a result, the top of the road surface on the bridge will a minimum of 8.9m above the existing railway line. As a consequence of this, the following impacts can be anticipated:

- Steep vertical grades on the approaching roads to the bridge.
- A large footprint of road embankments, high retaining walls on the sides of the road or longer bridge spans.
- Engine braking noises from heavy vehicles.

Figure 5.9 ARTC clearance requirements for grade separation over railway (double stacking clearances)
6 Preliminary route options

A total of 19 preliminary options were developed within the study area. These options were developed using a combination of inputs from the broader project team and the following sources:

- Community feedback, suggestions and community recommendations from the December 2012 drop in sessions.
- Input from RMS and other key stakeholders.

These preliminary options were divided into three corridors based on the configuration of the horizontal road alignment. A set of engineering plans and longitudinal profiles for each option is provided in Appendix B and described in Table 6.1 below.

Table 6.1: Preliminary route options within different corridors

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Corridor Description</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Street</td>
<td>This corridor consists of a new bridge on the existing New Street level crossing alignment.</td>
<td>Option 1A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 1B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 1C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 3</td>
</tr>
<tr>
<td>Behind Mill</td>
<td>This corridor consists of a new bridge west of the Gunnedah Maize Mill and links the northern and southern sides of Gunnedah.</td>
<td>Option 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 16</td>
</tr>
<tr>
<td>Farrar Road</td>
<td>This corridor consists of a new bridge that links Farrar Road to either the Kamilaroi Highway or Warrabungle Street. The Oxley Highway and Farrar Road intersections would be upgraded to accommodate HML vehicles and changes in traffic conditions.</td>
<td>Option 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 11A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 11B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option 15</td>
</tr>
<tr>
<td>Other options</td>
<td>Option 12 consists of a new bridge links South Road to the Rosemary / Railway Street intersection.</td>
<td>Option 12</td>
</tr>
<tr>
<td></td>
<td>Option 13 consists of a rail underpass that lowers the rail line to provide a minimum clearance under New Street.</td>
<td>Option 13</td>
</tr>
</tbody>
</table>

Options 1A, 1B and 1C all contain the same horizontal alignment, but have different vertical profiles. A map of all 19 preliminary options is provided in Figure 6.1.
Figure 6.1 Map of 19 preliminary options
6.1 New street corridor

The New Street corridor consists of a new bridge along the existing alignment corresponding with the New Street level crossing. Table 6.2 describes each option within this corridor.

Table 6.2 Preliminary options in New street corridor

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1A</td>
<td>This option would have a new bridge at New Street to replace the existing level crossing without compromising the existing roundabout at the intersection of the Oxley Highway and New Street/View Street. Vehicle access to New Street from Railway Street would be closed permanently due to the level difference between the approaching road to the bridge and Railway Street. As a consequence of maintaining the existing roundabout configuration, the vertical grade would become 15.27% to tie in to the roundabout which is greater than 10% maximum allowable grade. Alternative property accesses on New Street would be required.</td>
</tr>
<tr>
<td>Option 1B</td>
<td>This option would have the same horizontal alignment as Option 1A with a different vertical alignment. The existing roundabout would be raised approximately 7m to comply with the RMS vertical alignment requirements. Vehicle access to New Street from Railway Street would be closed permanently due to the level difference between the approaching road to the bridge and Railway Street. Alternative property accesses on New Street would be required and the existing box culvert upgraded to accommodate the change in vertical grade.</td>
</tr>
<tr>
<td>Option 1C</td>
<td>This option would have the same horizontal alignment as Option 1A with a different vertical alignment. The existing roundabout would be raised approximately 2.5m. As a consequence of this treatment of the roundabout, the vertical grade would be 12.25% with a smaller crest curve than the RMS requirements for 60 km/h design speed. It is expected that modifications to the design can mitigate these issues. Vehicle access to New Street from Railway Street would be closed permanently due to the level difference between the approaching road to the bridge and Railway Street. Alternative property accesses on New Street would be required.</td>
</tr>
</tbody>
</table>
Option 2
This option would have a new bridge on New Street to replace the existing level crossing. The intersection between New Street and View Street would be relocated or upgraded to the south of its current location. The Oxley Highway and South Street would be realigned to suit the new roundabout location. Vehicle access to New Street from Railway Street would be closed permanently due to the level difference between the approaching road to the bridge and Railway Street. Alternative property accesses on New Street would be required.

Option 3
This option consists of a new bridge on New Street to replace the existing level crossing, needing property acquisition of the Gunnedah Maize Mill site and direct access to Warrabungle Street. Vehicle access to New Street from Railway Street would be closed permanently due to the difference in levels between the bridge approach and Railway Street. Alternative property accesses on New Street would be needed.

6.2 ‘Behind Mill’ corridor
The ‘Behind Mill’ corridor consists of a new bridge west of the Gunnedah Maize Mill that connects the northern and southern sides of Gunnedah. Table 6.3 describes each of the options within this corridor.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 4</td>
<td>This would have a new bridge west of the Gunnedah Maize Mill that links Warrabungle Street and the Oxley Highway. This option would maintain the footprint of the existing roundabout that has a minimal impact on vehicle turning movements. The road alignment would run close to the railway on the south side to minimise ecological impacts and the Blackjack Creek floodplain. Barber Street would not connect to the bridge due to vertical grade constraints. Traffic flow along Warrabungle Street would be changed to allow the new ramp up to the bridge. Property accesses on Warrabungle Street would be treated to suit changes of the vertical grade of the roads.</td>
</tr>
<tr>
<td>Option 5</td>
<td>This option would have a new bridge west of the Gunnedah Maize Mill that links Warrabungle Street and the Oxley Highway. The intersection of the Oxley Highway and New Street View Street would be relocated or upgraded to west of its current location. Barber Street would not link to the bridge due to the vertical grade. Traffic along Warrabungle Street would be changed to allow the new ramp up to the bridge. Property accesses on Warrabungle Street would be changed due to the vertical grade of the roads.</td>
</tr>
</tbody>
</table>
Option 6 This option would have a new bridge west of the Gunnedah Maize Mill that links Warrabungle Street and the Oxley Highway with a change to the exit angle of the roundabout to the bridge. This option is a combination of the alignment used for Options 4 & 5 with similar vertical grade constraints, traffic flow changes and property modifications.

Option 7 This option would have a new bridge west of the Gunnedah Maize Mill that links to the Kamilaroi Highway, east of the drainage culverts and the Oxley Highway. A new road would be located adjacent to properties on the west side of Warrabungle Street. The Kamilaroi Highway drainage culverts would need to be extended to fit the new intersection.

Option 8 This option would have a new bridge west of the Gunnedah Maize Mill that links to the Kamilaroi Highway, east of the drainage culverts and the Oxley Highway. A new road would cross the floodplain joining at Stockman Close that would need to be upgraded to suit heavy vehicles.

Option 16 This option would have a new bridge west of the Gunnedah Maize Mill that links Warrabungle Street and the Oxley Highway through the caravan park on Warrabungle Street. The exit angle of the roundabout to the bridge would need adjustment to suit heavy vehicle turning movements.

6.3 Farrar road

The Farrar Road corridor consists of a new bridge that links Farrar Road to either the Kamilaroi Highway or Warrabungle Street. The Oxley Highway and Farrar Road intersections would be upgraded to accommodate HML vehicles and changes in traffic conditions.

All of the Farrar Road options involved road changes or property impacts outside the original identified study area, as seen in Table 6.4 below. Before pursuing any option in this corridor, further consultation may be required to engage affected land holders.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 9</td>
<td>This option would have a new bridge that links the northern end of Farrar Road to the Kamilaroi Highway, west of the drainage culverts. As the ground level on Kamilaroi Highway is significantly lower than Farrar Road, the vertical grade would be 12.1% which is greater than the 10% maximum grade.</td>
</tr>
<tr>
<td>Option 10</td>
<td>This option would have a new bridge that links Farrar Road to the corner of Barber Street and Warrabungle Street. This option would go across the floodplain and through properties on Farrar Road. Due to the significant level difference between the existing ground and design surface, alternative accesses would be needed.</td>
</tr>
<tr>
<td>Option 11A</td>
<td>This option would have a new bridge that links Farrar Road to</td>
</tr>
</tbody>
</table>
the Kamilaroi Highway east of the drainage culverts. This option goes across the floodplain and through properties on Farrar Road. A new road would be located adjacent to properties on the western side of Warrabungle Street and would impact properties along Stockman Close.

<table>
<thead>
<tr>
<th>Option 11B</th>
<th>This option would have the same horizontal alignment as Option 11A with a steeper vertical grade (10%, tie in to Kamilaroi Hwy) to minimise the property impacts on the western side of Warrabungle Street.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 14</td>
<td>This option would have a new bridge that links Farrar Road to the corner of Barber Street and Warrabungle Street. This option is similar to Option 10, but differs slightly in its alignment on approach to Warrabungle and Barber Street. Alternative property accesses on Barber Street would be needed due to changes in vertical alignment of Barber Street.</td>
</tr>
<tr>
<td>Option 15</td>
<td>This option would have a new bridge that links Farrar Road and Warrabungle Street through the caravan park. The new road would require property acquisition on Farrar Road in the vicinity of a new intersection and directly impact properties adjacent to Stockman Close and west of Warrabungle Street.</td>
</tr>
</tbody>
</table>

### 6.4 Other options

Table 6.5 below describes the remaining options that do not fit in any of the three previous corridors.

<table>
<thead>
<tr>
<th>Option 12 (South St option)</th>
<th>This option would have a new bridge that links east of South Street and Railway Street. Due to the short length of the road available, it does not comply with the RMS minimum vertical alignment requirements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 13</td>
<td>This option involves a vertical realignment of the railway line to achieve the minimum vertical clearance at New Street with lowering the railway line. Due to urban property clearances, track geometry and flood drainage issues, lowering the railway line would require significant works beyond the study area.</td>
</tr>
</tbody>
</table>

### Table 6.5 Remaining preliminary concept options
7 Assessment of preliminary options

This section outlines the process and criteria used to assess the 19 preliminary options described in Section 6 and presents the findings of this high level assessment.

The overall aim of the assessment process was to identify a short list of preliminary options to be taken forward for further investigation, consideration and public consultation.

7.1 Assessment methodology

The process of assessing and shortlisting concept options was based on the principles of a Multi Criteria Analysis (MCA). This allows preferences to be objectively established between options using criteria relevant to the needs of the project and ensuring transparency.

An overview of the process is presented in the Figure 7.1:

**Figure 7.1** Assessment methodology to shortlist preliminary concept options

The four steps used in this process are explained in further detail in the following sections.

7.2 Step 1 – Identify project objectives

The primary objectives for this project have been developed by RMS in consultation with key stakeholders to address the current traffic and transport issues surrounding the use of the existing New Street level crossing. The objectives used in the assessment of preliminary options are:

- Provide a grade separated HML route through Gunnedah.
- Improve local traffic efficiency / transport productivity and reliability.
- Improve road safety.
• Minimise the impact on the natural, cultural and built environment.
• Provide value for money.

The two project objectives relating to local traffic and road transport have been combined into a single objective for the purposes of the preliminary options assessment. These two objectives address similar issues and will have similar supporting objectives and criteria associated with them.

7.3 Step 2 – Identify supporting objectives and criteria for assessment

Each of the project objectives contains a series of supporting objectives. These supporting objectives provide measurable criteria that allows an assessment and comparison to be made for each preliminary concept option.

The supporting objectives used in the assessment of the preliminary options are shown in the Figure 7.2 below.

Figure 7.2 Project and supporting objectives

General descriptions of each supporting objective have been provided to allow a rational and inclusive review of each option.

Additional detailed MCA criteria will be established, together with suitable assessment weightings for each of the project and supporting objectives as part of the next stage of the project.
### Table 7.1  Project objective: Provide a grade separated HML route through Gunnedah

<table>
<thead>
<tr>
<th>Supporting Objectives</th>
<th>Description</th>
</tr>
</thead>
</table>
| Engineering Design    | Considers the relative performance of each grade separated crossing in relation to:  
  • ARTC clearances requirements  
  • RMS design requirements |
| Constructability / Disruption Potential | Considers temporary issues associated with the construction of the proposed grade separated crossing, and subsequent impacts on delivery of service /connectivity to the town including staging works & interruption of services |
| Operation & Maintenance | Considers the relative difficulty and extent of operation and maintenance effort of each grade separated crossing and associated roads. |

### Table 7.2  Project objective: Improve local traffic efficiency / transport productivity and reliability

<table>
<thead>
<tr>
<th>Supporting Objectives</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Capacity</td>
<td>Considers the estimated number of vehicles which will travel through the new grade separated crossing</td>
</tr>
<tr>
<td>Traffic Flow</td>
<td>Traffic connectivity to consider the impacts to intersections, existing driveways, pedestrians and cyclists across the broader road network.</td>
</tr>
<tr>
<td>Traffic Durations / Delays</td>
<td>Considers the relative average travel times per vehicle through Gunnedah along the new road / grade separated crossing alignment.</td>
</tr>
</tbody>
</table>

### Table 7.3  Project objective: Improve road safety

<table>
<thead>
<tr>
<th>Supporting Objectives</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Conflict Points</td>
<td>Traffic volumes to consider the increase or decrease of the number of conflict points between vehicles and trains at the existing at-grade crossing of new street and intersections within the surrounding road network.</td>
</tr>
</tbody>
</table>
| Pedestrian / Cyclist Routes | Considers the pedestrian and cyclist infrastructure provided as part of the new road / bridge in relation to:  
  • Connections to key destinations.  
  • Accessibility (DDA compliance).  
  • Likelihood of patronage. |
### Table 7.4  Project objective: Minimise the impact on the natural environment

<table>
<thead>
<tr>
<th>Supporting Objectives</th>
<th>Description</th>
</tr>
</thead>
</table>
| Ecology               | Considers the relative impact of each grade separated crossing in relation to:  
  - Endangered Ecological Communities.  
  - Other native vegetation  
  - Road corridor across Koala connectivity corridors. |
| Noise / Air Quality   | Considers the relative impact of each grade separated crossing in relation to:  
  - Operational traffic noise levels.  
  - Construction noise, vibration and noise sensitive locations. |
| Flooding / Water Quality / Drainage | Considers the relative impacts the new grade separated crossing will have on the existing floodplain along Blackjack Creek. |

### Table 7.5  Project objective: Minimise the impact on the cultural and built environment

<table>
<thead>
<tr>
<th>Supporting Objectives</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Amenity / Urban Design</td>
<td>Considers the overall impact the location and alignment of the grade separated crossing will have on the township of Gunnedah and surrounding locales.</td>
</tr>
</tbody>
</table>

#### Supporting objective: Heritage

| Heritage | Considers the relative impact of each grade separated crossing in relation to:  
  - Heritage items likely to be impacted.  
  - Indigenous cultural sites such as ceremonial or dreaming sites.  
  - Areas of high archaeological potential. |

#### Social / Community

| Social / Community | Considers the relative impact of each grade separated crossing in relation to:  
  - Residential, commercial and community properties in the study area.  
  - Contribution of the road to linking community destinations including footpath access for pedestrians and cyclists.  
  - Public Transport. |

### Table 7.6  Project objective: Provide value for money

<table>
<thead>
<tr>
<th>Supporting Objectives</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Costs</td>
<td>• The comparative differences between options at a strategic high level capital cost level.</td>
</tr>
</tbody>
</table>
| Life Cycle Costs / Benefits | Considers the relative performance of each grade separated crossing in relation to:  
  - Cost Benefit ratio.  
  - NPV over 30 years.  
  - Infrastructure operating costs. |
7.4 Step 3 – Initial review of options

The initial preliminary options were developed further using the RMS engineering design guidelines to establish a better understanding of likely impacts and feasibility of each option.

At this stage, an initial assessment was undertaken, with input provided by RMS, to establish a consolidated group of options that best addressed the fundamental requirements and objectives of the project.

Following this assessment, nine of the preliminary options were selected for further assessment as part of the Internal Technical Workshop. The results of this assessment are summarised in Table 7.7.

Table 7.7  Review of initial 19 preliminary concept options

<table>
<thead>
<tr>
<th>Option</th>
<th>Result of Review</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Discontinue</td>
<td>Significant vertical grade (15%) that does not comply with RMS design requirements.</td>
</tr>
<tr>
<td>1B</td>
<td>Discontinue</td>
<td>Requires significant changes to the Oxley Highway and surrounding area. Major visual impact on landscape beyond bridge location.</td>
</tr>
<tr>
<td>1C</td>
<td>Retained</td>
<td>Provides the most suitable compromise of options along New Street</td>
</tr>
<tr>
<td>2</td>
<td>Discontinue</td>
<td>Requires significant realignment of Oxley Highway, including Blackjack Creek bridge crossing.</td>
</tr>
<tr>
<td>3</td>
<td>Retain</td>
<td>Provides the most suitable horizontal and vertical alignment to Warrabungle Street. However has significant impact on the Gunnedah Maize Mill.</td>
</tr>
<tr>
<td>4</td>
<td>Retain</td>
<td>Provides a complying design west of the Gunnedah Maize Mill.</td>
</tr>
<tr>
<td>5</td>
<td>Retain</td>
<td>Provides a complying design west of the Gunnedah Maize Mill.</td>
</tr>
<tr>
<td>6</td>
<td>Discontinue</td>
<td>Provides a very similar option to both 4 and 5. To allow an assessment of a variety of options at the workshop, this option will not be continued.</td>
</tr>
<tr>
<td>7</td>
<td>Retain</td>
<td>Provides a complying design that avoids Warrabungle St and Barber St and issues relating to vertical alignment of link roads.</td>
</tr>
<tr>
<td>8</td>
<td>Discontinue</td>
<td>Longest option likely to exceed project budget and creates a significant grade separation along residential properties on Stockman Close blocking access at north end of project area.</td>
</tr>
<tr>
<td>9</td>
<td>Discontinue</td>
<td>Vertical grade does not comply with RMS design requirements and is the most remote link to Oxley Highway.</td>
</tr>
<tr>
<td>10</td>
<td>Discontinue</td>
<td>Identical to Option 14, except for the link to Warrabungle Street.</td>
</tr>
<tr>
<td>11A</td>
<td>Retain</td>
<td>Provides a complying design that connects Farrar Road to Kamilaroi Highway and avoids Warrabungle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and Barber Streets</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>-------------------</td>
</tr>
<tr>
<td>11B</td>
<td>Discontinue</td>
<td>Identical to Option 11A, except it has more significant impact on existing properties along Warrabungle Street.</td>
</tr>
<tr>
<td>12</td>
<td>Discontinue</td>
<td>Vertical grade is greater than 20% and does not comply with RMS design requirements.</td>
</tr>
<tr>
<td>13</td>
<td>Discontinue</td>
<td>Maximum vertical grade for ARTC rail is 1%, and would require extensive work outside the project area to achieve necessary clearances.</td>
</tr>
<tr>
<td>14</td>
<td>Retain</td>
<td>Provides a complying design that links Farrar Road to Warrabungle and Barber Streets.</td>
</tr>
<tr>
<td>15</td>
<td>Retain</td>
<td>Provides a complying design that connects Farrar Road to Warrabungle Street with suitable vertical grades.</td>
</tr>
<tr>
<td>16</td>
<td>Retain</td>
<td>Provides a complying design that connects the Oxley Highway to Warrabungle Street with suitable vertical grades.</td>
</tr>
</tbody>
</table>

The general criteria used in the assessment centred around these two key issues:

- Options that did not meet the minimum engineering criteria for HML vehicles were generally not carried forward unless it was considered possible to design out the non-compliance issues as part of future refinements, such as in Option 1C.
- Options that were similar to other options in horizontal location and in terms of impacts were compared and generally only the option that was expected to perform best were retained. Examples are Option 6 and 10, which were considered too similar to Options 5 and 14 for all of these to be retained.
Figure 7.3 Map of nine preliminary concept options assessed at the internal technical workshop
7.5 Step 4 – Internal technical workshop and assessment of preliminary options

This section summarises the assessment of the nine preliminary options that were considered at the Internal Technical Workshop in February 2013.

**Workshop aims**

An Internal Technical Workshop was held on February 13, 2013 to assess the nine preliminary options using the general MCA criteria. The objective of this workshop was to confirm and agree on a shortlist of up to four options to take forward to the next stage of the project.

The workshop was attended by 22 representatives of the project team, RMS and GSC. Invitations were issued to other key stakeholders such as ARTC; however, representatives from these stakeholders were unable to attend.

**Workshop process**

The process to assess the preliminary options and to choose a shortlist of options involved:

- A brief discussion on the background and work undertaken to date.
- A series of discussions and presentations by KBR and specialist sub-consultants to identify and describe key constraints.
- Dividing workshop participants into four groups (5 to 6 people) to develop and agree ratings and shortlisting of options.
- Predetermining composition of the groups prior to the workshop to ensure a balance between client and project team representatives and multi-discipline expertise.
- Scoring sheets and guide notes used to highlight issues and provide prompts under the four higher level objectives.
- Illustrating the nine preliminary options (A1 size) on walls, with ‘Pros & Cons’ sheets to allow participants to record their opinions of positive and negative aspects of the options.
- Ratings for each option were recorded and agreed within the groups under the four higher level objectives. The process of rating the options was left up to the groups to decide. Feedback during the review and ‘sanity checks’ indicated that groups undertook similar approaches to agreeing to their shortlist options.
- The rating sheets were discussed within the groups and reviewed by all participants, to agree an overall rating. There was consistency in most groups’ top rated shortlist options.

**General Assessment Results**

The general assessment of each option was summarized in the pros and con’s sheets provided underneath each of the option displays. Table 7.8 summarises the workshop participants’ assessment of each option.

---

**Table 7.8**  Key assessment results for nine preliminary concept options
<table>
<thead>
<tr>
<th>Option</th>
<th>Positive Impacts</th>
<th>Negative Impacts</th>
</tr>
</thead>
</table>
| Option 1C | • Shortest route option  
• Fits within existing road alignment  
• Remains outside flood plain and ecological connectivity areas | • Impact on access and visual amenity of Gunnedah Maize Mill and New Street properties  
• Steep approach grades  
• Severs Railway Street  
• Closer to noise receivers |
| Option 3 | • More direct traffic connectivity  
• Flatter approach grades | • Impact on operation of Gunnedah Maize Mill  
• Property acquisitions required  
• Severs Railway Street  
• Realignment and upgrade of Oxley Highway |
| Option 4 | • No impact on Oxley Highway roundabout  
• Provides a direct traffic connection  
• Offline construction possible  
• No impact on streets east of Gunnedah Maize Mill  
• Overall superior ecological performance | • Long skewed bridge required  
• Located within heritage buffer zone for Gunnedah Maize Mill  
• Potential impact on ecological connectivity areas  
• Indirect minor impact on Blackjack Creek |
| Option 5 | • More direct traffic connectivity  
• Flatter approach grades  
• No impact on streets east of Gunnedah Maize Mill  
• Minimal impact on Gunnedah Maize Mill  
• Offline construction possible | • Requires upgrade / relocation of roundabout on Oxley Highway  
• Alignment runs through potential ecological connectivity areas.  
• Indirect minor impact on Blackjack Creek |
| Option 7 | • Favourable approach grades  
• No impact on streets east of Gunnedah Maize Mill  
• Minimal impact on Gunnedah Maize Mill  
• Almost no property acquisitions | • Impacts at Kamilaroi Highway intersection adjacent to existing bridge  
• Impacts on Blackjack Creek for ecological connectivity and flooding  
• Longest alignment option  
• New road at rear of caravan park  
• Impacts on floodplain views |
<table>
<thead>
<tr>
<th>Option</th>
<th>Positive Impacts</th>
<th>Negative Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 11A</td>
<td>• No direct impact on Gunnedah Maize Mill&lt;br&gt;• Offline construction possible&lt;br&gt;• Provides a simply clean alignment&lt;br&gt;• Minimal visual impacts</td>
<td>• Farrar Road has less direct traffic connectivity with town&lt;br&gt;• Impact on Blackjack Creek for ecological connectivity and flooding&lt;br&gt;• Changes road hierarchy significantly and requires upgrades of Farrar Road and Oxley and Kamilaroi Hwy intersections&lt;br&gt;• Impacts on properties along Farrar Road and Stockman Close</td>
</tr>
<tr>
<td>Option 14</td>
<td>• Favourable location to Gunnedah Maize Mill&lt;br&gt;• Favourable crossing of Blackjack Creek for ecological impacts and flooding&lt;br&gt;• Favourable vertical grades&lt;br&gt;• Minimal visual impacts</td>
<td>• Farrar Road has less direct traffic connectivity with town&lt;br&gt;• Changes road hierarchy and requires upgrades of Farrar Road and Oxley Hwy intersection&lt;br&gt;• Limits Mill Access via Barber Street</td>
</tr>
<tr>
<td>Option 15</td>
<td>• Favourable location to Gunnedah Maize Mill&lt;br&gt;• Favourable crossing of Blackjack Creek for ecological impacts and flooding&lt;br&gt;• Minimal visual impacts&lt;br&gt;• Vertical elevations tie in well at Warrabungle Street</td>
<td>• Farrar Road has less direct traffic connectivity with town&lt;br&gt;• Changes road hierarchy and requires upgrades of Farrar Road and Oxley and Kamilaroi Hwy intersections&lt;br&gt;• Property acquisitions along Farrar Road and through caravan park</td>
</tr>
<tr>
<td>Option 16</td>
<td>• Vertical elevations tie in well at Warrabungle Street&lt;br&gt;• Offline construction possible&lt;br&gt;• Located west of Gunnedah Maize Mill</td>
<td>• Impact on Blackjack Creek for ecological connectivity and flooding&lt;br&gt;• Property acquisitions through caravan park&lt;br&gt;• Noise impacts at remaining caravans&lt;br&gt;• Moderate impacts on Gunnedah Maize Mill heritage buffer</td>
</tr>
</tbody>
</table>

The subsequent option rankings for each group have been provided in the Table 7.9 below.
Table 7.9  Assessment rankings of preliminary concept options

<table>
<thead>
<tr>
<th></th>
<th>Option 1C</th>
<th>Option 3</th>
<th>Option 4</th>
<th>Option 5</th>
<th>Option 7</th>
<th>Option 11A</th>
<th>Option 14</th>
<th>Option 15</th>
<th>Option 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Group 2</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>9</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Group 3</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Group 4</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Overall Rank</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Workshop agreed on the following preference order for the options shortlist:
1. Option 5.
2. Option 4.
3. Option 1C.

Considerable discussion was held about the refinement of these options to provide a best for project solution.

It was agreed that although Options 4 and 5 were similar in their horizontal alignment, they in fact presented considerable differences in the type of constraints. It was agreed that these two options be assessed separately as part of the next stage of the project.

Considerable discussion was also held about the detail of Option 14 at the Warrabungle and Barber Street intersection. It was agreed that a modified alignment be considered to allow a streamlined link to Warrabungle Street that avoids linking to Barber Street. This was agreed by all participants as the best way forward.

It was observed that the shortlisted options are representative of the three broad corridors being assessed, namely:
- New Street.
- Behind the Gunnedah Maize Mill.
- Farrar Road.

7.6 Shortlisted options

As agreed at the workshop, further investigations into the feasibility and viability of developing a Farrar Road concept option was undertaken. RMS advised that Option 14 should not be taken forward as it:
- Is outside the project study area.
- Does not satisfy the key objective of improved traffic operations within the study area.
• Is not suitable for reclassification as a State Road due to direct access from industrial / commercial premises is not permissible. Traffic conflicts would be unacceptable.
• Farrar Road is narrow and steep on its approach to the Oxley Highway which is problematic for B-Double operation.

As a result, three short listed options will remain for further assessment as part of the next stage of the project. These are:
1. Option 1C (also known as option A).
2. Option 4 (also known as option B).
3. Option 5 (also known as option C).

These maps have been illustrated in Figure 7.4 on the following page:
Figure 7.4 Shortlisted preliminary concept options
8 Strategic cost estimates of shortlisted options

This section summarises the outcomes of the strategic preliminary cost estimates of the three shortlisted options as set out in Table 8.1.

Table 8.1 Strategic cost estimates for shortlisted options

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Option 1C</th>
<th>Option 4</th>
<th>Option 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Development</td>
<td>$547,000</td>
<td>$582,000</td>
<td>$660,000</td>
</tr>
<tr>
<td>2</td>
<td>Detail design and Documentation</td>
<td>$855,000</td>
<td>$912,000</td>
<td>$1,036,000</td>
</tr>
<tr>
<td>3</td>
<td>Property Acquisitions</td>
<td>$302,000</td>
<td>$754,000</td>
<td>$754,000</td>
</tr>
<tr>
<td>4</td>
<td>Utility Adjustments</td>
<td>$601,000</td>
<td>$795,000</td>
<td>$932,000</td>
</tr>
<tr>
<td>5</td>
<td>Infrastructure (including construction (including temporary sidetrack) costs and Principals project accommodation</td>
<td>$22,103,000</td>
<td>$23,390,000</td>
<td>$26,544,000</td>
</tr>
<tr>
<td>6</td>
<td>Finalisation</td>
<td>$730,000</td>
<td>$748,000</td>
<td>$933,000</td>
</tr>
<tr>
<td></td>
<td><strong>Total Concept Estimate</strong></td>
<td>$25,138,000</td>
<td>$27,181,000</td>
<td>$30,859,000</td>
</tr>
<tr>
<td></td>
<td><strong>Estimate Rounded</strong></td>
<td>$26,000,000.00</td>
<td>$28,000,000.00</td>
<td>$31,000,000.00</td>
</tr>
</tbody>
</table>

This estimate is limited by the details currently available at this early stage of design. A large number of assumptions have been made and appropriate contingencies allowed due to the limited level of detail of the available design.

Refinement of the costings will be undertaken with further design. The following key areas will have the largest impact on estimates:

- Length of the bridge: minimising the skewed angle and number of piers / abutments will aid in reducing costs.
- Height of the road approach embankments: minimising these works will aid in reducing costs.
- Minimising the amount of permanent and temporary works on and near the Oxley Highway.
- Utility adjustments: finalising the impact for temporary and permanent utility locations will aid in confirming costs and thus reducing risk.
- Survey and geotechnical condition will assist in determining the needs for the bridge structure.
9 Next steps

The flow chart in Figure 9.1 represents the process to select a preferred option.

Next steps

The flow chart in Figure 9.1 represents the process to select a preferred option.

Following announcement and community consultation on the short list of preliminary options, further technical and environmental investigations will be undertaken to provide more detailed information on each option.

The shortlisted options will be further assessed using the developed MCA assessment methodology and criteria to allow transparent and unbiased decisions.

The investigations and assessment will be documented in the Concept Options Report as part of the next stage of this project. When complete, this report will be available for further community involvement.

Input from the community, together with the results of detailed investigations and outcomes of the Value Management Workshop will be used to recommend a preferred concept option.

Feedback from the display of the recommended preferred option will then be considered before a final decision and announcement.
References


DECC (2008) *Approved Recovery Plan Recovery plan for the Koala (Phascolarctos cinereus)*


DECCW (2009). *OEH Field Survey Methods, DECCW 2009;*

DEWHA (2010a). *Survey guidelines for Australia’s threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act*

DEWHA (2010b). *Survey guidelines for Australia’s threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act*
DEWHA (2010c). *Survey guidelines for Australia’s threatened mammals: Guidelines for detecting mammals as threatened under the EPBC Act.*


DSEWPaC (2013) *Weeds of National Significance,*


NSW NPWS 2000a.  *Preliminary Overview of the Brigalow Belt South Bioregion (Stage 1).* NSW Western Regional Assessments. Resource and Conservation Assessment Council