Katoomba to Lithgow
Great Western Highway Upgrade

Hartley Valley safety upgrade

Review of Environmental Factors
Volume 1  Review of Environmental Factors
Appendix A

November 2013
Executive summary

The proposal

Roads and Maritime Services is upgrading the Great Western Highway between Katoomba and Lithgow, west of Sydney. As part of this upgrade program, Roads and Maritime proposes to carry out safety upgrades along the highway through Hartley Valley in the Blue Mountains. This section of the highway extends about 7.8 kilometres between the base of Victoria Pass and the base of River Lett Hill. The main features of the proposal are:

- Increasing the design speed of this section of the highway from generally 80 km/h to 90 km/h.
- Road widening of about two to six metres to provide 3.5 metre wide lanes and shoulders.
- Constructing five new culverts and upgrade of pavement drainage.
- Upgrading nine intersections by providing or extending dedicated right turn lanes and adjusting the vertical and horizontal alignment to tie in to the existing highway.
- Improving the road surface by providing new pavement along the length of the highway except between Carroll Drive and about 300 metres east of Mid Hartley Road.
- Constructing four retaining walls, ranging from 1.7 to 7.5 metres in height and from 53 to 200 metres in length.
- Temporary construction ancillary facilities, including construction compounds, stockpile sites and erosion and sedimentation measures.

Need for the proposal

The proposal is required to reduce the crash rate on this section of the Great Western Highway, and to cater for existing and future traffic flows. The proposal is also required to continue supporting freight and tourism services that use the highway.

Options considered

Roads and Maritime considered three design options for this section of the highway (Options A, B and C). These options involved designing the highway for speeds ranging between 80 and 100 km/h, and entailed adjustments to horizontal and vertical aspects of the highway.

Roads and Maritime selected Option A as the preferred option as it would best meet the proposal objectives in terms of safety and catering for future traffic flows. This option would also provide the best balance between technical, environmental, social and economic benefits and costs.

Statutory and planning framework

The State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State. Clause 94 of the ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. The proposal can therefore be assessed under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act) by Roads and Maritime as both the proponent and the determining authority. Development consent from Lithgow City Council is not required. This review of environmental factors (REF) fulfils the
requirements of section 111 of the EP&A Act and has been prepared in accordance with Clause 228 of the *Environmental Planning and Assessment Regulation 2000* and matters of national environmental significance.

**Community and stakeholder consultation**

Roads and Maritime has managed the consultation for the proposal as part of the community and stakeholder engagement process for the wider program to upgrade the Great Western Highway between Katoomba and Lithgow. This process has included consultation with the general public, the Aboriginal community, Lithgow City Council, NSW Office of Environment and Heritage and other State government departments and utility providers.

Roads and Maritime has placed this REF on public display for community comment. It will consider and address all comments in a submissions report, which will be made publicly available on Roads and Maritime's website. Consultation will be ongoing during the detailed design and construction phases of the proposal.

**Environmental impacts**

Roads and Maritime has commissioned a number of technical experts to assess the potential impacts of the proposal and to identify safeguards and management measures. These have been summarised below.

**Biodiversity**

The proposal would impact on a total of about 4.4 hectares of native and modified vegetation. This would include the clearing of about 3.2 hectares of remnant native vegetation in varying degrees of condition and about 1.2 hectares of cleared and highly modified habitats.

The main impacts of this clearing and disturbance would be the removal of about 0.86 hectares of the ecological community ‘Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions’, which is listed as endangered under the NSW *Threatened Species Conservation Act 1995* (TSC Act).

Assessments of significance found that the proposal would not have a significant impact on any threatened species, populations or ecological communities once the management and mitigation measures identified in this REF are implemented. Therefore, a species impact statement is not required.

**Land use, property and socio-economic issues**

Roads and Maritime would need to acquire portions of 18 properties to construct the proposal. Final areas of acquisition would be determined during detailed design and in consultation with property owners likely to be impacted. Property acquisition would be managed in accordance with the provisions of Roads and Maritime’s Land Acquisition Policy (Roads and Maritime, 2012b) and the *Land Acquisition (Just Terms Compensation) Act 1991*.

In addition, during construction, the community and local businesses would be likely to experience temporary traffic delays, property access restrictions and noise, air quality and visual amenity impacts. No land use would be permanently affected as a result of the proposal.
Some utility services (including telecommunications networks and overhead power lines) would need to be relocated and/or adjusted. This may necessitate minor disruptions to services.

The construction contractor would notify property owners likely to be impacted by any disruptions and access restrictions before work begins.

**Non-Aboriginal heritage**

The proposal passes through the Little Hartley Draft Heritage Conservation Area and past eight heritage items (four items listed on the Lithgow City Local Environmental Plan and four heritage items listed on the Draft Lithgow Principal Local Environmental Plan). The proposal also borders the Hartley Historic Site and two other heritage items listed on the State Heritage Register. The proposal would not have any direct impacts on heritage items within the study area. Indirect visual impacts and impacts from vibration may occur during construction. These impacts are not considered to be significant and would be managed during construction through the application of mitigation measures identified in this REF.

**Hydrology**

The proposal would involve widening the highway, which would increase the impervious area of roadway. This would result in an increase in downstream peak flow rates during rainfall events at five locations. Of these, negligible to minor increases in downstream flooding would be experienced at four locations. However, the new intersection of Coxs River Road is expected to result in a relatively substantial increase in downstream peak flow rates, impacting on a farm dam downstream through scour and loss of capacity. The landowner would be consulted during detailed design to identify appropriate measures to manage this potential impact.

**Noise and vibration**

During construction, noise management levels (NML) may be exceeded at receivers within several noise catchment areas near to the proposal. During the more intensive earthworks and road preparation phases, five receivers located around Little Hartley may experience noise levels in the ‘highly noise affected’ range (greater than 75 dB(A)). Environmental safeguards and mitigation measures have been outlined in the REF. If construction activities are required outside normal working hours, it is likely to result in NMLs being exceeded at several locations. The closest receivers would experience noise levels in excess of the night time NML and sleep disturbance criterion. Management of work outside normal working hours would be addressed via the Construction Noise and Vibration Management Plan.

An estimated increase of around 0.5 dB(A) in operational road traffic noise is expected between 2013 (existing) and 2016 (year of opening). This is due to traffic growth over this time, and not related to any changes in the alignment. This increase is below the 2 dB(A) threshold and hence further consideration of mitigation is not required.

**Justification and conclusion**

The proposal as described in the REF best meets the proposal objectives in terms of improving safety and travel efficiency for this stretch of highway. This is achieved by improving the alignment, upgrading intersections, improving access to the highway and installing safety furniture. The proposal is also sensitive to the area’s natural environment, heritage and local communities.
This REF is based on thorough technical investigations that have examined, and taken into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the proposal. These investigations have enabled Roads and Maritime to avoid or reduce a number of potential environmental impacts that would otherwise have occurred.

Nevertheless, the proposal would still result in some impacts. These would include property acquisitions, noise and vibration impacts, temporary disruptions to traffic flow and access, impacts on biodiversity and an increase in the downstream peak flow rate in some areas surrounding the proposal.

However, the proposal would not have a significant impact on the environment and therefore an environmental impact statement and assessment under Part 5.1 of the EP&A Act is not required. This REF has also found there would be no significant impacts on matters of national environmental significance or the environment of Commonwealth land.

Roads and Maritime has developed a range of measures to minimise and mitigate these potential adverse impacts, and these are summarised in this REF.

In conclusion, this REF finds that the adverse impacts of the proposal would be outweighed by the longer-term community benefits of improved traffic flow, reduced congestion and improved safety for all road users.

On balance, the proposal is therefore considered justified.

**Display of the review of environmental factors**

This review of environmental factors is on display for comment between 25 November 2013 and 7 February 2014. You can access the documents in the following ways:

**Internet**


**Display**

The review documents can be viewed at the following locations:

- **Lithgow City Council**
  180 Mort Street
  Lithgow NSW 2790
  Open weekdays 8.15am to 4pm

- **Hartley Valley Lolly Shop**
  2297 Great Western Highway
  Little Hartley NSW 2790
  Open weekdays 10am to 4pm
  Weekends 8.30am to 5pm
• **Blue Mountains City Council**  
  2-6 Civic Place  
  Katoomba NSW 2780  
  Open 8.30am to 5pm

• **Mount Victoria General Store and Newsagency**  
  109 Great Western Highway  
  Mount Victoria NSW 2786  
  Open weekdays 7am to 6pm  
  Weekends 7am to 5pm

**Purchase**

The review documents are available for purchase in hard copy ($25.00) or CD ($10.00) by contacting the Katoomba to Lithgow project team on 1800 035 733.

**How can I make a submission?**

To make a submission on the proposal, please send your written comments to:

K2L Great Western Highway upgrade  
PO Box 1406, Lane Cove NSW 1595  
K2Lupgrade@rms.nsw.gov.au

Submissions must be received by close of business, 7 February 2014.

**Privacy information**

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

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

The supply of this information is voluntary. Each respondent has free access at all times to the information provided by that respondent but not to any identifying information provided by other respondents if a respondent has indicated that the representation should be kept confidential.

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

The information will be held by the Katoomba to Lithgow project team at Level 4, 460 Pacific Highway, St Leonards, NSW 2065.

**What happens next?**

Following the submissions period, Roads and Maritime will collate submissions. Acknowledgement letters will be sent to each respondent. The details of submission authors will be retained and authors will be subsequently advised when project information is released.
After consideration of community comments Roads and Maritime will determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are necessary. The community will be kept informed regarding Roads and Maritime’s determination.

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

If you have any queries, please contact the project information line on 1800 035 733 (toll free).
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- Appendix B  Stakeholder consultation
- Appendix C  Biodiversity technical report
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- Appendix I  Aboriginal heritage clearance letter
1 Introduction

This chapter provides an overview of the proposal and outlines the purpose of this report.

1.1 Proposal identification

1.1.1 The proposal

The Great Western Highway is the major arterial road linking the Sydney metropolitan area to the Blue Mountains, Lithgow, Bathurst and other regional centres in the Central West region of New South Wales. The highway serves as:

- A key freight route between Sydney and the Central West region, including the timber industry in the Oberon area.
- A tourist route serving destinations such as the Blue Mountains, historic Hartley, Jenolan Caves, Mudgee and Bathurst.
- A connection between many towns and villages.

Roads and Maritime Services is currently upgrading sections of the Great Western Highway between Lapstone and Lithgow.

As part of the upgrade program, Roads and Maritime proposes to carry out safety upgrades along the highway through Hartley Valley in the Blue Mountains, New South Wales. As shown in Figure 1-1 this section extends about 7.8 kilometres between the base of Victoria Pass and the base of River Lett Hill (in this report, this is referred to as 'the proposal').

The proposal does not represent a major upgrade, but rather localised safety work. An overview of the proposal is provided in Figure 1-2. The proposal is also described in further detail in Chapter 3. The key elements of the proposal include:

- Increasing the design speed of this section of the highway from generally 80 km/hr to 90 km/h.
- Road widening of about two to six metres to provide 3.5 metre wide lanes and shoulders.
- Constructing five new culverts and upgrade of pavement drainage.
- Upgrading nine intersections by providing or extending dedicated right turn lanes and adjusting the vertical and horizontal alignment to tie in to the existing highway.
- Improving the road surface by providing new pavement along the length of the highway except between Carroll Drive and about 300 metres east of Mid Hartley Road.
- Constructing four retaining walls, ranging from 1.7 to 7.5 metres in height and from 53 to 200 metres in length.
- Temporary construction ancillary facilities, including construction compounds, stockpile sites and erosion and sedimentation measures.

1.1.2 Timeframe and cost estimate

Roads and Maritime estimates that the proposal would take about 24 months to construct, with construction expected to start in late 2014. Roads and Maritime would stage construction to minimise overall impacts on vehicles that use the Great Western Highway and on nearby residents and businesses.
The proposal would cost about $40 million to construct. The Australian and NSW governments would jointly fund the proposal as part of the Great Western Highway upgrade program.

1.1.3 Terms used in this report
The following terms are used in this review of environmental factors (REF):

- ‘The highway’ refers to the Great Western Highway.
- ‘The proposal’ refers to the concept design of a section of the Great Western Highway through Hartley Valley in the Blue Mountains NSW.
- ‘The proposal area’ refers to the area that would be directly impacted by the proposal. It encompasses the concept road design, batters, cuts and embankments. It also includes the total construction footprint, compound sites, stockpile sites and any other areas that would be temporarily disturbed (such as construction basins and access tracks).
- ‘The construction footprint’ refers to the area that would be affected by construction of the proposal, assumed to be an area with a five-metre buffer from all design elements and known ancillary facilities.
- ‘The study area’ encompasses the proposal area and the area that may be indirectly impacted by the proposal.

1.1.4 The locality
As shown in Figure 1-1, the proposal area is located within the Hartley Valley, within the Lithgow local government area (LGA). The area includes:

- Natural features such as Hassans Walls Reserve to the north of the proposal and the Blue Mountains National Park and the Greater Blue Mountains World Heritage Area about 12 kilometres to the east (refer to Figure 1-1).
- A variety of land uses such as residential and rural residential villages, agriculture and tourist attractions (however, the area is predominantly rural).
- A number of small settlements next to the Great Western Highway; many properties have direct access to the highway.
- A number of heritage items listed on the State Heritage Register and the Lithgow City Local Environment Plan.
- A variety of vegetation types, including remnant native vegetation patches, and cleared and modified land.
- The River Lett, which drains into the Coxs River, about three kilometres downstream of the Great Western Highway (these rivers are within the Sydney Drinking Water Catchment). A number of creeks and tributaries feed the River Lett near the study area including Blackmans Creek, Butlers Creek, Boxes Creek, Finnigans Creek and other smaller tributaries. Three waterways cross the proposal, including a tributary of Butlers Creek, the River Lett and Boxes Creek.
FIGURE 1-1 | REGIONAL CONTEXT

HARTLEY VALLEY SAFETY UPGRADE - Review of environmental factors
FIGURE 1-2 | HARTLEY VALLEY SAFETY UPGRADE PROPOSAL

HARTLEY VALLEY SAFETY UPGRADE - Review of environmental factors

LEGEND
- The proposal
- Existing highway
- Primary waterway
- Minor waterway
- Property boundary

DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001

Sinclair Knight Merz does not warrant that this document is definitive nor free of error and does not accept liability for any loss caused or arising from reliance upon information provided herein.
1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Sinclair Knight Merz (SKM) on behalf of Roads and Maritime Western Region. For the purposes of these works, Roads and Maritime is the proponent and the determining authority under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

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

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

Roads and Maritime will consider the findings of the REF when assessing:

- Whether the proposal is likely to have a significant impact on the environment and, therefore, whether an environmental impact statement will be required, and approval sought, from the Minister for Planning and Infrastructure under Part 5.1 of the EP&A Act.
- The significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in section 5A of the EP&A Act and, therefore, the requirement for a Species Impact Statement.
- The potential for the proposal to significantly impact a matter of national environmental significance or Commonwealth land, and the need to make a referral to the Australian Government Department of the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.
2 Need and options considered

This chapter describes the need for the proposal and the alternatives that were considered in the selection of the preferred option.

2.1 Strategic need for the proposal

The Great Western Highway is the principal road connecting the Central West region of NSW, the Blue Mountains and Sydney. The highway is an important freight transport corridor and is also used by thousands of road users each day travelling between Sydney and the towns and villages in the Central West. The highway provides a vital connection to many popular tourist destinations within the region and, further west, to towns such as Oberon, Mudgee, Orange and Bathurst.

Within this context, the proposal is required in order to:

- Cater for existing and future traffic flows.
- Improve safety on the highway by reducing the crash rate.
- Support freight and tourism services that use the highway.
- Support connectivity between local and regional areas.

2.1.1 Strategic planning and policy framework

A number of Commonwealth and State strategic plans refer to the significance of the Great Western Highway and the need to improve its safety and efficiency. The proposal is consistent with these strategic plans, which include:

- NSW 2021: A plan to make NSW number one (NSW Government 2011). NSW 2021 has identified a number of goals to improve the transport network. The goals of reducing travel times and improving road safety are relevant to the proposal. The proposal is consistent with NSW 2021 as it would help to meet these goals by upgrading a State Highway in the Central West to provide adequate road capacity for projected population growth and would improve road safety.

- NSW Government State Infrastructure Strategy (2012-2032) (NSW Department of Premier and Cabinet, 2012). The Great Western Highway is identified as the main road freight corridor connecting Western NSW with Sydney and its ports. The Strategy identifies that the Great Western Highway suffers from constraints that limit freight movement, particularly for longer vehicles. The proposal is consistent with the Strategy as it would provide improved facilities for the movement of freight between Western NSW and Sydney.

- Sydney–Dubbo Corridor Strategy (Auslink, 2007). The strategic priorities of addressing crash risks, maintaining road pavements in a safe and efficient condition and managing operational flexibility for freight in the Blue Mountains are considered consistent with the objectives of the Hartley Valley safety upgrade proposal (refer to Section 2.3).

- National Road Safety Strategy 2011–2020 (Australian Transport Council, 2011). The key targets identified within the Strategy focus on the reduction of casualties from road crashes. The key targets are considered consistent with the objectives of the Mount Victoria to Lithgow upgrade program (refer to Section 2.3) and the anticipated outcomes of the proposal.
• Central West Transport Needs Study (SKM, 2009). A major finding of the report was the identification of the improvement of the Great Western Highway between Mount Victoria and Lithgow as a short term (2009–2015) candidate project for progression. This is consistent with the proposal which would improve the existing Great Western Highway at Hartley Valley.

2.1.2 Great Western Highway upgrade program

The Australian and NSW governments are jointly funding the Great Western Highway upgrade program. The aim of the program is to improve travel times for freight transport and provide a safer environment for all road users.

Currently, 16 projects have either been completed or are in progress between Lapstone and Lithgow. The completed projects have led to faster travel for motorists and a safer road environment for all motorists, pedestrians and cyclists. These improvements support the position of the Australian and NSW governments to continue to upgrade the highway, including the section through Hartley Valley, which is the subject of this report.

Mount Victoria to Lithgow upgrade project

As part of the Great Western Highway upgrade program, Roads and Maritime proposes to upgrade the section of highway between Mount Victoria and Lithgow to improve road safety and accessibility to communities in the Blue Mountains and Central West.

The Australian and NSW governments committed $250 million to the upgrade. Since 2007, Roads and Maritime has been investigating the area between Mount Victoria and Lithgow to determine the preferred route for the upgrade. A preferred route was announced in May 2010, and a concept design was displayed in 2011–12.

NSW Government independent review

In September 2011, the NSW Government engaged Evans and Peck to carry out an independent review of the proposed upgrades of the Great Western Highway west of Katoomba. The review was initiated following concerns raised by some community members about environmental, cultural, social and economic impacts of the upgrade and to ensure that the best value for money would be obtained from the investment. The report of the independent review was released in January 2012.

In July 2012, the NSW and Australian governments announced a revised package of upgrades for the highway between Katoomba and Lithgow to address the recommendations of the independent review. The government investment remained at $250 million.

The revised package of upgrades will enhance safety and target specific deficiencies along the highway. Roads and Maritime will manage and deliver the upgrades between Mount Victoria and Lithgow, with work due to be completed by mid-2016.

Enhanced safety works program

The independent review recommended additional highway safety improvements between Mount Victoria and Lithgow, including at Mount Victoria Village, Little Hartley, Hartley, River Lett Hill and Forty Bends. This ‘enhanced safety works program’ includes existing commitments such as the completed work at the top and bottom curves of Victoria Pass.
The purpose of the enhanced safety works program is to provide medium-term safety improvements throughout the corridor between Mount Victoria and Lithgow and provide the most effective use of currently available funding. These improvements were documented in the Mount Victoria to Lithgow Safety Review (NSW Centre for Road Safety, October 2010). The report identified key road safety measures required along the whole highway, including signage, delineation, line marking, junction treatments, road alignment, shoulder widening, safety barriers, clear zones, speed enforcement, and safe pedestrian and cycling facilities.

Roads and Maritime is currently undertaking the design development and environmental assessment of the enhanced safety works program through Hartley Valley. The environmental assessment for this program is documented in this REF.

2.1.3 Traffic flows and crash data

Traffic flows

During May 2011, daily traffic on the Great Western Highway through Hartley Valley was between about 9000 (Hartley) and 10,400 (Little Hartley) vehicles (two way); this annual average daily traffic (AADT) was calculated using automatic tube counts. Between 14.5 per cent (Little Hartley) and 16.7 per cent (Hartley) of these vehicles were classified as heavy vehicles.

The recorded two-way traffic volumes on the local connecting roads were substantially lower, with about 700 vehicles per day on Coxs River Road, 1600 vehicles per day on Jenolan Caves Road, 1200 vehicles per day on Browns Gap Road and less than 200 vehicles per day on Mid-Hartley Road.

Based on traffic surveys and growth predictions, Roads and Maritime has adopted a linear traffic growth rate of 1.7 per cent per annum for light vehicles and 1.3 per cent per annum for heavy vehicles on the highway through Hartley Valley. The forecast two-way traffic volumes are:

- Between about 9700 vehicles per day (Hartley) and 11,200 (Little Hartley) in 2016.
- Between about 11,200 vehicles per day (Hartley) and 13,000 (Little Hartley) in 2026.

The forecast two-way traffic flows on local roads are:

- Coxs River Road: About 750 vehicles per day (in 2016) and 780 (in 2026).
- Jenolan Caves Road: About 1000 vehicles per day (in 2016) and 1100 (in 2026).
- Browns Gap Road: About 1700 vehicles per day (in 2016) and 1800 (in 2026).
- Mid-Hartley Road: About 170 vehicles per day (in 2016) and 180 (in 2026).

Level of service

Existing levels of service (LoS) on the highway are generally LoS B. LoS is a qualitative measure used to describe the potential for delay due to traffic, usually in peak demand situations. LoS ranges from A to F, where LoS A indicates free-flowing traffic and LoS F indicates congested traffic.

Crash data

Police reported 217 crashes over the section of the Great Western Highway between Mount Victoria and Lithgow (including the section subject to this proposal) in the five years from 2008 to 2012. The incidence of crashes for the highway between Mount Victoria and Lithgow is about three and a half times higher than the State Plan target,
and up to 50 per cent higher than the State average of 30.4 per 100 million vehicle kilometres travelled (MVKT) for a two-lane two-way road (RTA, 2008a). For the section of the highway relevant to the proposal, 129 crashes were reported between 2008 and 2012 (refer to Section 6.9.1). The proposal aims to improve these crash rates by:

- Providing protected deceleration lanes at key intersections, including at Ambermere Drive and Coxs River Road.
- Improving horizontal and vertical alignment to provide more consistent driving conditions.
- Providing consistent, widened road shoulders for improved safety for road users.
- Widening road shoulders next to property accesses to improve access to and from the highway.

2.2 Existing road and infrastructure

2.2.1 Great Western Highway

The Great Western Highway through Hartley Valley is a classified State Highway. It is an important link in the regional road network and a key freight transport link over the Blue Mountains. The existing road was constructed during the late 1950s to early 1960s. Key elements of this highway section are listed in Table 2-1.

Table 2-1 Key elements of the existing highway through Hartley Valley

<table>
<thead>
<tr>
<th>Key element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed limit</td>
<td>• 80 km/h.</td>
</tr>
<tr>
<td>Vertical alignment</td>
<td>• Generally undulating with a maximum grade of 6%.</td>
</tr>
<tr>
<td>Length</td>
<td>• 7.8 km.</td>
</tr>
<tr>
<td>Road width</td>
<td>• 2-lane, mainly undivided two-way carriageway.</td>
</tr>
<tr>
<td></td>
<td>• Lanes: 3.5 m wide.</td>
</tr>
<tr>
<td></td>
<td>• Road shoulder: ranging between 0.5 m and 2 m wide.</td>
</tr>
<tr>
<td></td>
<td>• Overtaking lanes at three locations along the highway (at the base of Victoria Pass, between Mid-Hartley Road and Hartley Historic Site and at the base of River Lett Hill).</td>
</tr>
<tr>
<td>Bridge</td>
<td>• 2-lane bridge, located over the River Lett.</td>
</tr>
<tr>
<td>Residential access</td>
<td>• 28 properties have direct access onto the highway.</td>
</tr>
<tr>
<td></td>
<td>• No formal refuges for cars are provided along the highway.</td>
</tr>
<tr>
<td>Local roads which intersect with the highway</td>
<td>• Ambermere Road.</td>
</tr>
<tr>
<td></td>
<td>• Coxs River Road.</td>
</tr>
<tr>
<td></td>
<td>• Baaners Lane.</td>
</tr>
<tr>
<td></td>
<td>• Browns Gap Road.</td>
</tr>
<tr>
<td></td>
<td>• Mid Hartley Road.</td>
</tr>
<tr>
<td></td>
<td>• Carroll Drive.</td>
</tr>
<tr>
<td></td>
<td>• Old Bathurst Road.</td>
</tr>
<tr>
<td></td>
<td>• Kelly Street.</td>
</tr>
<tr>
<td></td>
<td>• Jenolan Caves Road.</td>
</tr>
<tr>
<td></td>
<td>• Blackmans Creek Road.</td>
</tr>
<tr>
<td>Safety barriers</td>
<td>• W-Beam barriers are used intermittently along the highway predominantly on the eastbound carriageway.</td>
</tr>
<tr>
<td></td>
<td>• A Type F concrete safety barrier is used in the median to divide the carriageway around the Hartley Historic Site curve.</td>
</tr>
<tr>
<td>Retaining walls and cuttings</td>
<td>Major cuttings are located at:</td>
</tr>
<tr>
<td></td>
<td>• The inner bend directly east of the Hartley Historic Site.</td>
</tr>
<tr>
<td></td>
<td>• Directly east of the Log Cabin Farmhouse (the Lolly Shop).</td>
</tr>
<tr>
<td>Key element</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>There are no retaining walls along the highway in the proposal area.</td>
</tr>
<tr>
<td>Bus stops</td>
<td>• One formal bus stop is provided along the highway at Ambermere drive. This consists of a bus shelter and a gravelled area where the bus would pull over.</td>
</tr>
<tr>
<td></td>
<td>• There are informal pull-over areas on the highway shoulder next to side roads at Baaners Lane and Jenolan Caves Road.</td>
</tr>
</tbody>
</table>

Examples of the existing highway design are shown in Photo 2-1 and Photo 2-2.

Photo 2-1 The highway at Hartley Valley, showing narrow shoulders
2.2.2 Drainage culverts

Culverts along the highway within the proposal area are listed in Table 2-2. Culverts crossing property access and local roads are listed in Table 2-3.

Table 2-2 Drainage culverts within the proposal area

<table>
<thead>
<tr>
<th>Ref ID</th>
<th>Chainage</th>
<th>Structure ID</th>
<th>Crossing type</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20300</td>
<td>CE20300</td>
<td>Cross</td>
<td>1 x 750 mm RCP and 1 x 450 mm RCP</td>
</tr>
<tr>
<td>2</td>
<td>20470</td>
<td>CE20470</td>
<td>Cross</td>
<td>1 x 450 mm RCP</td>
</tr>
<tr>
<td>3</td>
<td>20630</td>
<td>CE20630</td>
<td>Cross</td>
<td>1 x 300 mm RCP</td>
</tr>
<tr>
<td>4</td>
<td>20820</td>
<td>CE20820</td>
<td>Cross – Tributary of Butlers Creek (existing HEC-RAS)</td>
<td>2 x 3.6 m x 2.4 m RCBC</td>
</tr>
<tr>
<td>5</td>
<td>20980</td>
<td>CE20980</td>
<td>Cross</td>
<td>1 x 450 mm RCP</td>
</tr>
<tr>
<td>6</td>
<td>21260</td>
<td>CE21260</td>
<td>Cross</td>
<td>1 x 750 mm RCP</td>
</tr>
<tr>
<td>7</td>
<td>21330</td>
<td>CE21330</td>
<td>Cross</td>
<td>1 x 750 mm RCP</td>
</tr>
<tr>
<td>8</td>
<td>21560</td>
<td>CE21560</td>
<td>Cross</td>
<td>1 x 600 mm RCP</td>
</tr>
<tr>
<td>9</td>
<td>21820</td>
<td>CE21820</td>
<td>Cross</td>
<td>1 x 600 mm RCP</td>
</tr>
<tr>
<td>10</td>
<td>22070</td>
<td>CE22070</td>
<td>Cross</td>
<td>1 x 450 mm RCP</td>
</tr>
<tr>
<td>11</td>
<td>22260</td>
<td>CE22260</td>
<td>Cross</td>
<td>1 x 450 mm RCP</td>
</tr>
<tr>
<td>12</td>
<td>22620</td>
<td>CE22620</td>
<td>Cross</td>
<td>1 x 450 mm RCP</td>
</tr>
</tbody>
</table>
### Table 2-3 Existing cross drainage under local roads and property accesses

<table>
<thead>
<tr>
<th>Ref ID</th>
<th>Chainage</th>
<th>Structure ID</th>
<th>Crossing type</th>
<th>Existing structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23090</td>
<td>CE23090-LocRd</td>
<td>Local road</td>
<td>1 x 450mm RCP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Baaners Lane)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>24860</td>
<td>CE24860-PropAcc</td>
<td>Property access</td>
<td>1 x 450mm RCP</td>
</tr>
<tr>
<td>3</td>
<td>24890</td>
<td>CE24890-LocRd</td>
<td>Local road</td>
<td>1 x 450mm RCP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Mid Hartley Road)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>24900</td>
<td>CE24900-PropAcc</td>
<td>Property access</td>
<td>1 x 450mm RCP</td>
</tr>
<tr>
<td>5</td>
<td>25130</td>
<td>CE25130-PropAcc</td>
<td>Property access</td>
<td>1 x 375mm RCP</td>
</tr>
<tr>
<td>6</td>
<td>26440</td>
<td>CE26440-LocRd80</td>
<td>Local road</td>
<td>1 x 450mm RCP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Old Bathurst Road)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>26520</td>
<td>CE26520-LocRd170</td>
<td>Local road</td>
<td>1 x 450mm RCP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Old Bathurst Road)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- RCP: reinforced concrete pipe
- RCBC: reinforced concrete box culvert
- HEC-RAS: Hydrologic Engineering Centres River Analysis System, a hydraulic model used to simulate the hydraulics of water flow through natural rivers and other channels.
- XP-RAFTS: Hydrological modelling software used to simulate the transformation of rainfall into run-off.
### Table 2-4 Intersections in the proposal area

<table>
<thead>
<tr>
<th>No</th>
<th>Intersection</th>
<th>Intersection treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ambermere Drive</td>
<td>Give way/ priority for vehicles on the highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated left turn from the highway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated right turn from the highway.</td>
</tr>
<tr>
<td>2</td>
<td>Coxs River Road</td>
<td>Give way/ priority for vehicles on the highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated left turn from the highway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated right turn from the highway.</td>
</tr>
<tr>
<td>3</td>
<td>Baaners Lane</td>
<td>Give way/ priority for vehicles on the highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated right turn from the highway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated left turn from the highway.</td>
</tr>
<tr>
<td>4</td>
<td>Browns Gap Road</td>
<td>Give way/ priority for vehicles on the highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated right turn lane from the highway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated left turn from the highway.</td>
</tr>
<tr>
<td>5</td>
<td>Mid Hartley Road</td>
<td>Give way/ priority for vehicles on the highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated right turn from the highway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated left turn from the highway.</td>
</tr>
<tr>
<td>6</td>
<td>Carroll Drive</td>
<td>Give way/ priority for vehicles on the highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated left turn lane from the highway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated right hand turn from the highway.</td>
</tr>
<tr>
<td>7</td>
<td>Old Bathurst Road</td>
<td>Give way/ priority for vehicles on the highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated left turn lane from the highway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Acceleration lane from the Old Bathurst Road, onto the highway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated right turn from the highway.</td>
</tr>
<tr>
<td>8</td>
<td>Kelly Street</td>
<td>Give way/ priority for vehicles on the highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated right turn lane from the highway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Basic left turn from the highway.</td>
</tr>
<tr>
<td>9</td>
<td>Jenolan Caves Road/ Blackmans Creek Road</td>
<td>Give way/ priority for vehicles on the highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated left and right turns from the highway for both roads.</td>
</tr>
</tbody>
</table>

Notes: RCP: reinforced concrete pipe  
RCBC: reinforced concrete box culvert

2.2.3 Local roads and intersections

The Great Western Highway intersects with 10 local roads within the proposal area. All vehicle movements are permitted at all intersections. These intersections do not have traffic signals; however, some of them have protected and dedicated turning lanes to avoid through-traffic having to wait for cars to turn off the highway. A description of each intersection is provided in Table 2-4.

Most of these roads are narrow, unmarked two-way undivided roads that are typically only used for access to private properties along these roads. The exceptions are Coxs River Road, which provides a connection to Jenolan Caves Road; Browns Gap...
Road, which provides access to Hartley Valley and across Hassans Walls to Lithgow; and Jenolan Caves Road, which provides access to the Jenolan Caves and Oberon and is an important tourist and heavy vehicle route. These three roads have line markings and are signposted for 80, 100 and 80 km/h respectively. In addition, Ambermere Drive and Baaners Lane are signposted 60 km/h and Mid Hartley Road is signposted at 80 km/h. The remaining roads in the study area are not signposted for speed but would have a speed limit of 50 km/h consistent with Lithgow City Council requirements.

All of the local roads within the proposal area have low traffic volumes as outlined in Section 2.1.3.

2.3 Proposal objectives

The objectives of the proposal are to:

- Improve road safety for all road users along the Great Western Highway through Hartley Valley.
- Cater for the mix of through, local and tourist traffic, including pedestrians and cyclists.
- Be sensitive to the area’s natural environment, heritage and local communities.

These objectives have been refined during the project development process to ensure they are relevant and will guide the development of an appropriate safety solution. The objectives are also consistent with the objectives for the overall Mount Victoria to Lithgow project, which are to:

- Improve road safety.
- Improve freight efficiency.
- Cater for the mix of through, local and tourist traffic.
- Be sensitive to the area’s natural environment, heritage and local communities.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of options

In 2012, following the identification of the need for the proposal, Roads and Maritime developed various strategic options while incorporating community feedback from safety reviews carried out in 2011. These options involved improving the existing road alignment between the bottom curve of Victoria Pass and the eastern extent of the proposed Forty Bends upgrade, which encompasses this proposal. These options included the ‘do-nothing’ option and three alternative safety upgrade options.

The Hartley Valley safety upgrade Feasibility Report (Roads and Maritime, 2012a) provides further detail and discussion on these options. The options, and the selection of the preferred option, are outlined in the following sections.

The design options were reviewed at a technical review workshop in July 2012 (attended by representatives from Roads and Maritime and the Mount Victoria to Lithgow Alliance). The purpose of this workshop was to review the options within the context of the proposal objectives and various technical/ environmental constraints, as the basis for recommending a preferred option. The proposal objectives are outlined in Section 2.3. The technical and environmental constraints considered during the review workshop included:
• Design considerations.
• Drainage design.
• Utilities.
• Aboriginal and non-Aboriginal heritage.
• Impacts to water, including groundwater.
• Contaminated land risks.
• Noise impacts.
• Implications for nearby land use.

The review included consideration of the outcomes of community consultation carried out in 2011.

Each option was assessed against the proposal objectives. The preferred option was selected based on the evaluation of all options against the proposal objectives.

2.4.2 Identified options

Roads and Maritime assessed the do-nothing option and three design options (labelled A, B and C), including various sub-options, for the section of the Great Western Highway between the bottom curve of Victoria Pass and the eastern extent of the proposed Forty Bends upgrade. Sub-options were also considered for the treatment of the curve next to the intersection of Old Bathurst Road at Hartley Historic Site and these are summarised below.

Do-nothing option

This option would involve no change to the current highway alignment.

Option A

The key features of Option A are:

• A design speed of 90 km/h between the bottom curve of Victoria Pass (chainage 20200) and the Hartley Historic Site curve (chainage 26300).
• A design speed of 80 km/h through Hartley Historic Site curve (from chainage 26045 to chainage 26395).
• A design speed of 90 km/h from Hartley Historic Site Curve (chainage 26395) to bottom of River Lett Hill (chainage 27970).
• Widened shoulders and retention of the existing horizontal alignment.
• The vertical alignment would be adjusted in two locations to improve sight distance at:
  - Browns Gap Road: The crest opposite the Browns Gap Road would be reduced in height by about 1.2 metres.
  - Nioka (about chainage 21140): The crest opposite Nioka would be reduced in height by about one metre.

Two sub-options for Option A were considered for the treatment of the curve next to the intersection with Old Bathurst Road at Hartley Historic Site:

• Sub-option 1: This sub-option would retain the existing geometry of the road and would achieve a design speed of 65 km/h. While road shoulders would be widened, sight distance would remain restricted by the central barrier and the cut slope on the southern side of the road.
• Sub-option 2: This sub-option is based on a design speed of 80 km/h. This would involve realigning the curve resulting in substantial land acquisition, earthworks, environmental impacts and costs. The use of retaining walls was included to reduce potential property acquisition and environmental impacts.

Two feasible sub-options were identified for the treatment of the Jenolan Caves Road intersection. The sub-options considered were:

• Sub-option 1: This would include an eastbound acceleration lane for vehicles turning right from Jenolan Caves Road onto the Great Western Highway, to enable a safer merge. The acceleration lane would be created by resuming the right-turn lane for traffic turning from the Great Western Highway into Blackmans Creek Road. As a consequence, right turns into or out of Blackmans Creek Road would be banned and served by a remote U-turn bay in Jenolan Caves Road. Right-turning traffic entering or leaving Blackmans Creek Road would need to cross the highway to complete the manoeuvre.

• Sub-option 2: The existing road alignment of Jenolan Caves Road intersection would be retained. The diverge point from one to two lanes for westbound traffic on the highway would be moved to the west of the intersection to reduce the number of potential traffic manoeuvres occurring at the intersection. The existing dedicated right-turn and dedicated left-turn treatments would be retained in the design. The right turn lane would be extended to provide additional deceleration length for heavy vehicles turning into Jenolan Caves Road on the downhill grade.

Option B

Option B is the same as Option A except for the design speed of the section between the bottom curve of Victoria Pass and Hartley Historic Site curve, which is 80 km/h under Option B (90 km/h under Option A).

This option would involve widening the shoulders of the highway along the length of the proposal to improve sight distance. The vertical and horizontal alignment of the highway would not be adjusted.

Option C

Option C is the same as Option A except for the design speed of the section between the bottom curve of Victoria Pass and Hartley Historic Site curve, which is 100 km/h under Option C (90 km/h under Option A).

To achieve a higher design speed, Option C would involve substantial and major change to the highway horizontal alignment and vertical alignment for much of the length of the highway within the proposal area.

2.4.3 Analysis of options

The do-nothing option would not address the strategic need (refer to Section 2.1), would not address the recommendations of the independent review by Evans and Peck, and would not fulfil the proposal objectives. This option was therefore discounted.

On the basis of the review workshop in July 2012, Option A was identified as the preferred option as the 90 km/h design speed would provide the best overall outcomes with respect to speed, sight distances, property impacts, environmental impacts and cost.
Compared to Option B, Option A would result in:

- A higher speed environment which would improve traffic flow.
- Increased sight distances, therefore improving road safety.
- Limited additional property and environmental impact.
- Similar cost.

To achieve a higher design speed, Option C would involve substantial and major change to the highway horizontal alignment and vertical alignment for much of the length of the highway within the proposal area. These alignment changes would result in substantial environmental, social and heritage impacts. For example, the curve at Hartley Historic Site would require adjustment which would result in an impact to state listed heritage and National Parks and Wildlife Services land (requiring an Act of Parliament to revoke). In addition, application of Option C would require a substantial amount of property acquisition. Since, the ultimate alignment for the Mount Victoria to Lithgow Great Western Highway upgrade would bypass this section, adopting Option C would exacerbate the overall impacts associated with the upgrade of the highway in the long term. For these reasons, Option C was discounted.

In summary, compared to Option C, Option A would result in:

- Less property impacts.
- Less environmental impacts.
- Retention of the existing concrete pavement.
- Lower cost.

**Treatment of Hartley Historic Site curve**

Although sub-option 1 would not improve the speed characteristics of the curve, the new pavement surface and shape would improve grip and control for drivers. However, sight distance would remain restricted by the central barrier and the cut slope on the southern side of the road. Compared to sub-option 1, sub-option 2 would result in:

- Improved horizontal alignment of the curve.
- A higher speed environment which would improve traffic flow.

To minimise property and environmental impacts as a result of realigning the curve, retaining walls were used. On this basis, sub-option 2 was selected as the preferred option.

**Treatment of Jenolan Caves Road/Blackmans Creek Road intersection**

Sub-option 1 consists of providing an acceleration lane which would be created by resuming the right-turn lane for traffic turning from the Great Western Highway into Blackmans Creek Road. The introduction of the additional requirement to cross the highway (as described above) was considered an undesirable outcome for a safety improvement. It was also considered that some drivers would not comply with the turning restrictions associated with this sub-option, which would result in illegal and potentially unsafe manoeuvres at the intersection. In addition, there was insufficient room in the road reserve to achieve the required length for an acceleration lane, and accordingly a large embankment would have been required. For these reasons, sub-option 1 was discounted.

Compared to sub-option 1, sub-option 2 would result in:
- Reduced number of traffic manoeuvres occurring at the intersection.
- Additional deceleration lane length for heavy vehicles turning into Jenolan Caves Road.

As sub-option 2 performed best overall, this option was selected as the preferred option.

2.5 Preferred option

Roads and Maritime has selected Option A, with sub-option 2 for Hartley Historic Site Curve and sub-option 2 for Jenolan Caves Road/Blackmans Creek Road intersection, as the preferred option for the Hartley Valley safety upgrade. This option responds to the intent of the enhanced safety works program, the proposal objectives and the issues raised by the Hartley Valley communities. The preferred option would:

- Help to meet the broader objective for improving safety and reducing the crash rate on the Great Western Highway between Mount Victoria and Lithgow (which includes the section assessed in this proposal).
- Improve traffic flows.
- Cater for the predicted traffic growth expected over the next 20 years.
- Provide a solution that represents value for money and is able to accommodate planned developments in the area.
- Enhance the unique visual and heritage qualities of the valley.

The design options were publicly displayed in October 2012 (refer to Section 5.2). As a result of the issues and concerns raised by the community and further technical investigations, the concept design for the proposal was further refined. These design refinements are outlined in Section 2.6.

2.6 Design refinements

The design refinements made during the design process include the addition of retaining walls throughout the proposal to limit property and environmental impact. The retaining walls are located at:

- Chainage 25740 to chainage 25850.
- Chainage 25917 to chainage 25970.
- Chainage 26015 to chainage 26105.
- Chainage 26300 to chainage 26500.

A potential retaining wall may be located between chainage 26130 and 26220. Further detail on these retaining walls is provided in Section 3.2.3.

2.7 Conclusion

This chapter outlines the need for the proposal and the options considered to address this need. It has been substantiated that the proposal is needed to cater for the mix of traffic now and in the future, reduce crashes and support connectivity within and beyond Hartley Valley.

The next chapter presents a description of the proposal.
3 Description of the proposal

This chapter describes the proposal and provides descriptions of the design parameters and major design features, the construction method, and associated infrastructure and activities.

3.1 The proposal

Roads and Maritime is proposing to carry out a safety upgrade along a section of the Great Western Highway through Hartley Valley in the Blue Mountains. The proposed safety upgrade (the proposal) would occur between the base of Victoria Pass (chainage 20200) and the base of River Lett Hill (chainage 27970). Line marking on the existing pavement to extend the overtaking lane from chainage 27640 to 27970 would also be included. This is a total distance of about 7.8 kilometres.

The concept design is based on the available information and current design standards and criteria for the overall Great Western Highway upgrade program, which Roads and Maritime is currently undertaking. Some elements of the design may be further refined during detailed design. The main features of the proposal are listed in Table 3-1.

Table 3-1 Main features of the proposal

<table>
<thead>
<tr>
<th>Main feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design speed</td>
<td>90 km/h design speed along the length of the proposal, except at the Hartley Historic Site curve, where the design speed would be 80 km/h.</td>
</tr>
<tr>
<td>Road width</td>
<td>Carriageway would be widened up to 6 m to enable:</td>
</tr>
<tr>
<td></td>
<td>- Through lanes: 3.5 m wide.</td>
</tr>
<tr>
<td></td>
<td>- Shoulders: Minimum 2 m wide (3 m wide next to property accesses) along the length of the proposal.</td>
</tr>
<tr>
<td></td>
<td>- Kerb and gutter drains at cuttings, grades greater than 5% and where drainage or safety measures are required: shallow V-shaped drains.</td>
</tr>
<tr>
<td>Vertical alignment</td>
<td>Adjustment of two crests to improve line of sight at:</td>
</tr>
<tr>
<td></td>
<td>- Browns Gap Road: The crest opposite the Browns Gap Road would be reduced in height by about 1.2 m.</td>
</tr>
<tr>
<td></td>
<td>- Nioka (about chainage 21140): The crest opposite Nioka would be reduced in height by about 1 m.</td>
</tr>
<tr>
<td>Overtaking lane</td>
<td>Existing downhill overtaking lane would be extended using line marking on existing pavement between chainage 27640 and chainage 27970.</td>
</tr>
<tr>
<td></td>
<td>Overtaking lane at Hartley Historic Site curve (chainages 26430-25940) would be shortened by 490 m to create an improved alignment in existing corridor while maintaining sufficient length in the overtaking lane.</td>
</tr>
<tr>
<td></td>
<td>Westbound overtaking lane at chainages 27150-27400 would be shortened by about 250 m. The diverge point would be moved to the west of the Jenolan Caves Road intersection to reduce the number of potential traffic manoeuvres occurring at the intersection.</td>
</tr>
<tr>
<td>Intersection upgrades</td>
<td>Coxs River Road/Ambermere Road intersection.</td>
</tr>
<tr>
<td></td>
<td>Baaners Lane intersection.</td>
</tr>
<tr>
<td></td>
<td>Browns Gap Road intersection.</td>
</tr>
<tr>
<td></td>
<td>Mid Hartley Road intersection.</td>
</tr>
<tr>
<td></td>
<td>Carroll Drive intersection.</td>
</tr>
</tbody>
</table>
An overview of the proposal showing key features is shown in Figure 3-1a to 3–1c. A detailed description of the concept design is provided below.

### 3.2 Design

The concept design was prepared to provide road geometry with a design speed of 90 km/h, more consistent intersections, and wider shoulders. The concept design is described below. It would be further refined during the detailed design phase.

#### 3.2.1 Design criteria

The concept design for the proposal was prepared in accordance with a design management system certified under AS/NZS ISO 9001:2008 Quality Management Systems. Other design guides and policies considered during the development of the proposal included:

- Austroads Guide to Road Design (Austroads, 2009) and Roads and Maritime supplements to the Austroads Guide.

The adopted design criteria are summarised in Table 3-2.

**Table 3-2 Design criteria**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design speed</td>
<td>Design speed horizontal 90 km/h.</td>
</tr>
<tr>
<td></td>
<td>Design speed vertical 90 km/h.</td>
</tr>
<tr>
<td></td>
<td>Posted speed limit 80 km/h.</td>
</tr>
<tr>
<td>Grade</td>
<td>0.5 % minimum.</td>
</tr>
<tr>
<td></td>
<td>6.0 % maximum.</td>
</tr>
<tr>
<td>Cross-section / lane width</td>
<td></td>
</tr>
<tr>
<td>Clear zones</td>
<td>The following clear zones (meaning an area next to a road that should be kept free from features that would be hazardous to vehicles should they leave the roadway) would be applied to the proposal:</td>
</tr>
<tr>
<td></td>
<td>- Minimum 5 m clear zone.</td>
</tr>
<tr>
<td></td>
<td>- Ideal 9 m clear zone where there would be no additional impact to environmental constraints.</td>
</tr>
<tr>
<td></td>
<td>A wire rope would be used in areas where the minimum clear zone of 5 m cannot be achieved.</td>
</tr>
<tr>
<td>Tie-ins</td>
<td>Great Western Highway at the base of Victoria Pass and at the end of the River Lett Hill eastbound overtaking lane.</td>
</tr>
<tr>
<td>Property access</td>
<td>Property access would be available along the length of the proposal from both directions.</td>
</tr>
<tr>
<td>Pavement</td>
<td>Preliminary pavement design comprises of between 280 mm and 340 mm asphalt over the existing subgrade.</td>
</tr>
<tr>
<td>Drainage</td>
<td>A 1 in 20 year storm event over 5 minute duration was used for all drainage calculations.</td>
</tr>
<tr>
<td>Stopping sight distance</td>
<td>126 m for cars. This allows for a reaction time of 1.5 seconds at 90 km/h design speed.</td>
</tr>
<tr>
<td>Shoulder width</td>
<td>Typically 2 m.</td>
</tr>
<tr>
<td></td>
<td>3 m at property accesses and at intersections.</td>
</tr>
<tr>
<td>Batter slope</td>
<td>Fill batter 4:1 to 2:1.</td>
</tr>
<tr>
<td></td>
<td>Cut batter 4:1 to 2:1.</td>
</tr>
</tbody>
</table>
FIGURE 3-1a I OVERVIEW OF THE DESIGN

Coxs River Rd - Ambermere Dr intersection:
- Dedicated right and left turn lanes
- Coxs River Rd realigned 55 m to the east
- Vertical levels of roads adjusted to match highway level
- Bus bays provided on both sides of the highway

Proposed stockpile and compound site

Legend:
- Proposal area
- Retaining wall
- Possible retaining wall
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Property boundary
- Design feature
- Construction activity

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DATA SOURCES:
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001
**Carroll Dr intersection**
- Extension of existing right turn lane from the highway
- Dedicated left turn from the highway
- Vertical levels of road adjusted to match highway level

**Mid Hartley Rd intersection**
- Dedicated right and left turn lanes from highway
- Bus bay located near intersection
- Vertical levels of road adjusted to match highway level

**Browns Gap Rd intersection:**
- Dedicated right and left turn lanes from the highway
- Bus bay located at intersection
- Improved vertical alignment

**Baaners Ln intersection:**
- Dedicated right and left turn lanes from the highway
- Bus bay located at intersection

**HARTLEY VALLEY SAFETY UPGRADE** - Review of environmental factors
Extend existing downhill overtaking lane using linemarking on existing pavement

Overtaking lane shortened by 250 m to reduce traffic movements at intersection

Kelly St intersection - Tie into existing vertical levels

Shorten overtaking lane to improve alignment

Old Bathurst Rd intersection - Realign Hartley Historic Site curve - Shift existing intersection 12 m to tie into realigned curve

Jenolan Caves Rd/ Blackmans Creek Rd intersection
- Retain existing turning lanes
- Westbound traffic limited to one lane
- Increased length of right turn bay into Jenolan Caves Rd
- Tie into vertical levels of highway
- The vertical level of Jenolan Caves Road would be would be adjusted to match the level of the highway
- Widen shoulders NW of intersection

LEGEND
- Proposal area
- Retaining wall
- Possible retaining wall
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Property boundary

Sinclair Knight Merz does not warrant that this document is definitive nor free of error and does not accept liability for any loss caused or arising from reliance upon information provided herein.

DATA SOURCES
- Roads and Maritime Services 2013
- LPMA 2010
- STREETWORKS 2001

Fig 3-1c I OVERVIEW OF THE DESIGN

HARTLEY VALLEY SAFETY UPGRADE - Review of environmental factors
3.2.2 Engineering constraints

The design and construction of the proposal needed to consider a number of issues and constraints. The main issues and constraints are:

- Existing natural features: These include topography on either side of the Great Western Highway, particularly at the base of Victoria Pass and around Hartley Historic Site and the River Lett.
- The existing bridge across the River Lett: This would not be upgraded as part of the proposal, but care would be required during construction to avoid indirect impacts from run-off.
- Tie-ins to the existing highway: The eastern end of the proposal ties in to the base of Victoria Pass and the western end to the eastern extent of the bottom of River Lett Hill.
- The presence of utilities infrastructure: These include electricity, telecommunications and water services, which may need to be moved.
- Access: Residents and businesses would need to access their premises during construction work.
- Existing road connections: 10 local roads intersect the highway, and their vertical and horizontal alignments may need to be adjusted to tie in with the chosen design.
- Environmental constraints, in particular:
  - Non-Aboriginal heritage: A number of heritage items abut the proposal area. They are listed on the State Heritage Register or the Lithgow City Local Environment Plan 1994.
  - Biodiversity: Potential constraints include patches of remnant vegetation abutting the proposal.
  - Noise: A number of residences and other sensitive receivers are located next to the highway.
  - Economic: Several businesses are located along the highway through Hartley Valley, and would need access maintained during construction.
  - Urban design: The project needs to ‘fit’ with the surrounding visual and heritage landscape.
- Staging of the proposal: The proposal would be generally constructed on the same alignment as the existing highway. This would pose staging challenges as traffic flows in both directions would need to be maintained.

3.2.3 Major design features

Intersections

Table 3-3 describes the intersection upgrades associated with the proposal.

Table 3-3 Intersection upgrades

<table>
<thead>
<tr>
<th>Intersection upgrade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coxs River Road and Ambermere Drive</td>
<td>• Dedicated right turn and left turn lanes into both roads from the highway.</td>
</tr>
<tr>
<td></td>
<td>• Coxs River Road would be aligned about 55 m to the east to form a staggered intersection with Ambermere Drive.</td>
</tr>
<tr>
<td></td>
<td>• Vertical levels of both roads would be adjusted to match the level of the highway.</td>
</tr>
<tr>
<td></td>
<td>• Bus bays would be located on the highway shoulders near the intersection (both sides of the highway).</td>
</tr>
</tbody>
</table>
### Intersection upgrade

<table>
<thead>
<tr>
<th>Intersection upgrade</th>
<th>Description</th>
</tr>
</thead>
</table>
| Baaners Lane                        | • Dedicated right turn and left turn lanes from the highway.  
|                                    | • Bus bay would be located on highway shoulder near intersection.  
| Browns Gap Road                     | • Dedicated right turn and left turn lanes from the highway.  
|                                    | • Bus bay would be located on highway shoulder near intersection.  
|                                    | • Vertical alignment would be improved by cutting into the existing crest by 1.5 m to improve sight distance.                                                                                               |
| Mid Hartley Road                    | • Dedicated right turn and left turn lane from the highway.  
|                                    | • Bus bay would be located on highway shoulder near intersection.  
|                                    | • Vertical levels would be adjusted to match the level of the highway.                                                                                                                                     |
| Carroll Drive                       | • Extension of existing right turn lane from the highway.  
|                                    | • Dedicated left turn from the highway.  
|                                    | • Vertical levels of both roads would be adjusted to match the level of the highway.                                                                                                                       |
| Old Bathurst Road                   | • Hartley Historic Site curve would be realigned about 12 m to the north.  
|                                    | • Existing intersection would be shifted about 12 m to tie into realigned curve.                                                                                                                           |
| Kelly Street                        | • Vertical levels would be adjusted to match the level of the highway.                                                                                                                                       |
| Jenolan Caves Road/Blackmans Creek Road | • Existing right turn and left turn lanes into both roads would be retained.  
|                                    | • Traffic movements would be reduced by limiting westbound traffic to one lane until after intersection.                                                                                                 |
|                                    | • Length of right turn bay into Jenolan Caves Road would be increased.  
|                                    | • The vertical level of Jenolan Caves Road would be would be adjusted to match the level of the highway.                                                                                                     |
|                                    | • Widen shoulders at north-west side of intersection.                                                                                                                                                       |

### Retaining walls

Retaining walls would be required along the length of the proposal at the following locations:

- Next to the eastbound carriageway between chainage 25740 and 25850, with a maximum height of about 1.7 metres.
- Next to the eastbound carriageway between chainage 25917 and 25970, with a maximum height of about 3.6 metres.
- Next to the eastbound carriageway between chainage 26015 and 26105, with a maximum height of about 2.6 metres.
- Next to the eastbound carriageway between chainage 26300 and 26500, with a maximum height of about 7.5 metres.

A possible retaining wall about 4.1 metres high would be provided between chainages 26130 and 26220 next to the westbound carriageway. Finishing materials for these retaining walls would be confirmed during detailed design and would consider materials recommended in the Landscape Character and Visual Impact Assessment Technical Paper (SMM, 2013) (**Appendix H**), as follows:

- Reinforced concrete, reinforced soil or soldier piled walls with facing panels.
- Grey concrete, with heavy horizontal ribbing and dark exposed aggregate (e.g. basalt) for facing panels.
- A matching precast concrete capping unit at the top of all reinforced soil walls, except where a road safety barrier is required to be integrated with the wall.

**Cut and fill**

A cut batter of 0.5:1 and eight metres in height would be constructed between chainage 21360 and 21420. Finishing materials for the cut batter would be confirmed during detailed design and consider materials recommended in the Landscape Character and Visual Impact Assessment Technical Paper (SMM, 2013), as follows:

- The cutting would retain the natural rock surface where feasible.
- Shotcrete would be avoided. If shotcrete is necessary, visibility of the shotcrete would be minimised.
- Cutting angles would be as steep as possible.
- Top batters of the cutting would be ‘rounded’ over.
- Sides of cuttings would be shaped back into the existing landform.
- A space would be provided at the base of the cutting for grassing, where feasible.

Fill requirements would be determined during detailed design. Where fill is required, principles from the recommended in the Landscape Character and Visual Impact Assessment Technical Paper (SMM, 2013) would be considered, as follows:

- Slope angles on embankments in bushland areas would facilitate planting (2H:IV).
- Embankments in agricultural areas would be vegetated and use the flattest embankment as possible. Where space permits, a flatter embankment profile (4H:IV) would be used. Where space is limited, a minimum angle of 2H:IV is preferred.

**Drainage**

The proposal would involve:

- Retention of 20 culverts.
- Extension of 14 culverts to accommodate the widened highway.
- Five new culverts at property accesses, and at a local road (Coxs River Road alignment).
- Removal and replacement of two existing culverts with new culverts in locations nearby (Baaners Lane and Mid Hartley Road).
- Removal of two culverts from property accesses and replacement with SO gutters (shallow v-shaped wide drains).

The size and location of the new culverts are listed in **Table 3-4**.

**Table 3-4 New drainage culverts**

<table>
<thead>
<tr>
<th>Chainage</th>
<th>Structure ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>21240</td>
<td>New CP21240-PropAcc</td>
<td>New 450mm culvert at property access.</td>
</tr>
<tr>
<td>22300</td>
<td>New CP22300-LocRd50</td>
<td>New 450mm culvert at local road (Coxs River Road).</td>
</tr>
<tr>
<td>23090</td>
<td>Replace CE23090-LocRd</td>
<td>Remove existing 450mm culvert at local road, Baaners Lane, and create new 450mm culvert in new location nearby.</td>
</tr>
<tr>
<td>23420</td>
<td>New CP23420-PropAcc</td>
<td>New 450mm culvert at property access.</td>
</tr>
<tr>
<td>Chainage</td>
<td>Structure ID</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>23460</td>
<td>New CP23460-PropAcc</td>
<td>New 450mm culvert at property access.</td>
</tr>
<tr>
<td>24120</td>
<td>New CP24120-PropAcc</td>
<td>New 450mm culvert at property access.</td>
</tr>
<tr>
<td>24890</td>
<td>Replace CE24890-LocRd</td>
<td>Remove existing 375mm culvert at Mid Hartley Road and create new 450mm culvert in new location.</td>
</tr>
</tbody>
</table>

As part of the widening, SO kerbs (shallow v-shaped wide drains) would replace the existing formed table drains in most locations. The concentrated run-off produced by the SO kerbs would be controlled by new and upgraded pavement drainage systems including SO gutter pits, new drainage pipes and pipe outlets. New concentrations of flow caused by the new drainage system would be managed through:

- Placement of seven drainage outlets at batters between chainages 25620 and 26060 at:
  - Chainage 25630.
  - Chainage 25670.
  - Chainage 25740.
  - Chainage 25780.
  - Chainage 25875.
  - Chainage 25990.
- Placement of a drainage outlet point at chainage 26500.

Scour protection would be provided at outlet locations, and at new and extended culverts where required. The location and extent of scour protection measures would be confirmed during detailed design.

**Urban design**

Principles for development of the proposal have been based on the urban design objectives defined for the proposal in the Landscape Character and Visual Impact Assessment Technical Paper (SMM, 2013) (Appendix H). The specific urban design principles are summarised in Table 3-5, and reflect the underlying urban design principles contained in Beyond the Pavement (Roads and Maritime, 2009) as well as the proposal’s relationship to its surrounding environment.

**Table 3-5 Urban design objectives and principles**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Design principle</th>
</tr>
</thead>
</table>
| 1. Develop an integrated concept design that fits sensitively with the existing qualities and characteristics of the Hartley Valley and its setting. | • Minimise the physical footprint and scale of new infrastructure in order to retain the existing qualities and characteristics of the Great Western Highway as it travels through the Hartley Valley.  
• Ensure that the new works are well integrated with the adjoining built areas, open space, historic and natural settings.  
• Minimise negative physical impacts on parklands, open spaces, heritage items and private property.  
• Minimise the extent and scale of road-related elements including retaining walls and barriers.  
• Consolidate any residual land parcels into adjoining land uses as appropriate.  
• Devise a planting / revegetation strategy that takes into account the long-term visual quality and biodiversity of the areas adjoining the proposal. |
<table>
<thead>
<tr>
<th>Objective</th>
<th>Design principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Produce a good urban design and landscape outcome, taking into account</td>
<td>• Retain and reinforce the unique landform and landscape character of the route.</td>
</tr>
<tr>
<td>the existing amenity, visual character and cultural landscapes of the</td>
<td>• Recognise the key heritage and cultural landmarks along the route and minimise</td>
</tr>
<tr>
<td>Hartley Valley.</td>
<td>any impacts on them.</td>
</tr>
<tr>
<td></td>
<td>• Retain existing view corridors, particularly at elevated points, to establish a</td>
</tr>
<tr>
<td></td>
<td>sense of place for the journey along the Great Western Highway.</td>
</tr>
<tr>
<td></td>
<td>• Retain, and where possible improve, views to important landmarks and the local</td>
</tr>
<tr>
<td></td>
<td>heritage buildings.</td>
</tr>
<tr>
<td></td>
<td>• Control the placement of any utilities in the corridor and locate underground</td>
</tr>
<tr>
<td></td>
<td>where possible to enhance views and maximise planting opportunities.</td>
</tr>
<tr>
<td>3. Maintain the integrity of cultural and historic buildings, structures,</td>
<td>• Maintain the physical and visual integrity of State-significant items</td>
</tr>
<tr>
<td>elements and spaces of the Hartley Valley.</td>
<td>including heritage buildings, public spaces and their curtilage.</td>
</tr>
<tr>
<td></td>
<td>• Preserve the integrity of heritage items and areas of cultural importance to the</td>
</tr>
<tr>
<td></td>
<td>local community.</td>
</tr>
<tr>
<td></td>
<td>• Minimise impacts on Aboriginal heritage sites and their associated heritage</td>
</tr>
<tr>
<td></td>
<td>values.</td>
</tr>
<tr>
<td>4. Develop a simple and unified palette of elements and details that are</td>
<td>• Provide standard road elements that have been used in other upgraded section of</td>
</tr>
<tr>
<td>attractive, easily maintained and fits sensitively into the specific</td>
<td>the Great Western Highway.</td>
</tr>
<tr>
<td>landscape character of this area.</td>
<td></td>
</tr>
</tbody>
</table>

To achieve these objectives and integrate the proposal into the existing visual character of the landscape, urban design and landscape treatments would include:

- Implement targeted revegetation measures to maintain and enhance the vegetated character of the corridor.
- Provide opportunities to view the wider landscape from selected locations.
- Incorporate materials and finishes for new road elements that align with those elements already used along the Great Western Highway.
- Seek to limit the visual dominance of road elements relative to the wider vegetated corridor through a consistent and limited colour palette.

### 3.3 Construction activities

This section provides a summary of the likely construction methodology, staging, work hours, plant and equipment that would be used to construct the proposal and associated activities. For the purpose of this REF, an indicative construction plan and methodology are provided.

The detailed construction staging plans and methods would be determined by the construction contractor(s) after completion of the detailed design. The actual construction methods may vary from the description in this chapter due to:

- The identification and location of underground utilities and services.
- On-site conditions identified during pre-construction activities.
- Ongoing refinement of the detailed design.
- Community consultation, including consideration of submissions received.
The final construction environmental management plan (CEMP) and methods used for construction would be consistent with statutory requirements (including any work, health and safety (WH&S) regulations) and all conditions of approval issued following determination of the proposal.

A contractor environmental management framework to manage and mitigate impacts is presented in Chapter 7. The final construction plan and methods would be consistent with this framework.

### 3.3.1 Work methodology

The likely construction activities and sequencing construction are shown in Table 3-6.

**Table 3-6 Proposed construction phases and activities**

<table>
<thead>
<tr>
<th>Construction phase</th>
<th>Activities</th>
</tr>
</thead>
</table>
| Environmental management system (EMS) | • Develop EMS.  
• Develop environmental management plans.  
• Obtain statutory approvals and licensing. |
| Early works | • Carry out land acquisition.  
• Survey construction site.  
• Notify residents of start of work.  
• Carry out site establishment.  
• Develop site compounds.  
• Fence the site boundaries and areas to be used for stockpile sites.  
• Fence the sensitive environmental and heritage areas.  
• Install erosion and sediment control outside identified environmental constraint areas, and temporary sedimentation basins.  
• Carry out other activities determined by the environmental representative to have minimal environmental impact. |
| Service relocations | • Adjust utility infrastructure (electricity and telecommunications) as required. |
| Site preparation | • Remove and mulch vegetation in stages, and grub along the new section of the alignment and along the section of the highway to be widened.  
• Strip and stockpile topsoil in stages.  
• Prepare surface using graders, dozers, scrapers and other equipment.  
• Establish access tracks.  
• Establish temporary and permanent crossovers.  
• Erect traffic barriers.  
• Carry out temporary pavement widening. |
| Earthworks | • Excavate cuttings.  
• Fill embankments.  
• Place select materials.  
• Construct roadside cuts and fill batters.  
• Prepare batter treatments.  
• Erect retaining walls. |
| Pavement | • Lay gravel base/sub-base layers and asphaltic concrete paving.  
• Apply asphaltic concrete pavement using pavers and rollers.  
• Remove redundant highway pavement and rehabilitate. |
| Other works | • Provide access to properties.  
• Work on service roads and local roads.  
• Tie in the project to adjoining highway sections. Specific activities |
<table>
<thead>
<tr>
<th>Construction phase</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>would be determined during detailed design and may include milling and resheeting to create consistent levels between existing and new pavement.</td>
</tr>
</tbody>
</table>
| Finishing works     | • Install noise mitigation measures (if required).  
                        • Install safety barriers and safety screens (if/where required).  
                        • Install kerbs, gutters and verges.  
                        • Carry out landscape and re-vegetation work.  
                        • Install line marking, signs and guide posts.  
                        • Decommission temporary facilities (eg site compounds).  
                        • Clean up the site and dispose of all surplus waste materials. |
| Drainage            |                                                                                                                                 |
| Extension of pipe culverts | • Establish sediment and erosion controls downstream of the culvert.  
                                        • Remove existing headwalls.  
                                        • Excavate for new pipe.  
                                        • Compact subgrade.  
                                        • Place and compact bedding material.  
                                        • Place pipe.  
                                        • Place headwalls.  
                                        • Fill and compact material around the pipe.  
                                        • Place erosion protection at the entry/exit of pipe. |
| Water quality control basins | • Establish sediment and erosion controls downstream of the culvert.  
                                        • Clearing and grubbing of the area.  
                                        • Excavation of basin and overflow channel.  
                                        • Placement of erosion and sediment controls in the overflow channel. |

Construction staging and program

The detailed construction staging plans and methods would be determined by the construction contractor(s) after completion of the detailed design. It is anticipated that the work would be built in segments, with the length of each segment dependent on on-site conditions, community/stakeholder consultation, property access and traffic management requirements. Activities to tie the proposal into the existing alignment of the Great Western Highway would be determined during detailed design and may require milling and resheeting to create consistent levels between existing and new pavement.

Construction staging would typically comprise of:

- Stage 1, preparation work, clearing and grubbing, extension of existing transverse drainage, property adjustments.
- Stage 2, formation widening and longitudinal drainage and retaining structures (where required).
- Stage 3, pavement construction.
- Stage 4, linemarking, signage.

The final stage would involve opening the new carriageway sections, the removal of temporary pavement and final finishing work.

Where possible, two lanes of traffic would be maintained at all times during construction. However, where there is insufficient width to achieve this, traffic would be reduced to one lane. Impacts to traffic would be kept to a minimum through the management measures outlined in Section 6.9.
Depending on the construction staging and methods determined by the contractor, a number of sections may be constructed in parallel, although potentially at different stages.

### 3.3.2 Construction hours and duration

Construction is anticipated to start in late-2014 and finish in late-2016.

The construction workforce would be expected to fluctuate, depending on the stage of construction and associated activities. The workforce would be expected to peak at about 120 personnel per day across all construction locations. On either side of this peak period, daily workforce numbers would fluctuate between about 20 and 100 personnel across all construction sites along the proposal at any given time. The final number of construction workers would be determined by the construction contractor following the detailed design of the proposal. Construction would be carried out during standard construction working hours in accordance with the Interim Construction Noise Guideline (DECC, 2009) as follows:

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

To minimise disruption to daily traffic and disturbance to surrounding landowners and businesses, it may be necessary to carry out some work outside these standard working hours, including at night. If any work needs to be carried out outside standard working hours, it would be in accordance with the Interim Construction Noise Guideline (DECC, 2009) and Roads and Maritime’s Environmental Noise Management Manual Practice Note vii – Road Work Outside Normal Working Hours (RTA, 2001a). The contractor would give the community prior notice of any work planned to be carried out outside normal construction hours.

Where practical, materials and plant would be removed and delivered outside peak traffic periods to minimise delays. Traffic control measures would be used to manage general earthworks and the import and export of material.

### 3.3.3 Plant and equipment

An indicative list of plant and equipment that would typically be required is provided below. (Additional equipment is likely to be used and would be determined during detailed design by the construction contractor.)

- Asphalt pavers.
- Asphalt profiling machines.
- Back hoes.
- Bobcats.
- Bulldozers.
- Cherry pickers.
- Chipping machines.
- Compactors.
- Compressors.
- Compressed air machinery.
- Concrete pavers.
- Concrete saws.
- Concrete trucks.
- Concrete pumps.
- Elevated work platform.
- Excavators.
- Front-end loaders.
- Generators.
- Graders.
- Hand tools.
- Hydraulic hammer.
- Hydraulic jacks.
- Lighting units.
- Line marker.
- Mobile cranes.
- Roadheaders.
- Rock breakers.
- Road rollers.
3.3.4 Earthworks

The proposal has been designed to minimise excess spoil and/or the need to import large quantities of fill. Earthworks for the new road realignment would require about 45,000 cubic metres of excavation and about 28,000 cubic metres of fill. The current design would therefore produce an excess of about 17,000 cubic metres of fill material. Roads and Maritime would seek to reuse the fill material on other safety upgrade projects in the vicinity of the proposal.

Should the proposal require additional materials outside of what would be available on site, off-site quarries would be used as a source. The quality of the required material is readily available from established quarries in the local area (refer Section 3.3.5).

Detailed earthwork requirements would be determined during detailed design of the proposal. The final batter would be assessed after completion of the geotechnical investigation and design to minimise the overall size and impact of the proposal area.

3.3.5 Source and quantity of materials

The source and quantity of materials required to construct the proposal would be finalised during detailed design through the development of a construction materials and resources plan.

As discussed in Section 3.3.4 all of the required fill material would be sourced from cut materials from within the proposal area. However, should additional material be required to meet the requirements across the proposal, this would be sourced from local quarries and would be confirmed during pre-construction. Two quarries are located in the local area including:

- Austen Quarry (Hy-Tec), located about 11 kilometres south of the intersection of the Great Western Highway and Jenolan Caves Road.
- Marrangaroo (Metromix), located about seven kilometres west of Lithgow.

Where feasible, excavated materials would be reworked (if necessary) and used to meet general fill material needs, such as the foundations for fill embankments.

The accuracy of fill material required is subject to variations in bulking factors for excavated material, the relative compaction achieved for placed material, and the volume of usable material once it has been excavated. This would be refined during detailed design.

The major resource requirements for the proposal are described below.

Quarry products

The following quarry products would be required to construct the proposal:

- Asphalt – the quarry location would be dependent on the supplier chosen by the contractor.
• Select material would be used where required – this will be obtained from on-site material gained from cuttings or registered quarries.

Additional materials (ie those not sourced on site) would be obtained from local quarries where possible and would be confirmed during pre-construction.

**Water**

Water would be required for earthworks and dust control. The volume of water required for construction is currently unknown. However, it is anticipated that the likely quantity and quality of water would be available from existing sources in the local area. This would be determined by the construction contractor.

Water would be sourced from authorised off-site sources, including recycled and re-used water, farm dams, and groundwater bores. Water from on-site construction basins would also be used.

**Concrete, steel reinforcement, asphalt and bitumen**

Construction would require the following materials (actual quantities would be refined during detailed design):

• An estimated 1900 cubic metres of concrete for kerb and gutter. Due to the size and location of the proposal, on-site concrete batching facilities would not be required; ready-mix concrete would be supplied by established local sources.

• Manufactured items, including stormwater pipes, pits and culverts, which would be sourced from commercial providers.

• Asphalt and bitumen to construct the road surface and to tie in the eastern and western ends of the proposal with the existing pavement. This work would require about 10,000 litres of bitumen, 30,000 cubic metres of dense graded asphalt, and 9500 cubic metres of select material. Due to the size and location of the proposal, on-site asphalt batching facilities would not be required; asphalt would be supplied by established local sources.

**Surplus materials**

Surplus material that cannot be used on site as part of the proposal would be re-used or disposed of in the following order of priority:

• Transfer to other nearby Roads and Maritime projects for immediate use.

• Transfer to an approved Roads and Maritime temporary stockpile site for future use during projects or routine maintenance.

• Transfer to a Roads and Maritime approved site for reuse on a concurrent private/local government project (with appropriate approvals as required).

• Disposal at an approved materials recycling or waste disposal facility.

• As otherwise provided for by the relevant waste legislation.

The process for managing excess material would be detailed in a waste management plan that would form part of the CEMP (refer to **Section 6.14**).

### 3.3.6 Traffic management and access

**Construction vehicle traffic**

Construction vehicles would generally access the site from the Great Western Highway and Darling Causeway, resulting in a temporary increase in heavy vehicle movements along the highway and nearby local roads. Construction traffic would...
include cars, light and heavy trucks, and concrete trucks. Construction traffic would be greatest during the main earthworks and civil construction, and would comprise vehicles transporting equipment, materials and spoil, and construction workers accessing the work sites. The estimated vehicle movements per day are provided in Table 3-7.

### Table 3-7 Estimated construction traffic volumes

<table>
<thead>
<tr>
<th>Type</th>
<th>Movements per day</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light vehicles</td>
<td>200–500</td>
<td>20 months</td>
</tr>
<tr>
<td>Trucks – external earth</td>
<td>50–130</td>
<td>16 months</td>
</tr>
<tr>
<td>Trucks – internal earth</td>
<td>50–130</td>
<td>16 months</td>
</tr>
<tr>
<td>Water trucks</td>
<td>0–20</td>
<td>16 months</td>
</tr>
<tr>
<td>Trucks – external pavement</td>
<td>50–130</td>
<td>16 months</td>
</tr>
<tr>
<td>Concrete trucks</td>
<td>10–100</td>
<td>16 months</td>
</tr>
<tr>
<td>Delivery trucks</td>
<td>0–10</td>
<td>20 months</td>
</tr>
</tbody>
</table>

Construction workers would generally arrive by car. The main construction car park would likely be at the main site compound next to the Coxs River Road intersection (refer to Figure 3-1 to 3–1c). Limited car parking would be provided within the proposed road corridor, near nominated access gates, where this would not interfere with traffic on the highway or local property access.

During construction it would be necessary to move a large amount of on-site excavated materials from cuttings to fill areas. Any haulage movement across or along the highway would be in accordance with an approved traffic management plan (TMP).

As a proportion of the required fill material would be sourced from outside of the proposal area, major material truck haulage routes would be required between the proposal area and the sourced material. Material being imported from the local quarries would use the Great Western Highway and access the work areas from established and designated access points.

**Traffic management, control and signage**

Where possible, construction would be programmed to minimise impact on traffic using the local and regional road network.

Standard traffic management measures would be used to minimise short-term traffic impacts during construction and ensure that traffic flow along the highway is maintained throughout construction. These measures would be identified in a TMP and developed in accordance with Roads and Maritime’s Traffic Control at Works Sites Manual (RTA, 2010) and Specification G10 – Control of Traffic. Roads and Maritime would review the TMP before implementation.

Access to properties along the alignment would be maintained during construction and temporary property access would be provided to residences where required. The management of property access would be considered by the construction contractor and detailed as part of the final staging plan for the proposal.
Road and lane closures

The construction staging would aim to provide two lanes (one lane each way) for traffic flow throughout the construction period. Where there is insufficient width to achieve this, traffic would be reduced to one lane. Some short-term work under traffic control or lane closure would be required during traffic switches, barrier work and asphalting. However, it is expected that traffic delays would be minimal during construction due to the reasonably low traffic volumes on the highway and intersecting roads. Work would be staged so that construction at the intersections would be limited to the shortest possible duration.

Construction parking impacts would be managed through measures identified in the TMP, which would form part of the CEMP. Impacts to traffic would be kept to a minimum through the management measures outlined in Section 6.9.

3.4 Ancillary facilities

3.4.1 Compound and stockpile sites

Construction compound and stockpile sites of varying sizes would be required to construct the proposal. The potential compound and stockpile sites are identified in Figure 3-1a to 3–1c.

The most suitable location for the main compound site has been identified at Lot 1, DP264645 on Roads and Maritime land, next to the Coxs River Road intersection. It would typically include demountable offices, meal rooms, toilets/showers and parking facilities (where possible).

Stockpile sites would occur in areas identified as potential stockpile sites (refer to Figure 3-1a to 3–1c). They would store materials, such as spoil, stripped topsoil, excavated rock and building materials. Some stockpile sites would also have laydown facilities, equipment storage, maintenance sheds, and stores of chemicals and fuel. These stockpile sites are located on road reserves or Roads and Maritime owned land.

The final location of the stockpile sites would be subject to the site location criteria set out in Roads and Maritime’s Stockpile Site Management Procedures (RTA, 2011b). To minimise impacts from the construction compounds, they would ideally be located:

- On relatively level ground.
- In a place accessible to construction traffic and deliveries.
- Away from areas of ecological and heritage conservation value.
- In areas previously disturbed within the proposal area that do not require the clearing of native vegetation.
- Away from residential buildings or heritage items.
- In plain view of the public to deter theft and illegal dumping.
- Close to key construction activities to minimise transport of materials and equipment.
- Within the area of potential impact on minimise impacts on private and public property.
- In areas not prone to flash flooding and more than 40 metres from a watercourse.
- Outside the drip line of trees.
The final location of the compound, stockpile and storage sites would be determined during detailed design. Once the contractor has a preferred location for the stockpile and storage sites, they would consult with Roads and Maritime’s Senior Environmental Officer (Western) before any work in those locations to determine if any additional environmental assessment is required.

Each site would be securely fenced with temporary fencing. Signage would be erected advising the general public of access restrictions. Upon completion of construction, the temporary compound, work area and stockpile sites would be removed, cleared of all rubbish and materials, and rehabilitated.

### 3.4.2 Water quality facilities

Construction of the proposal has the potential to affect water quality through erosion of exposed or disturbed areas and subsequent sedimentation of watercourses.

To mitigate these effects, temporary sedimentation control basins would be installed throughout the proposal area to trap sediments and other pollutants from disturbed areas. Preliminary investigations have been carried out in accordance with the guidelines set out in the Soils and Construction – Managing Urban Stormwater Volume 1 (Landcom, 2004) and Volume 2D (DECCW, 2008) to determine the likely number, size and location of detention basins required. The potential locations and sizes of temporary sediment basins for the construction phase are listed in Table 3-8 and shown on Figure 3-2.

The temporary sediment basins shown in Table 3-8 were not included in the construction footprint and have not been included in the environmental assessment.

#### Table 3-8 Potential temporary sediment basin locations and volumes

<table>
<thead>
<tr>
<th>Chainage</th>
<th>Side of highway (increasing chainage)</th>
<th>Volume (m$^3$)</th>
<th>Conversion to an operational basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>22070</td>
<td>Right</td>
<td>230</td>
<td>Yes</td>
</tr>
<tr>
<td>22260</td>
<td>Left</td>
<td>270</td>
<td>--</td>
</tr>
<tr>
<td>22830</td>
<td>Left</td>
<td>280</td>
<td>--</td>
</tr>
<tr>
<td>22830</td>
<td>Right</td>
<td>290</td>
<td>--</td>
</tr>
<tr>
<td>23610</td>
<td>Left</td>
<td>360</td>
<td>--</td>
</tr>
<tr>
<td>23930</td>
<td>Left</td>
<td>210</td>
<td>--</td>
</tr>
<tr>
<td>24080</td>
<td>Left</td>
<td>210</td>
<td>Yes</td>
</tr>
<tr>
<td>24640</td>
<td>Right</td>
<td>340</td>
<td>Yes</td>
</tr>
<tr>
<td>24660</td>
<td>Left</td>
<td>240</td>
<td>Yes</td>
</tr>
<tr>
<td>25250</td>
<td>Left</td>
<td>570</td>
<td>Yes</td>
</tr>
<tr>
<td>26140</td>
<td>Left</td>
<td>270</td>
<td>Yes</td>
</tr>
<tr>
<td>26400</td>
<td>Right</td>
<td>420</td>
<td>--</td>
</tr>
<tr>
<td>26580</td>
<td>Right</td>
<td>340</td>
<td>Yes</td>
</tr>
</tbody>
</table>

In addition, the proposal would result in some changes to the local hydrology, with some modifications to sub-catchments in the study area due to the realignment and widening of the highway. To mitigate the impacts of any increased flows, to manage...
flows in the other sub-catchments and to mitigate potential impacts on water quality, permanent water quality measures are proposed including basins, ponds, gross pollutant traps and swales to capture and direct stormwater.

Of the 13 potential basins for construction, eight could be retained as permanent water quality basins due to their close proximity. The locations of permanent water quality measures are listed in Table 3-9 and are shown in Figure 3-2.

**Table 3-9 Potential operational water quality measures**

<table>
<thead>
<tr>
<th>Chainage</th>
<th>Side of road (increasing chainage)</th>
<th>Road catchment (ha)</th>
<th>Treatment type</th>
<th>Treatment volume (m³)</th>
<th>Conversion from construction sediment basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>20470</td>
<td>Left</td>
<td>0.268</td>
<td>Pond</td>
<td>100</td>
<td>--</td>
</tr>
<tr>
<td>20470</td>
<td>Right</td>
<td>0.124</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>20630</td>
<td>Left</td>
<td>0.161</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>20630</td>
<td>Right</td>
<td>0.199</td>
<td>Pond</td>
<td>75</td>
<td>--</td>
</tr>
<tr>
<td>20710</td>
<td>Left</td>
<td>0.065</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>20740</td>
<td>Right</td>
<td>0.099</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>20920</td>
<td>Left</td>
<td>0.094</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>20980</td>
<td>Left</td>
<td>0.148</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>20980</td>
<td>Right</td>
<td>0.258</td>
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<td>--</td>
</tr>
<tr>
<td>21570</td>
<td>Left</td>
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<td>Pond</td>
<td>120</td>
<td>--</td>
</tr>
<tr>
<td>21820</td>
<td>Left</td>
<td>0.351</td>
<td>Pond</td>
<td>130</td>
<td>Yes</td>
</tr>
<tr>
<td>22070</td>
<td>Right</td>
<td>0.426</td>
<td>Pond</td>
<td>155</td>
<td>Yes</td>
</tr>
<tr>
<td>22180</td>
<td>Left</td>
<td>0.070</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>22320</td>
<td>Left</td>
<td>0.054</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>22350</td>
<td>Right</td>
<td>0.039</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>22475</td>
<td>Left</td>
<td>0.072</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>22510</td>
<td>Right</td>
<td>0.106</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>22680</td>
<td>Left</td>
<td>0.023</td>
<td>Spill basin</td>
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<td>--</td>
</tr>
<tr>
<td>22680</td>
<td>Right</td>
<td>0.021</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>22780</td>
<td>Left</td>
<td>0.062</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>22820</td>
<td>Right</td>
<td>0.089</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>22980</td>
<td>Right</td>
<td>0.696</td>
<td>Pond</td>
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</tr>
<tr>
<td>23520</td>
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<td>Pond</td>
<td>125</td>
<td>--</td>
</tr>
<tr>
<td>23650</td>
<td>Right</td>
<td>0.044</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>23890</td>
<td>Right</td>
<td>0.437</td>
<td>Pond</td>
<td>160</td>
<td>--</td>
</tr>
<tr>
<td>23910</td>
<td>Right</td>
<td>0.210</td>
<td>Pond</td>
<td>80</td>
<td>--</td>
</tr>
<tr>
<td>24080</td>
<td>Left</td>
<td>0.325</td>
<td>Pond</td>
<td>120</td>
<td>Yes</td>
</tr>
<tr>
<td>24247</td>
<td>Left</td>
<td>0.033</td>
<td>Swale/GPT</td>
<td>n/a</td>
<td>--</td>
</tr>
<tr>
<td>24460</td>
<td>Left</td>
<td>0.096</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>24640</td>
<td>Right</td>
<td>0.557</td>
<td>Pond</td>
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</tr>
<tr>
<td>24660</td>
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<td>Pond</td>
<td>155</td>
<td>Yes</td>
</tr>
<tr>
<td>24660</td>
<td>Right</td>
<td>0.045</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>25250</td>
<td>Left</td>
<td>0.624</td>
<td>Pond</td>
<td>230</td>
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</tr>
<tr>
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<td>--</td>
</tr>
<tr>
<td>25420</td>
<td>Right</td>
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<td>110</td>
<td>--</td>
</tr>
<tr>
<td>25820</td>
<td>Left</td>
<td>0.066</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
</tbody>
</table>
### Table 3-1

<table>
<thead>
<tr>
<th>Chainage</th>
<th>Side of road (increasing chainage)</th>
<th>Road catchment (ha)</th>
<th>Treatment type</th>
<th>Treatment volume (m³)</th>
<th>Conversion from construction sediment basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>25940</td>
<td>Left</td>
<td>0.103</td>
<td>Spill basin</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>26140</td>
<td>Left</td>
<td>0.307</td>
<td>Pond</td>
<td>115</td>
<td>Yes</td>
</tr>
<tr>
<td>26230</td>
<td>Left</td>
<td>0.181</td>
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<td>70</td>
<td>--</td>
</tr>
<tr>
<td>26400</td>
<td>Left</td>
<td>0.369</td>
<td>Pond</td>
<td>135</td>
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</tr>
<tr>
<td>26440</td>
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<td>0.045</td>
<td>Swale/GPT</td>
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</tr>
<tr>
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<td>70</td>
<td>--</td>
</tr>
<tr>
<td>26970</td>
<td>Left</td>
<td>0.158</td>
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<td>60</td>
<td>--</td>
</tr>
<tr>
<td>26970</td>
<td>Right</td>
<td>0.251</td>
<td>Pond</td>
<td>95</td>
<td>--</td>
</tr>
<tr>
<td>27350</td>
<td>Left</td>
<td>0.580</td>
<td>Pond</td>
<td>215</td>
<td>--</td>
</tr>
</tbody>
</table>

The specific locations and volumes of each temporary and permanent basin would be developed further and confirmed during detailed design, and would be subject to environmental assessment at that stage. Scour mitigation devices would be included in the drainage design where scour may occur along drainage lines, culverts and basin spillways. Additional soil and water management measures would be further developed during detailed design and included the CEMP (refer to Section 6.4.5 and Section 6.8.3).

### 3.5 Public utility adjustment

The utilities present within the proposal site are:

- Telstra cables and optic fibre.
- Overhead power lines and poles.

These utilities would need to be relocated as part of this proposal. The full extent of these relocations would not be known until the contractor(s) are engaged for the construction of this proposal.

### 3.6 Property acquisition

The proposal would require partial acquisition of 18 properties. Table 3-10 lists the properties that would be acquired as part of the proposal.

Roads and Maritime has undertaken consultation with affected landowners about the area of acquisition that would be required as a result of the proposal. Final areas of acquisition would be finalised during detailed design in consultation with these affected landowners.

Some additional areas of land may also be required to be leased by Roads and Maritime during the construction period for use as compound and stockpile sites. These areas would be confirmed during detailed design. Areas that are leased by Roads and Maritime during construction would be returned to the landowner following the completion of work.
All property acquisitions would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, the *Roads Act 1993* and Roads and Maritime’s Land Acquisition Information Guide February 2012 (Roads and Maritime, 2012b).

**Table 3-10 Properties where portions of land would be acquired**

<table>
<thead>
<tr>
<th>Lot</th>
<th>DP</th>
<th>Acquisition area (square metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7311</td>
<td>1162788</td>
<td>1,121</td>
</tr>
<tr>
<td>137</td>
<td>751644</td>
<td>245</td>
</tr>
<tr>
<td>89</td>
<td>650604</td>
<td>50</td>
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<td>1094740</td>
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<td>1410</td>
</tr>
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<td>1,161</td>
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</tr>
<tr>
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<td>1067654</td>
<td>778</td>
</tr>
<tr>
<td>24</td>
<td>1067654</td>
<td>1019</td>
</tr>
<tr>
<td>25</td>
<td>1067654</td>
<td>941</td>
</tr>
<tr>
<td>1</td>
<td>629411</td>
<td>2,109</td>
</tr>
<tr>
<td>2</td>
<td>733945</td>
<td>694.2</td>
</tr>
<tr>
<td>1</td>
<td>733945</td>
<td>715</td>
</tr>
<tr>
<td>7016</td>
<td>1057029</td>
<td>1,050</td>
</tr>
<tr>
<td>11</td>
<td>831091</td>
<td>570</td>
</tr>
<tr>
<td>1</td>
<td>195993</td>
<td>5,026</td>
</tr>
</tbody>
</table>

| Total acquisition area (square metres) | 20,341 |

### 3.7 Conclusion

The concept design is based on available information and current design standards and criteria for the overall Great Western Highway upgrade program. Some elements of the design may be further refined during detailed design. The key elements of the proposal are to improve road geometry in order to achieve a design speed of 90 km/h, to widen the carriageway, to extend the downhill overtaking lane, and to upgrade intersections with local roads.

The next chapter presents the statutory and planning framework for the proposal.
4 Statutory and planning framework

This chapter provides the statutory and planning framework for the proposal and considers provisions of relevant State and Commonwealth legislation, plans and policies.

4.1 State environmental planning policies

4.1.1 State Environmental Planning Policy (Infrastructure) 2007

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

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

As the proposal is for a road and is to be carried out on behalf of Roads and Maritime, it can be assessed under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). Development consent from council is not required.

The proposal is not located on land reserved under the National Parks and Wildlife Act 1974 and does not affect land or development regulated by State Environmental Planning Policy No. 14 – Coastal Wetlands, State Environmental Planning Policy No. 26 – Littoral Rainforests, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (Transitional Major Projects) 2005.

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

4.1.2 State Environmental Planning Policy 55 – Remediation of Land

The objective of State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) is to provide a statewide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. In accordance with Clause 7(1) of SEPP 55, a consent authority must not consent to the carrying out of any development on land unless it has considered whether the land is contaminated.

A number of potential areas of environmental interest have been identified in the proposal area. These include:

- Stockpiled materials (predominantly road construction materials with some evidence of other general waste materials) along the existing highway.
- The existing highway.
- Agricultural land within and surrounding the proposal area, where there may have been a history of chemical use; fuel storage and use; contaminated fill; stock dips; and waste disposal.

The potential areas of environmental interest identified were considered to be a negligible to low constraint on the design and construction of the proposal. It is
considered that the proposal would not trigger any requirements to carry out any site remediation.

4.1.3 State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

The objective of State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 (SEPP [Sydney Drinking Water Catchment]) is to secure the environmental, economic and social future of drinking water catchments for the greater Sydney region, inclusive of the Blue Mountains and the Illawarra. The area of these catchments extends from north of Lithgow to the Shoalhaven River north of Cooma.

The proposal area is located within the boundary of the Warragamba Drinking Water Catchment. Consequently, the SEPP (Sydney Drinking Water Catchment) is applicable to the proposal.

Clause 9 of the SEPP states that any development or activity within this catchment should incorporate the Sydney Catchment Authority’s (SCA) current recommended practices and performance standards that relate to the protection of water quality. Clause 12 of the SEPP (Drinking Sydney Water Catchment) states that: ‘A public authority must, before it carries out any activity to which Part 5 of the Act applies, consider whether the activity would have a neutral or beneficial effect on water quality.’

Once the proposed mitigation measures are implemented (refer to Section 6.4.5), it is anticipated that the proposal would not have an adverse impact on the quality of water being discharged into the Mid Coxs River sub-catchment. In accordance with Clause 9 of the SEPP, the mitigation measures for the proposal would also take into account the relevant SCA recommended practices and performance standards.

While the SEPP does not affect the permissibility of the proposal, consideration would be required regarding the proposal’s impact on water quality. A qualitative Neutral or Beneficial Effect (NorBE) water quality assessment has been carried out and is included in Section 7 of the Water Quality Report (SKM, 2013c), which is included in Appendix F.

4.2 Local environmental plans

4.2.1 Lithgow City Local Environmental Plan 1994

The proposal is located within the Lithgow City Council LGA. Consequently, the principal relevant local environmental planning instrument under the EP&A Act is the Lithgow City Local Environmental Plan 1994 (Lithgow City LEP).

A substantial proportion of the proposal area is within the existing road corridor, so the proposal would not substantially impact on other land uses. However, the land zonings (under the LEP) would be affected by the proposal in some sections and are outlined with their objectives in Table 4-1.

Table 4-1 Lithgow City LEP zones affected by the proposal

<table>
<thead>
<tr>
<th>Zone</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a) Rural (General)</td>
<td>To protect, enhance and conserve rural land, particularly crop and pasture land.</td>
</tr>
</tbody>
</table>
The proposal has considered these objectives and has sought to be consistent with them. The proposal also supports the overarching Lithgow City LEP aim to facilitate the efficient and effective provision of amenities and services by providing a safer route within the Lithgow local government area on the highway.

The LEP zones are shown in Figure 4-1. The impacts to land use are discussed in Section 6.10. Roads are permissible with development consent under all of the above zonings. However, as discussed in Section 4.1.1, ISEPP operates to remove the otherwise applicable consent requirement.

Roads and Maritime has consulted Lithgow City Council, particularly regarding potential impacts of the proposal on locally listed heritage items. Details of this consultation are provided in Chapter 5.

4.2.2 Draft Lithgow Principal Local Environmental Plan 2013

The Draft Lithgow Principal LEP 2013 (Draft Lithgow LEP) contains the four proposed land use zones that would be affected by the proposal. Roads are now permitted without consent in all of these zones. These are outlined with their objectives in Table 4-2.

Table 4-2 Draft Lithgow LEP land use zones affected by the proposal

<table>
<thead>
<tr>
<th>Zone</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>RU1 Primary Production</td>
<td>To encourage sustainable primary industry production appropriate for the area by maintaining and enhancing the natural resource base.</td>
</tr>
<tr>
<td></td>
<td>To minimise the fragmentation, alienation and conflict of land uses.</td>
</tr>
<tr>
<td>R5 Large Lot Residential</td>
<td>To allow residential housing in a rural setting while preserving, and minimising impacts on, environmentally sensitive locations and scenic quality.</td>
</tr>
<tr>
<td>SP2 Infrastructure (Roads and Traffic)</td>
<td>To provide for infrastructure and related uses, prevent development that is not compatible with infrastructure and maintain and improve water quality of receiving water catchments.</td>
</tr>
<tr>
<td>E1 National Parks and Nature Reserves</td>
<td>To enable the management and appropriate use of land that is reserved under the National Parks and Wildlife Act 1974.</td>
</tr>
</tbody>
</table>

The proposal has considered these objectives and has sought to be consistent with them. The proposal supports the overarching Draft Lithgow LEP aim to facilitate the efficient and effective provision of amenities and services by providing a safer route within the Lithgow local government area on the highway.
These zones still require confirmation and, as such, are not discussed further in this REF. However, as discussed in Section 4.1.1, should the LEP come into force during approvals for this proposal, ISEPP will operate to remove the otherwise applicable consent requirement.

4.3 NSW legislation

4.3.1 Heritage Act 1977

The \textit{Heritage Act 1977} aims to protect and preserve items of non-Aboriginal heritage significance. The Act provides for the protection of items of local, regional and State heritage significance. It establishes a list of State heritage items and outlines processes for approving development that may impact items of heritage significance.

A number of historic items listed on the Lithgow City LEP as being of local and State significance have been identified near the proposal. An assessment of the non-Aboriginal impacts was carried out and is provided in Section 6.2 and Appendix D.

4.3.2 National Parks and Wildlife Act 1974

The \textit{National Parks and Wildlife Act 1974} is the primary legislation dealing with Aboriginal cultural heritage in New South Wales. Items of Aboriginal cultural heritage (Aboriginal objects) or Aboriginal places (declared under Section 84) are protected and regulated under the Act. Aboriginal objects are protected under Section 86 of the Act. Under Section 90(1) of the Act, the Director-General may issue an Aboriginal heritage impact permit for an activity that will harm an Aboriginal object.

An assessment of the potential impacts on Aboriginal cultural heritage is provided in Section 6.7.

4.4 Commonwealth legislation

4.4.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix A and Section 6.1.

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

4.5 Confirmation of statutory position

Roads and Maritime is both the proponent and the determining authority for the proposal. Clause 94 of the ISEPP provides that the proposal may be carried out without development consent and is therefore subject to assessment under Part 5 of the EP&A Act. Development consent from Lithgow City Council is not required. Additional permits and approvals are also required for this proposal in addition to the Part 5 determination, and these are detailed in Section 7.3.
4.6 Conclusion

This chapter finds that there are no statutory or planning impediments to constructing the proposal, although certain permits would need to be obtained.

The next chapter presents stakeholder and community consultation that has been carried out for the proposal, as well as proposed consultation activities.
FIGURE 4-1 | LEP ZONING WITHIN HARTLEY VALLEY

LEGEND

- Proposal area
- Existing highway
- Road
- Primary waterway
- Minor waterway
- LGA boundary

Lithgow City LEP 1994
- Zone 1a Rural (general)
- Zone 1c Rural (small holdings)
- Zone 8 National Parks and Natura Reserves

Blue Mountains LEP 1991
- Rural
- Rural Residential
- Special Use - Public Purpose
- Open Space and Recreation
- and Environmental Conservation

DATA SOURCES

HARTLEY VALLEY SAFETY UPGRADE - Review of environmental factors
5  Stakeholder and community consultation

This chapter presents consultation that has been carried out for the proposal, as well as proposed consultation activities. The chapter includes the consultation strategy and methodology and the results of consultations with the local community, the Aboriginal community, and relevant government agencies and stakeholders.

5.1 Consultation strategy

Consultation has been managed as part of the community and stakeholder engagement strategy for the wider program to upgrade the Great Western Highway between Katoomba and Lithgow. A community consultation and stakeholder engagement plan (communications plan) was developed and implemented to guide consultation activities. The communications plan identifies key objectives and outcomes of consultation activities with the community, stakeholders and government agencies.

The consultation objectives are to:

- Identify all potentially interested stakeholders and provide opportunities to include and engage them in the project development process.
- Obtain input from the community during the key development phases of the project.
- Build relationships and resolve issues during planning.
- Provide good information to assist the community to understand the planning process.

The following sections outline the consultation that has been carried out specifically for the proposal.

For further information on community consultation carried out as part of the wider program to upgrade the Great Western Highway between Katoomba and Lithgow, refer to Roads and Maritime’s website http://www.rms.nsw.gov.au/roadprojects/projects/great_western_hway/index.html.

5.2 Community involvement

The Hartley Valley safety upgrade Feasibility Report (Roads and Maritime, 2012a) was displayed for community comment from 8 to 26 October 2012. During that time, staffed displays were held in Lithgow, Hartley and Mount Victoria. The draft design plans were displayed on Roads and Maritime’s website and a community update newsletter was distributed to about 7500 local households and businesses between Mount Victoria and Lithgow.

The outcomes of this consultation (which accompanied the display of the feasibility report) are detailed in the Hartley Valley safety upgrade Community Feedback Report (Roads and Maritime, 2013). Roads and Maritime received 13 submissions via emails and feedback forms. Community issues were also recorded at the staffed displays. More than 85 per cent of written responses were received from residents of Little Hartley and Hartley. No responses were received from government agencies.

The most frequently raised issues are summarised in Table 5-1.
## Table 5-1 Main issues raised by the community (October, 2012)

<table>
<thead>
<tr>
<th>Issue category</th>
<th>Description of issue category</th>
<th>Summary of issues raised</th>
<th>Relevant REF section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design engineering</td>
<td>This category refers to technical aspects and specific design issues related to the proposal.</td>
<td>Most responses were in relation to the safety of intersections along the Great Western Highway throughout Hartley Valley, in particular Coxs River Road. Respondents also raised concerns about the road gradient, number of lanes, the past and proposed speed limit and general comments about the safety upgrade design. The need for a wide shoulder to accommodate cyclists was also raised.</td>
<td>Section 3.2, Section 6.8.3</td>
</tr>
<tr>
<td>Road user concerns</td>
<td>This category refers to issues that impact upon stakeholders who travel on the highway and surrounding local roads.</td>
<td>Most responses were in regard to road safety improvements required in Hartley Valley. Some raised the need for maintenance work on the Great Western Highway in Hartley Valley, as well as concerns about speeding and large freight vehicles.</td>
<td>Section 3.2, Section 6.8.3</td>
</tr>
<tr>
<td>Project justification</td>
<td>This category refers to reasons why the community supports or opposes the proposal.</td>
<td>Three respondents gave general support for the safety upgrades through Hartley Valley. Respondents also raised concerns about the cost of the Great Western Highway upgrade and gave support for alternative funding allocations.</td>
<td>Section 2.1</td>
</tr>
<tr>
<td>Environment</td>
<td>This category refers to environmental impacts and studies related to the proposal.</td>
<td>One respondent raised concerns about the environmental assessment carried out in 1999 for a different design, and the need to avoid impact on the curtilage of Billesdene Grange and the heritage listed causeway. Concerns were also raised regarding geotechnical conditions near Nioka and the Log Cabin, should widening and cutting be required in these areas. Two respondents raised the issues of noise and vibration in regard to current freight traffic and the potential for an increase in noise at heritage properties as a result of the safety upgrade. Concerns about air quality and drainage issues were also raised.</td>
<td>Section 6.2, Section 6.5, Section 6.3, Section 6.12</td>
</tr>
<tr>
<td>Heritage</td>
<td>This category refers to heritage concerns and heritage studies that have or are required to be conducted.</td>
<td>Two respondents raised concerns about the protection of non-Aboriginal heritage. One of these respondents also raised a concern about the findings of a heritage study previously conducted by Roads and Maritime.</td>
<td>Section 6.2</td>
</tr>
</tbody>
</table>
5.3 Aboriginal community involvement

Comber Consultants undertook consultation with local Aboriginal heritage stakeholders in accordance with Roads and Maritime’s Procedure for Aboriginal Cultural Heritage Consultation and Investigation (Roads and Maritime, 2011a) and Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010) for the Mount Victoria to Lithgow project. The following activities were carried out as part of this consultation:

- Public advertising in regional and local newspapers to seek registration of interested Aboriginal parties (closing date April 2010). Aboriginal land councils and individuals were invited to register their interest for involvement in the assessment of Aboriginal archaeology and cultural heritage.
- Identification of potential knowledge holders in consultation with the Office of Environment and Heritage (April to May 2011).
- Invitation to registered parties to participate in the consultation process and attend Aboriginal focus group meetings.
- Participation of Aboriginal representatives in the ongoing field investigations.

The Aboriginal focus group provides a forum for the registered Aboriginal stakeholders to identify and manage Aboriginal cultural issues at an early stage of the proposal. The group facilitates ongoing community involvement throughout the life of the Mount Victoria to Lithgow project, ensures appropriate care and control of Aboriginal artefacts identified during the Aboriginal heritage investigations, and provides comment on all aspects of Aboriginal heritage management.

Twenty-nine Aboriginal stakeholders were registered for the Mount Victoria to Lithgow project, including members from the following groups:

- Bathurst Local Aboriginal Land Council (LALC).
- Darug Land Observation.
- Darug Aboriginal Cultural Heritage Assessment.
- Deerubbin LALC.
- Gundungurra Aboriginal Heritage.
- Gundungurra Tribal Council Aboriginal Corporation.
- Mingaan Aboriginal Corporation.
- Muru Mittagr Aboriginal Group.
- Wargon and Bura Aboriginal Centre Inc.
- Wiradjuri Traditional Owners.
- Yarrawalk (a division of Tocomwall Pty Ltd).

Two focus group meetings (related to this proposal area) were held and culminated in the Aboriginal stakeholders determining that the work carried out as part of the ongoing Aboriginal investigations for the Mount Victoria to Lithgow project was appropriate and that the results and recommendations were suitable. Appropriate care and control of the Aboriginal artefacts identified was also agreed upon.

A site walkover was carried out on 13 September 2013 to supplement previous surveys and consultation carried out for the Mount Victoria to Lithgow project and confirms any potential impacts of the proposal on previously recorded Aboriginal heritage sites within and next to the proposal area. Attendees included the Aboriginal cultural heritage officer (Western Region) and project manager from Roads and Maritime, project archaeologist (Comber Consultants) and a representative from Bathurst Local Aboriginal Land Council. The walkover identified no direct impacts from the proposal on Aboriginal heritage. This was confirmed by the Aboriginal...
heritage clearance letter, provided in Appendix I. Measures to mitigate potential construction impacts have been outlined in Section 6.7.3.

5.4 Consultation required by ISEPP

Clause 13(1)(f) of the ISEPP (refer Section 4.1) requires consultation with Lithgow City Council for development that would impact on council-related infrastructure or services. Ten local roads intersect the highway in the proposal area (refer to Section 2.2).

In addition, Clause 14(1) of the ISEPP requires consultation with council for a development that would have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item). As outlined previously, a number of heritage items listed on the State Heritage Register or Lithgow City LEP (as local and State significant) are next to the proposal. The proposal also passes through the Hartley Historic Site and through the Little Hartley Draft Heritage Conservation Area.

Clause 15 of the ISEPP states that a public authority must not carry out a development on flood-labile land that would change flood patterns other than to a minor extent, unless the authority has given written notice of the intention to carry out the development to the relevant council. The proposal would not involve development in an area that is considered to constitute flood-labile land. Therefore, formal consultation with Lithgow City Council is not required under this clause.

Clause 16 of the ISEPP states that a consent authority must not carry out any of the following development without giving written notice to the specified authority and taking their responses into consideration:

(a) development adjacent to land reserved under the National Parks and Wildlife Act 1974 – the Office of Environment and Heritage,
(b) development adjacent to a marine park declared under the Marine Parks Act 1997 – Marine Parks Authority,
(c) development adjacent to an aquatic reserve declared under the Fisheries Management Act 1994 – the Office of Environment and Heritage,
(d) development in the foreshore area within the meaning of the Sydney Harbour Foreshore Authority Act 1998 – Sydney Harbour Foreshore Authority,
(e) development comprising a fixed or floating structure in or over navigable waters – Roads and Maritime Services (maritime branch),
(f) development for the purposes of an education establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act) – NSW Rural Fire Services.

No part of the proposal would be located on land next to a declared marine park, declared aquatic reserve or foreshore area. Further, the proposal would not involve development over navigable waters or for the purposes of an educational establishment, health services facility, correction centre, group home or for residential purposes. However, the proposal is located on land next to land reserved under the National Parks and Wildlife Act 1974. As such, consultation with the Office of Environment and Heritage is required for this work. Consultation under Clause 16
of ISEPP was carried out on 24 July 2013 with the Office of Environment and Heritage.

Consultation with Lithgow City Council was carried out in accordance with Clause 13 of ISEPP, on 24 July 2013 and in accordance with Clause 14 of the ISEPP on 11 October 2013. No responses were received from Lithgow City Council for this proposal.

### 5.5 Government agency and stakeholder involvement

Consultation with government authorities and agencies has been carried out throughout the proposal’s development. This has involved regular correspondence and their involvement in one-on-one meetings and briefings.

In July 2013, relevant government authorities and agencies were sent a letter detailing the proposal and providing an opportunity to comment. The agencies and stakeholders contacted were:

- NSW Environment Protection Authority (EPA).
- NSW Department of Primary Industries (DPI) (Agriculture).
- NSW Department of Human Services.
- Department of Primary Industries – Crown Lands Division.
- DPI (Fisheries).
- NSW Department of Primary Industries (Office of Water).
- NSW Office of Environment and Heritage (OEH) (Parks and Wildlife).
- OEH (Heritage Branch).
- Sydney Catchment Authority/ Hawkesbury Nepean Catchment Authority.
- NSW Trains (formerly RailCorp).
- Fire and Rescue NSW.
- NSW Police.
- NSW Rural Fire Service.

In addition, in July 2013, utility service providers whose services occur within or abut the proposal area were sent letters detailing the proposal and provided with an opportunity to comment. Letters were sent to:

- Endeavour Energy.
- Jemena (an electricity, water and gas provider).
- Telstra.
- Sydney Water.

A letter was also issued to CSR Building Products in response to a recommendation from Mineral Resources Branch. This letter was sent on 15 August 2013.

Four stakeholders responded: Jemena, NSW Department of Trade and Investment – Mineral Resources Branch (received via NSW Department of Primary Industries), NSW EPA and the Heritage Council of NSW. The issues raised in their submissions, and where these issues are addressed in the REF, are provided in Table 5-2. Copies of the responses received are included in Appendix B of this REF.

#### Table 5-2 Summary of issues raised by government agencies and stakeholders

<table>
<thead>
<tr>
<th>Agency/stakeholder</th>
<th>Issue category</th>
<th>Issues raised</th>
<th>Relevant REF section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jemena</td>
<td>Location of</td>
<td>No gas infrastructure is located within</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Hartley Valley safety upgrade
Review of Environmental Factors

52
<table>
<thead>
<tr>
<th>Agency/stakeholder</th>
<th>Issue category</th>
<th>Issues raised</th>
<th>Relevant REF section</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW Department of Trade and Investment – Mineral Resources Branch</td>
<td>Location of Mount Victoria clay pit.</td>
<td>A clay pit is located to the south of the Great Western Highway, at the eastern end of the proposal. Mineral Resources Branch recommends consultation with the titleholder, CSR Building Products, to be satisfied that the proposal would not affect future extraction of the identified resource.</td>
<td>Section 5.5</td>
</tr>
</tbody>
</table>
| NSW EPA | Potential impacts associated with the upgrade. | All activities must comply with the requirements of the *Protection of the Environment Operations Act 1997* (POEO Act) including, but not limited to:  
  - Section 115 and 116 (disposal of waste and leaks, spillages and other escapes).  
  - Section 120 (pollution of waters).  
  - Section 124 and 126 (operations that result in air pollution).  
  - Section 139 (noise pollution).  
  - Section 167 (appropriate maintenance and operation of plant and equipment). | Section 6.4, Appendix F  
Section 6.5, Appendix G |
<p>|                | Water quality impacts during construction. | REF should identify potential impacts to surface water from construction activities. | Section 6.4.4 Appendix F |
|                | Mitigating water quality impacts during construction. | REF should detail appropriate pollution control systems such as erosion and sediment controls during construction and the rehabilitation stage, as well as the use of permanent erosion and sediment controls where required. | Section 3.4.2, Section 6.4.4, Appendix F |
|                | Location of the proposal within the Sydney Drinking Water Catchment and proximity to sensitive receiving environments. | Priority should be given to achieving a high standard of erosion and sediment control and general site management, given the proposal's proximity to sensitive receiving environments and location within the Sydney Drinking Water Catchment. | Section 6.4.5, Appendix F |
|                | Potential noise impacts. | Identify all noise sensitive receivers and provide a risk ranking of potential noise impacts during construction and operation of the project. Identify noise mitigation strategies to ensure compliance with relevant noise guidelines and legislation. | Section 6.5 Appendix G |
|                | Potential odour and air impacts. | Identify impacts from dust during the construction period and detail mitigation measures to minimise dust. | Section 6.12 |</p>
<table>
<thead>
<tr>
<th>Agency/ stakeholder</th>
<th>Issue category</th>
<th>Issues raised</th>
<th>Relevant REF section</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>emissions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Potential</td>
<td>Identify potential areas of soil or groundwater contamination and detail appropriate remediation actions.</td>
<td>Section 6.8</td>
</tr>
<tr>
<td></td>
<td>contaminated</td>
<td>land within the proposal area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Waste</td>
<td>All reasonable and feasible options and strategies for waste minimisation, reuse and recycling should be assessed.</td>
<td>Section 6.14</td>
</tr>
<tr>
<td></td>
<td>management.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Storage of</td>
<td>Details of control measures proposed for storage to appropriately manage the risk of spills contaminating waterways and land should be provided.</td>
<td>Section 6.4,</td>
</tr>
<tr>
<td></td>
<td>chemicals/fuels.</td>
<td></td>
<td>Section 6.8</td>
</tr>
<tr>
<td></td>
<td>Incident</td>
<td>Details for ensuring that incidents that cause material harm to the environment are notified to the appropriate regulatory authorities within required timeframes should be provided in the REF.</td>
<td>Section 7.1</td>
</tr>
<tr>
<td></td>
<td>management</td>
<td>procedures.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heritage Council of NSW</td>
<td>The proposal is located next to the State Heritage Register listed Hartley Historic Site, which is listed, in part, for its significant aesthetic qualities. Any intervention or changes Roads and Maritime carries out to this area must be done with appropriate planning and consideration of this heritage significance.</td>
<td>Section 6.2,</td>
</tr>
<tr>
<td></td>
<td>Heritage</td>
<td></td>
<td>Section 6.6</td>
</tr>
<tr>
<td></td>
<td>significance</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>of the Hartley</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Historic Site</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(State Heritage Listed)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 5.6 Ongoing or future consultation

This REF will be placed on public display for comment. Following the submissions period, Roads and Maritime will collate submissions. After consideration of community comments, Roads and Maritime will determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are necessary.

The toll-free information line will also be available for any queries that the community or affected road users may have during the public display period and during construction. Roads and Maritime will also continue to update the project website (http://www.rta.nsw.gov.au/roadprojects/projects/great_western_hway/) and issue community update newsletters during the display of this REF and during construction.

#### 5.6.1 Consultation with affected landowners

If the proposal is determined, Roads and Maritime will consult with all directly affected landholders before the start of construction activities. Roads and Maritime will consult with:

- Landowners whose access could be affected (access to private properties would
be maintained during construction).

- Landowners whose land would be acquired, to ensure their concerns are clearly understood and can be addressed wherever possible.
- Landowners affected by construction noise impacts (to discuss individual noise mitigation treatments) and night work (if required) (consultation would occur before and during construction).

5.6.2 Consultation with government agencies and service providers

Roads and Maritime would continue to consult with government agencies such as OEH, DPI and SCA and Lithgow City Council before and during construction, specifically in regard to staging plans, traffic management and temporary road shut-downs.

Roads and Maritime would also continue to consult with service providers such as Endeavour Energy, Telstra and Sydney Water to ensure the design adheres to their requirements and that no services are inadvertently impacted by the proposal.

5.7 Conclusion

Roads and Maritime has consulted with the local community, the Aboriginal community, government agencies and stakeholders since 2010. Consultation has included meetings, displays, newsletters, items in the local media, and a project website. As a result, Roads and Maritime is confident that the proposal has been well publicised, and that all interested individuals and stakeholders have had an opportunity to learn about the proposal and to comment on it. Feedback received has been generally supportive of the proposal. Roads and Maritime will continue to consult with the local community, the Aboriginal community, government agencies and stakeholders.

The next chapter presents the environmental assessment of the proposal.
6 Environmental assessment

This chapter provides a detailed description of all potential environmental impacts that could result from the construction and operation of the proposal. It considers the factors specified in the guideline, Is an EIS required? (DUAP, 1999), as required under clause 228(1)(b) of the Environmental Planning and Assessment Regulation 2000. The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix A. This chapter also includes site-specific safeguards to ameliorate the potential impacts.

6.1 Biodiversity

An assessment has been prepared to identify the extent and magnitude of potential impacts of the proposal on biodiversity. The assessment is presented in the Biodiversity Assessment Technical Paper (SKM, 2013a), which is provided in full in Appendix C. A summary of this assessment is provided in this section.

6.1.1 Methodology

Study area

This assessment uses the following terms:

- The ‘locality’: This refers to the broader bioregional context defined by Thackway and Cresswell (1995) as the Sydney Bioregion.
- The ‘study locality’: This refers to the area within a radius of 10 kilometres of the study area.
- The ‘proposal area’, ‘study area’ and ‘construction footprint’ are as per the definition provided in Section 1.1 of this REF.

Review of literature, mapping and government databases

A desktop review was carried out of background reports pertaining to the biodiversity of the bioregion and the study locality. These reports included:

- Great Western Highway Upgrade: Biodiversity Corridor Studies (MV2L Alliance, 2011a).
- Great Western Highway Upgrade: Biodiversity Survey Results – Sections 2 to 6 (MV2L Alliance, 2012b).

Government databases and mapping were also reviewed to identify potential threatened species, populations and ecological communities of the study locality. Databases and mapping were consulted in July 2013 and again in October 2013, and included:

- The GIS data layer of the regional biodiversity corridors in the Hawkesbury-Nepean Catchment Management Authority Area (DECC, 2005).
- Vegetation types database [Biometric] (OEH).
- Threatened species database of the NSW Office of Environment and Heritage (OEH).
- Native Vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al, 2010).
Field investigations

SKM has collected detailed ecological data in the study area for previous studies (Roads and Maritime 2009, 2011, 2012), which formed the basis of baseline information used in this assessment and informed the identification of key areas for investigation.

Additional field surveys focused on the construction footprint and proposal area along the length of the proposal. They were carried out in winter 2013, and completed on 10–11 July 2013. The surveys involved:

- Identifying biodiversity values within the vicinity of the proposal, within areas of known high ecology sensitivity and in areas where existing data was limited.
- Capturing qualitative data on flora and fauna diversity.
- Recording additional vegetation distribution and habitat associations.
- Undertaking road traverses for any threatened flora and fauna species, and their habitat, particularly those identified during the database reviews.
- Identifying habitat for threatened fauna and important resources such as hollow-bearing trees, logs, large rocks and nectar-producing plants.
- Identifying key Koala habitat.
- Recording all opportunistic sightings and evidence of fauna presence (this included listening for bird calls; occasional searches in leaf litter, fallen timber, and inspecting droppings and tracks).

A spring survey targeting the Bathurst Copper Butterfly (*Paralucia spinifera*) (also known as the Purple Copper Butterfly) was carried out for the proposal on 10 October 2013. The primary purpose of this survey was to confirm the presence and distribution of the Bathurst Copper Butterfly.

6.1.2 Existing environment

The study area is located within the South Eastern Highlands and Sydney Basin bioregions (Interim Biogeographic Regionalisation for Australia, 2012). The study area is located entirely within the Hawkesbury-Nepean Catchment Management Area (CMA) and traverses the Mid Coxs River Subcatchment. The region is important for biodiversity because it provides a transition from the mountains in the east to the western slopes and plains.

The study area traverses the slopes of the Sydney Basin western escarpment of conglomerate, shale and sandstone, and the Bathurst Granites. The dominant vegetation formations include grassy woodlands, dry sclerophyll forests and riparian forest.

The majority of the study area supports areas of high condition native vegetation, modified remnant vegetation and previously cleared roadsides linked to pastures nearby. The majority of areas close to the roadside consist of younger tree regrowth (less than 10 years old), with more mature trees present in the eastern portion of the proposal including hollow-bearing trees. Roadside areas typically have weed cover mixed with native understorey. These areas vary in condition but have good potential for regeneration as tree species become present.
Vegetation communities

Eight native vegetation communities and one exotic community occur in the study area. These were all identified during the review of previous corridor studies (MV2L Alliance, 2011a), however, only six communities were identified during field investigations for the proposal. They are listed in Table 6-2 along with the equivalent map units identified in regional vegetation community mapping projects and the conservation status of each community according to information provided by Tozer et al (2010), DEC (2006) and the TSC Act and EPBC Act. The distribution of these communities within the study area is shown in Figure 6-1a to Figure 6–1c.

One vegetation community in the proposal area is a threatened ecological community. It is Map Unit 5: Ribbon Gum Grassy Woodland, consistent with Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions community listed as endangered under the TSC Act.

Fauna habitats

Five fauna habitats were identified in the study area (refer Table 6-2, which lists their association with native vegetation communities, and Table 6-3, which provides a description of the habitats). The distribution of these habitats is mapped in associated vegetation types in Figure 6-2a to Figure 6–2c.

Potential Bathurst Copper Butterfly (*Paralucia spinifera*) (also known as Purple Copper Butterfly) habitat was previously identified next to the existing highway in several locations during surveys (MV2L Alliance, 2011a and Mjadwesch Environmental Service Support, 2012). However, with updated targeted surveys (Mjadwesch Environmental Service Support) in 2013 it was confirmed that the Bathurst Copper Butterfly is absent in the study area. No potential habitat is represented in the study area based on habitat characteristics such as the low abundance of Blackthorn and altitude below 850 metres.

About 13 large habitat trees, dead standing trees with hollows and developing hollows were identified throughout the construction footprint during field surveys (refer to Figure 6-2a to Figure 6–2c). Most hollows vary in size from small (less than 10 centimetres diameter) to medium (equal to or greater than 10 centimetres and equal to or less than 20 centimetres diameter). However, few large hollows were observed during field surveys.

In NSW, terrestrial vertebrate species that are reliant on tree hollows for shelter and nests include at least 46 mammals, 81 birds, 31 reptiles and 16 frogs (Gibbons and Lindenmayer 2002). Hollows identified in the construction footprint may be used by the following species listed in Table 6-1.

Table 6-1 Threatened species potentially affected by the loss of hollow-bearing trees and considered moderately or highly likely to occur in the study area

<table>
<thead>
<tr>
<th>Common name</th>
<th>Species</th>
<th>TSC Act</th>
<th>EPBC Act</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gang-gang Cockatoo</td>
<td><em>Callocephalon fimbriatum</em></td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Powerful Owl</td>
<td><em>Ninox strenua</em></td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Barking Owl</td>
<td><em>Ninox connivens</em></td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Spotted-tailed Quoll</td>
<td><em>Dasyurus maculatus</em></td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Common name</td>
<td>Species</td>
<td>TSC Act</td>
<td>EPBC Act</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>Eastern False Pipistrelle</td>
<td><em>Falsistrellus tasmaniensis</em></td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Eastern Freetail-bat</td>
<td><em>Mormopterus norfolkensis</em></td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Southern Myotis</td>
<td><em>Myotis macropus</em></td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Yellow-bellied Glider</td>
<td><em>Petaurus australis</em></td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Yellow-bellied Sheatetail-bat</td>
<td><em>Saccolaimus flaviventris</em></td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Greater Broad-nosed Bat</td>
<td><em>Scoteanax rueppellii</em></td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Squirrel Glider</td>
<td><em>Petaurus norfolcensis</em></td>
<td>V</td>
<td>-</td>
</tr>
</tbody>
</table>

V: Vulnerable
HARTLEY VALLEY SAFETY UPGRADE - Review of environmental factors

LEGEND
Proposal area
Existing highway
Road
Primary waterway
Minor waterway
Waterbody
Property boundary

Vegetation communities
Map unit 1: Mountain Gum – Peppermint Open Forest
Map unit 2: Thin-leaved Stringybark Woodland
Map unit 3: Brittle Gum – Stringybark Woodland
Map unit 4: River Oak Forest
Map unit 5: Ribbon Gum Grassy Woodland
Map unit 6: Yellow Box Grassy Woodland
Map unit 7: Blakely's Red Gum Grassy Woodland
Map unit 8: Red Stringybark Woodland
Map unit 9: Horticultural native/exotic plantings/weeds

Vegetation condition
High
Moderate
Low

DATA SOURCES

Newcastle Spatial Team - Prepared by: KO
Checked by: VC
FIGURE 6-1b VEGETATION COMMUNITIES

Legend:
- Proposal area
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Waterbody
- Property boundary

Vegetation communities:
- Map unit 1: Mountain Gum – Peppermint Open Forest
- Map unit 2: Thin-leaved Stringybark Woodland
- Map unit 3: Brittle Gum – Stringybark Woodland
- Map unit 4: River Oak Forest
- Map unit 5: Ribbon Gum Grassy Woodland
- Map unit 6: Yellow Box Grassy Woodland
- Map unit 7: Blakely’s Red Gum Grassy Woodland
- Map unit 8: Red Stringybark Woodland
- Map unit 9: Horticultural native/exotic plantings/weeds

Vegetation condition:
- High
- Moderate
- Low

Data Sources:
- Roads and Maritime Services 2013
- LPMA 2010
- STREETWORKS 2001
- SKM 2013, 2011
FIGURE 6-1c | VEGETATION COMMUNITIES

LEGEND
Proposal area
Existing highway
Road
Primary waterway
Minor waterway
Waterbody
Property boundary
Vegetation communities
- Map unit 1: Mountain Gum – Peppermint Open Forest
- Map unit 2: Thin-leaved Stringybark Woodland
- Map unit 3: Brittle Gum – Stringybark Woodland
- Map unit 4: River Oak Forest
- Map unit 5: Ribbon Gum Grassy Woodland
- Map unit 6: Yellow Box Grassy Woodland
- Map unit 7: Blakely’s Red Gum Grassy Woodland
- Map unit 8: Red Stringybark Woodland
- Map unit 9: Horticultural native/exotic plantings/weeds

Vegetation condition
- High
- Moderate
- Low

DATA SOURCES

HARTLEY VALLEY SAFETY UPGRADE - Review of environmental factors
<table>
<thead>
<tr>
<th>Vegetation community</th>
<th>Equivalent vegetation communities</th>
<th>Conservation</th>
<th>Status EPBC Act</th>
<th>Status TSC Act</th>
<th>Fauna habitat type and characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map Unit 2: Thin-leaved Stringybark Woodland</td>
<td>DEC (2006) MU 22 Kanangra Gorge Sheltered Grey Gum Forest. Tozer et al (2010). DSF p37: Kowmung-Wollondilly Grassy Gorge Forest and possibly part of GW p24 Tableland Grassy Box-Gum Woodland. Biometric: Grey Gum – Thin-leaved Stringybark grassy woodland of the southern Blue Mountains gorges, Sydney Basin.</td>
<td>Tozer et al (2010) estimate &gt;90% of the pre-clearing area of this vegetation community (DSF p37: Kowmung-Wollondilly Grassy Gorge Forest) remains, and 70–90% of the pre-clearing area is in conservation reserves. Tozer et al (2010) identify that GW p24 Tableland Grassy Box-Gum Woodland may be consistent with the State and federal determinations for the TEC for grassy box-gum woodland, but the dominance by <em>Eucalyptus eugenoides</em>, the landscape position on a steep sandstone slope and the low abundance of diagnostic species in the understorey identify that this community is not consistent with the determinations for any TECs.</td>
<td>-</td>
<td>-</td>
<td>Grassy woodland.</td>
</tr>
<tr>
<td>Map Unit 3: Brittle Gum – Stringybark Woodland</td>
<td>Tozer et al (2010) Possibly part of GW p24 Tableland Grassy Box-Gum Woodland DEC (2006) MU 34 Tableland Slopes Brittle Gum – Broad-</td>
<td>The closest equivalent map unit as described by Tozer et al (2010) (GW p24) is regarded as being highly cleared with only 20–40% of the pre-clearing area estimated to remain and &lt;2% of the pre-clearing area estimated to occur in conservation reserves.</td>
<td>-</td>
<td>-</td>
<td>Grassy woodland.</td>
</tr>
<tr>
<td>Vegetation community</td>
<td>Equivalent vegetation communities</td>
<td>Conservation</td>
<td>Status</td>
<td>Fauna habitat type and characteristics</td>
<td></td>
</tr>
<tr>
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<td>--------------</td>
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<td>---------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Leaved peppermint Grassy Forest. Biometric: Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands and South East Corner.</td>
<td>Tozer et al (2010) identify that GW p24 Tableland Grassy Box-Gum Woodland may be consistent with the State and federal determinations for the TEC for grassy box-gum woodland, but the lack of diagnostic species and the shrubby understorey identify that this community is not consistent with the determinations for any TECs.</td>
<td>EPBC Act</td>
<td>TSC Act</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Map Unit 4: River Oak Forest</strong></td>
<td>Tozer et al (2010). FoW p32: Riverbank Forest. Biometric: River Oak open forest of major streams, Sydney Basin and South East Corner.</td>
<td>Areas of this community in the study area have been identified as priority fauna habitat (DECC, 2005). Tozer et al (2010) estimate there is about 60–85% of the pre-clearing area of this vegetation community (FoW p32 Riverbank Forest) remaining, and 25–45% of the pre-clearing area is in conservation reserves. This map unit has affinities to the State-listed TEC River-flat Eucalypt Forest on Coastal floodplains. However, the corridor is unlikely above 250 metres elevation which excludes this community as being on a coastal floodplain.</td>
<td>-</td>
<td>Riparian forest.</td>
<td></td>
</tr>
<tr>
<td><strong>Map Unit 5: Ribbon Gum Grassy Woodland (TEC)</strong></td>
<td>Tozer et al (2010) GW p420 Tableland Granite Grassy Woodland. Biometric: Broad-leaved Peppermint – Ribbon Gum grassy open forest in the northeast of the South Eastern Highlands.</td>
<td>This community is consistent with the TEC Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions listed as Endangered under the TSC Act. This community is regarded as being highly cleared with only 20–35% of the pre-European extant estimated to remain and &lt;1 per cent of the pre-European extant estimated to occur in conservation reserves (Tozer et al, 2010). This community has not</td>
<td>-</td>
<td>Grassly woodland.</td>
<td></td>
</tr>
<tr>
<td>Vegetation community</td>
<td>Equivalent vegetation communities</td>
<td>Conservation</td>
<td>Status</td>
<td>Fauna habitat type and characteristics</td>
<td></td>
</tr>
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<td></td>
</tr>
<tr>
<td>Map Unit 6: Yellow Box Grassy Woodland (TEC)</td>
<td>Tozer et al (2010) GW p420 Tableland Granite Grassy Woodland. Biometric: Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north-east of the South Eastern Highlands.</td>
<td>This community is regarded as being highly cleared with only 20–35% of the pre-European extant estimated to remain and &lt;1% of the pre-European extant estimated to occur in conservation reserves (Tozer et al, 2010). This map unit is dominated by Yellow Box (Eucalyptus melliodora) and supports a herb-rich grassy understorey and therefore is considered to be consistent with the determination for grassy box-gum woodland under both the TSC Act and the EPBC Act. Considering the dominance of Yellow Box (Eucalyptus melliodora) in this map unit and the low abundance of Ribbon Gum (Eucalyptus viminalis), this community is considered to be not consistent with the TEC Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions listed as Endangered under the TSC Act.</td>
<td>Critically endangered</td>
<td>Endangered</td>
<td>Grassly woodland.</td>
</tr>
<tr>
<td>Map Unit 7: Tozer et al (2010) GW p23</td>
<td>This community is regarded as being highly cleared</td>
<td>Critically</td>
<td>Endangered</td>
<td>Grassly</td>
<td></td>
</tr>
<tr>
<td>Vegetation community</td>
<td>Equivalent vegetation communities</td>
<td>Conservation</td>
<td>Status EPBC Act</td>
<td>Status TSC Act</td>
<td>Fauna habitat type and characteristics</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------</td>
<td>--------------</td>
<td>----------------</td>
<td>--------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Blakely’s Red Gum Grassy Woodland (TEC)</td>
<td>Tableland Hills Grassy Woodland and DEC (2006) MU 33 Tableland Broad-leaved Peppermint – Brittle Gum – Red Stringybark Grassy Open Forest. Biometric: Broad-leaved Peppermint – Red Stringybark grassy open forest on undulating hills, South Eastern Highlands.</td>
<td>with only 20–40% of the pre-European extant estimated to remain and &lt;2% of the pre-European extant estimated to occur in conservation reserves (Tozer et al, 2010). This map unit is dominated by Blakely’s Red Gum (Eucalyptus blakelyi) and supports a herb-rich grassy understorey and therefore is considered to be consistent with the determination for grassy box-gum woodland under both the TSC Act and the EPBC Act.</td>
<td>endangered</td>
<td></td>
<td>woodland.</td>
</tr>
<tr>
<td>Map Unit 8: Red Stringybark Woodland</td>
<td>Tozer et al (2010) GW p23 Tableland Hills Grassy Woodland. Biometric: Broad-leaved Peppermint – Red Stringybark grassy open forest on undulating hills, South Eastern Highlands.</td>
<td>This community is regarded as being highly cleared with only 20–40% of the pre-European extant estimated to remain and &lt;2% of the pre-European extant estimated to occur in conservation reserves (Tozer et al, 2010).</td>
<td>-</td>
<td>-</td>
<td>Grassy woodland.</td>
</tr>
<tr>
<td>Map Unit 9: Horticultural plantings/weeds</td>
<td>Nil. May include streetscapes (footpaths and parklands) that contain exotic trees or natives not natural to the local area. Also includes landscaped residential frontages with only one or two canopy species representative of original vegetation communities in the area with a maintained understorey.</td>
<td>Nil.</td>
<td>-</td>
<td>-</td>
<td>Modified habitats.</td>
</tr>
</tbody>
</table>
FIGURE 6-2a I THREATENED FLORA, FAUNA AND HABITAT

DATA SOURCES
FIGURE 6-2b I THREATENED FLORA, FAUNA AND HABITAT

LEGEND
- Proposal area
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Waterbody
- Property boundary
- Wildlife corridors - Blue Mountains Western Escarpment
- Connectivity zones
- Habitat tree
- Threatened flora
- Eucalyptus nicholii
- Threatened fauna (2012)
  - Barking Owl
  - Gang-gang Cockatoo
  - Powerful Owl
  - Varied Sittella
  - Little Bentwing Bat
- Fauna habitat
  - Dry sclerophyll forest
  - Farm dam
  - Sheltered dry sclerophyll forest
  - Grassy woodland
  - Riparian forest
  - Wet meadow - pasture
  - Modified habitat

DATA SOURCES
Roads and Maritime Services 2013,
LPMA 2010, STREETWORKS 2001,
SKM 2013, 2011

HARTLEY VALLEY SAFETY UPGRADE - Review of environmental factors

4/11/2013 | I:\ENVR\Projects\EN04213\Technical\Spatial\GIS_Directory\ArchMap\Figures\REF\HartleyValley\EN04213_GIS_Ec_F004_HV_ThSpHabitat_r3v1.mxd
Newcastle Spatial Team - Prepared by: HS
Checked by: VC
HARTLEY VALLEY SAFETY UPGRADE - Review of environmental factors

LEGEND
- Proposal area
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Waterbody
- Property boundary
- Wildlife corridors - Blue Mountains Western Escarpment
- Connectivity zones
- Habitat tree
- Threatened flora
- Eucalyptus nicholii
- Threatened fauna (2012)
  - Barking Owl
  - Gang-gang Cockatoo
  - Powerful Owl
  - Varied Sittella
  - Little Bentwing Bat
- Fauna habitat
  - Dry sclerophyll forest
  - Farm dam
  - Sheltered dry sclerophyll forest
  - Grassy woodland
  - Riparian forest
  - Wet meadow - pasture
  - Modified habitat

DATA SOURCES
Roads and Maritime Services 2013,
LPMA 2010, STREETWORKS 2001,
SKM 2013, 2011

FIGURE 6-2c THREATENED FLORA, FAUNA AND HABITAT
### Table 6-3 Fauna habitats in the study area

<table>
<thead>
<tr>
<th>Fauna habitat</th>
<th>Habitat description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grassy woodland</td>
<td>This habitat is widespread and varies in size and condition across the study area. It provides foraging and sheltering habitat for woodland and generalist bird species. Some of the dominant tree species are known as potential feed trees for Koala, while tree hollows are scarce or absent. The open structure of the woodland habitat is suited to a range of macropod and reptile species as well as small mammals. Grassy woodland could provide habitat for the following threatened fauna: Regent Honeyeater, Varied Sittella, Barking Owl, Powerful Owl, Scarlet Robin, Eastern False Pipistrelle, Eastern Bentwing Bat, Eastern Free-tailed Bat, Southern Myotis, Spotted-tailed Quoll and Squirrel Glider.</td>
</tr>
<tr>
<td>Sheltered dry sclerophyll forest</td>
<td>This habitat dominates the steeper slopes near the base of Victoria Pass. It comprises a dense understorey with greater cover of large and mid-sized trees and shrubs, including tree hollows and dead trees. It generally has a greater abundance of macropods and bandicoots, as well as small mammals. This habitat may provide for a range of threatened mammals and birds, including Regent Honeyeater, Gang-gang Cockatoo, Varied Sittella, Little Lorikeet, Barking Owl, Powerful Owl, Scarlet Robin, Eastern False Pipistrelle, Little Bentwing Bat, Eastern Bentwing Bat, Eastern Free-tailed Bat, Southern Myotis, Yellow-bellied Sheathtail-bat, Greater Broad-nosed Bat, Squirrel Glider, Yellow-bellied Glider and Spotted-tailed Quoll.</td>
</tr>
<tr>
<td>Riparian habitat</td>
<td>This habitat is limited to vegetation next to permanent creeks and rivers in the study area, which include the River Lett, Boxes Creek and other unnamed permanent watercourses. This habitat is susceptible to disturbance, weed invasion and degradation. It provides for stream-dwelling temperate frog species, while providing foraging and potential sheltering opportunities for the Glossy Black-cockatoo, Regent Honeyeater and Little Lorikeet, reptiles, small mammals such as Southern Myotis, and native fish species such as Australian Grayling.</td>
</tr>
<tr>
<td>Aquatic habitat</td>
<td>The main freshwater habitat within the study area is located within the River Lett. Previous studies have identified stream-dwelling frogs and other frog species as utilising this habitat within the study area. There is potential for Australian Grayling fish to occur in the area.</td>
</tr>
<tr>
<td>Modified habitat</td>
<td>Cleared and semi-cleared farmland is plentiful on both sides of the Great Western Highway. Vegetation cover is restricted to paddock trees, small fragments of regrowth woodland or planted shelter rows. Tree hollows and logs are limited and restricted to immediate areas surrounding remnant trees. This habitat could be used by a range of threatened fauna for foraging and dispersal, such as Spotted-tailed Quoll, Scarlet Robin, Eastern Bentwing Bat, Eastern Free-tailed Bat. Also, migratory birds such as Great Egrets and Cattle Egrets forage in paddocks and use farm dams.</td>
</tr>
</tbody>
</table>

**Threatened ecological communities**

Two threatened ecological communities (TECs, covering three Map Units) listed under the TSC Act and the EPBC Act were identified in the study area and are listed in **Table 6-4**.
Table 6-4 Threatened ecological communities

<table>
<thead>
<tr>
<th>Threatened ecological community</th>
<th>Equivalent units</th>
<th>Conservation status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the Southeastern highlands, Sydney Basin, South-east Corner and NSW South Western Slopes Bioregions (Tablelands Grassy Woodland)</td>
<td>Map Unit 5: Ribbon Gum Grassy Woodland</td>
<td>E</td>
<td>Low to moderate condition vegetation occurs next to the highway between Mid Hartley Road and the Old Bathurst Road intersections. Higher condition vegetation occurs next to the Jenolan Caves Road and Blackmans Creek Road intersections with the highway and River Lett. About 0.86 ha of this TEC occurs within the proposal area, of which 0.18 ha is in high condition and 0.14 is in moderate condition.</td>
</tr>
<tr>
<td>White Box-Yellow Box-Blakely’s Red Gum Woodland (TSC Act) White Box-Yellow Box-Blakely’s Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)</td>
<td>Map Unit 6: Yellow Box Grassy Woodland. Map Unit 7: Blakely’s Red Gum Grassy Woodland.</td>
<td>E CE</td>
<td>High condition vegetation occurs to the north of River Lett near the Jenolan Caves Road intersection. Although vegetation areas are disturbed by weed invasion and agricultural land use, there are some areas of high condition vegetation with higher diversity of native flora species, including areas consistent with the Commonwealth determining criteria. This TEC does not occur within the proposal area.</td>
</tr>
</tbody>
</table>

E: Endangered, CE: Critically endangered

**Groundwater-dependent ecosystems**

Vegetation communities in the study area are considered to have a low level of dependency on groundwater resources. A search of the Atlas of Groundwater Dependent Ecosystems (Bureau of Meteorology, 2013) indicated no groundwater interaction with the surface. Previous surveys have observed no wetlands and no water in drainage lines. There is potential for groundwater contribution to the riparian vegetation next to the River Lett, but the dry nature of surrounding woodland and farmland indicates an absence of groundwater in the broader landscape.

**Threatened flora**

A search of threatened flora database records in July 2013 found that 27 threatened flora species potentially occur in the study area. Of these, 19 species are considered to have a low likelihood of occurrence within the proposal area, while seven species are considered to be unlikely to occur within the proposal area. One record of Narrow-leaved Black Peppermint (*Eucalyptus nicholli*) is confirmed in the study area (listed as vulnerable the TSC Act and EPBC Act) however observed trees have been planted and are not naturally occurring. Threatened flora species within the locality are shown in Figure 6-3.
Threatened fauna

A search of threatened fauna database records for the locality in July 2013 found that 30 threatened fauna species potentially occur in the study area. Of these, seven birds, 11 mammals and one invertebrate species have a moderate or high likelihood of occurring within the study area. They are listed in Table 6-5.

Table 6-5 Threatened fauna species with moderate to high likelihood of occurring in study area

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Status</th>
<th>Potential habitat in the study area</th>
<th>Likelihood of occurrence in the proposal area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Birds</strong></td>
<td></td>
<td>EPBC Act</td>
<td>TSC Act</td>
<td></td>
</tr>
<tr>
<td>Anthochaera phrygia</td>
<td>Regent Honeyeater</td>
<td>E</td>
<td>CR</td>
<td>Dry Box-Ironbark eucalypt woodland and dry sclerophyll forest and riparian forests containing River Oak.</td>
</tr>
<tr>
<td>Callocephalon fimbriatum</td>
<td>Gang-gang Cockatoo</td>
<td>-</td>
<td>V</td>
<td>Wet and dry sclerophyll forests.</td>
</tr>
<tr>
<td>Daphoenositta chrysoptera</td>
<td>Varied Sittella</td>
<td>-</td>
<td>V</td>
<td>Eucalypt forests and woodlands, containing rough-barked species.</td>
</tr>
<tr>
<td>Glossopsitta pusilla</td>
<td>Little Lorikeet</td>
<td>-</td>
<td>V</td>
<td>Wet and dry sclerophyll forests, woodlands and riparian areas.</td>
</tr>
<tr>
<td>Ninox connivens</td>
<td>Barking Owl</td>
<td>-</td>
<td>V</td>
<td>Dry sclerophyll forests, woodlands.</td>
</tr>
<tr>
<td>Ninox strenua</td>
<td>Powerful Owl</td>
<td>-</td>
<td>V</td>
<td>Wet and dry sclerophyll forests, woodlands and rainforest.</td>
</tr>
<tr>
<td>Petroica boodang</td>
<td>Scarlet Robin</td>
<td>-</td>
<td>V</td>
<td>Dry sclerophyll forests and woodlands, agricultural areas with scattered tree remnants.</td>
</tr>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Falsistrellus tasmaniensis</td>
<td>Eastern False Pipistrelle</td>
<td>-</td>
<td>V</td>
<td>Sclerophyll forests and woodlands.</td>
</tr>
<tr>
<td>Miniopterus australis</td>
<td>Little Bentwing Bat</td>
<td>-</td>
<td>V</td>
<td>Wet and dry sclerophyll forests, moist eucalypt forests.</td>
</tr>
<tr>
<td>Miniopterus schreibersii oceanensis</td>
<td>Eastern Bentwing Bat</td>
<td>-</td>
<td>V</td>
<td>Dry sclerophyll forests, woodlands and derived grasslands, agricultural areas.</td>
</tr>
</tbody>
</table>
Invertebrates

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Status EPBC Act</th>
<th>Status TSC Act</th>
<th>Potential habitat in the study area</th>
<th>Likelihood of occurrence in the proposal area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paralucia spinifera</td>
<td>Bathurst Copper Butterfly</td>
<td>V</td>
<td>E</td>
<td>Dry sclerophyll forests and woodlands.</td>
<td>High.</td>
</tr>
</tbody>
</table>

V: Vulnerable, E: Endangered

In addition, previous studies included detailed fauna surveys within and outside the study area (MV2L Alliance, 2011a) have confirmed the presence of four threatened birds and one threatened microbat (refer to Table 6-6). Surveys carried out for the proposal did not confirm the presence of any additional threatened species within the proposal area.

Table 6-6 Threatened species recorded in surveys

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
<th>Fauna habitat type</th>
<th>Habitat condition</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gang-gang Cockatoo (Callocephalon fimbriatum)</td>
<td>Vulnerable (TSC Act)</td>
<td>Grassy woodland</td>
<td>High (Map Unit 3).</td>
<td>Pair recorded in the east of study area.</td>
</tr>
<tr>
<td>Species</td>
<td>Status</td>
<td>Fauna habitat type</td>
<td>Habitat condition</td>
<td>Location</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------------</td>
<td>-----------------------------------------</td>
<td>----------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Varied Sittella</td>
<td>Vulnerable (TSC Act)</td>
<td>Grassy woodland</td>
<td>Moderate–High (Map Unit 3 and 5).</td>
<td>In small flocks (3–6 birds) in the study area.</td>
</tr>
<tr>
<td>(Daphoenositta chrysoptera)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barking Owl</td>
<td>Vulnerable (TSC Act)</td>
<td>Grassy woodland (near riparian forest)</td>
<td>High (Map Unit 5 and near Map Unit 4).</td>
<td>A tentative record based on call playback response near River Lett.</td>
</tr>
<tr>
<td>(Ninox connivens)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powerful Owl</td>
<td>Vulnerable (TSC Act)</td>
<td>Grassy woodland</td>
<td>High (Map Unit 7).</td>
<td>Recorded on the basis of an adult bird responding to call playback between the River Lett and Forty Bends Road. May occur in open forest and riparian areas. Commonly preys on Common Ringtail Possums which were found to occur in both the grassy woodland and dry sclerophyll forest.</td>
</tr>
<tr>
<td>(Ninox strenua)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little Bent-wing bat</td>
<td>Vulnerable (TSC Act)</td>
<td>Grassy woodland (near riparian forest)</td>
<td>Moderate (Map Unit 5 and near Map Unit 4).</td>
<td>Single call recording at River Lett.</td>
</tr>
<tr>
<td>(Miniopterus australis)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Koala**

No evidence of Koala was found during surveys for this proposal, nor in previous surveys (MV2L Alliance, 2011a). Six scattered records from the last 20 years in the locality are recorded for the upper Blue Mountains, with the closest recording about seven kilometres to the north of the eastern end of the Hartley Valley proposal area (refer to Figure 6-4). Known populations have been recorded further north in Wollemi National Park, about 25 kilometres to the north of the proposal area. There are no known populations in the study area. However, the study area has a relatively high proportion of potential habitat food trees listed in the NSW Koala Recovery Plan (DEGC, 2008) and under Schedule 2 of the State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44). Potential primary food trees include the Ribbon Gum (*Eucalyptus viminalis*). During field investigations and the habitat assessment, ‘habitat critical to the survival of the Koala’ (DSEWPaC, 2012) was considered, but no evidence was found to support Koala activity in the study area.
FIGURE 6-4 | THREATENED FAUNA IN THE LOCALITY

LEGEND
- The proposal
- Existing highway
- Road
- Primary waterway
- Proposal 10 km buffer

DATA SOURCES

OEH Atlas - threatened fauna (2013)
- Insects
  - Giant Dragonfly
  - Giant Burrowing Frog
  - Red-crowned Toadlet
  - Stuttering Frog

- Frogs
  - Giant Burrowing Frog
  - Red-crowned Toadlet
  - Stuttering Frog

- Reptiles
  - Blue Mountains Water Skink
  - Broad-headed Snake

- Birds
  - Flame Robin
  - Gang-gang Cockatoo
  - Little Lorikeet
  - Powerful Owl
  - Rainbow Bee-eater
  - Scarlet Robin
  - Savory Owl
  - Varied Sittella
  - White-throated Needletail

- Mammalia
  - Eastern Bentwing Bat
  - Eastern Freetail Bat
  - Greater Broad-nosed Bat
  - Large-eared Pied Bat
  - Yellow-bellied Sheathtail Bat

- Bats
  - Eastern Bentwing Bat
  - Eastern Freetail Bat
  - Greater Broad-nosed Bat
  - Large-eared Pied Bat
  - Yellow-bellied Sheathtail Bat

- Insects
  - Giant Dragonfly
  - Giant Burrowing Frog
  - Red-crowned Toadlet
  - Stuttering Frog

- Frogs
  - Giant Burrowing Frog
  - Red-crowned Toadlet
  - Stuttering Frog

- Reptiles
  - Blue Mountains Water Skink
  - Broad-headed Snake

- Birds
  - Flame Robin
  - Gang-gang Cockatoo
  - Little Lorikeet
  - Powerful Owl
  - Rainbow Bee-eater
  - Scarlet Robin
  - Savory Owl
  - Varied Sittella
  - White-throated Needletail

- Mammalia
  - Southern Myotis
  - Eastern False Pipistrelle
  - Koala
  - Spotted-tailed Quoll
  - Squirrel Glider
  - Tasmanian Bettong

HARTLEY VALLEY SAFETY UPGRADE - Review of environmental factors
Bathurst Copper Butterfly

The Bathurst Copper Butterfly, listed as endangered under the TSC Act and vulnerable under the EPBC Act, inhabits open forest and woodland areas above 850 metres elevation in a restricted range between Bathurst and Hartley in association with the larvae food plant Native Blackthorn (*Bursaria spinosa* subsp. *lasiophylla*) and the attendant ant species *Anonychomyra itinerans*. This species has a moderate likelihood of occurring, particularly in the northern end of the study area where Bathurst Copper Butterfly has been detected on the lower slopes of Hassans Walls. Recent targeted surveys (Mjadwesch Environmental Service Support 2013) of the Bathurst Copper Butterfly were completed at two locations of grassy woodland near the proposal area to confirm potential habitat for this species. There were no observations of the Bathurst Copper Butterfly in the study area and no potential habitat was recorded.

Migratory and marine species

Thirteen migratory fauna species listed under the EPBC Act potentially occur in the locality. While seven species have either a low or unlikely potential to occur, six species have a moderate potential to occur. These are listed in Table 6-7. Field investigations found no evidence to suggest that an area of important habitat for migratory species exists, or that the study area is occupied by an ecologically significant proportion of the populations of these migratory species.

Table 6-7 Migratory species with moderate potential to occur in the study area

<table>
<thead>
<tr>
<th>Common name</th>
<th>Species</th>
<th>Status</th>
<th>Preferred habitat</th>
<th>Likelihood of occurrence at the proposal area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainbow Bee-eater</td>
<td><em>Merops ornatus</em></td>
<td>Marine, Migratory (JAMBA)</td>
<td>Predominantly woodland and timbered plains.</td>
<td>Moderate: Potential habitat for this species occurs in a diversity of habitats including remnant woodland and partially cleared agricultural areas provided there is a patchwork of small woodland remnants in the landscape. These habitats form part of the much larger habitat range of the species.</td>
</tr>
<tr>
<td>Satin Flycatcher</td>
<td><em>Myiagra cyanoleuca</em></td>
<td>Marine, Migratory (Bonn Convention)</td>
<td>Predominantly forests, in particular thick vegetation in gullies.</td>
<td>Moderate: Potential to occur at forested sites throughout the study area. These habitats form part of the much larger habitat range of the species.</td>
</tr>
<tr>
<td>Latham’s Snipe</td>
<td><em>Galliago hardwickii</em></td>
<td>Marine, Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)</td>
<td>Wetlands, wet meadows, flooded grassy paddocks, open grassland and drainage areas.</td>
<td>Moderate: Potential to occur in farm dams, wet meadows and riparian areas in the study area.</td>
</tr>
<tr>
<td>Common name</td>
<td>Species</td>
<td>Status</td>
<td>Preferred habitat</td>
<td>Likelihood of occurrence at the proposal area</td>
</tr>
<tr>
<td>-------------</td>
<td>---------</td>
<td>--------</td>
<td>-------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Cattle Egret</td>
<td>Ardea ibis</td>
<td>Marine, Migratory (CAMBA, JAMBA)</td>
<td>Grasslands, woodlands and wetlands. It also uses pastures and croplands, especially where drainage is poor. Often seen with cattle. Not common in arid areas.</td>
<td>Moderate: This species may forage over all open habitat types, particularly those with isolated paddock trees and small habitat patches.</td>
</tr>
<tr>
<td>Great Egret</td>
<td>Ardea alba</td>
<td>Marine, Migratory (CAMBA, JAMBA)</td>
<td>Prefers shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.</td>
<td>Moderate: Potential to occur in farm dams, wet meadows and riparian areas in the study area.</td>
</tr>
</tbody>
</table>

Notes:  
JAMBA: Japan-Australia Migratory Bird Agreement.  
CAMBA: China-Australia Migratory Bird Agreement.  
ROKAMBA: Republic of Korea-Australia Migratory Bird Agreement.  

Weeds

Weeds are already prevalent along the roadsides within the study area, particularly in areas next to existing cleared land. There is a high potential for weeds to spread along modified road edges and penetrate into nearby remnant vegetation as a result of construction activities.

Noxious weed species recorded in low abundance within the study area include Montpellier Broom (*Genista monspessulana*), Patterson's Curse (*Echium plantagineum*), Small-leaved Privet (*Liqustrum sinense*) and Sweet Briar (*Rosa rubignosa*), while Hemlock (*Conium maculatum*) was recorded in low to moderate abundance. St John's Wort (*Hypericum perforatum*) and Blackberry (*Rubus fruticosus*) were recorded in moderate to high abundance, while African Lovegrass (*Eragrostis curvula*) was recorded in high abundance.

Wildlife connectivity corridors

NSW Department of Environment and Climate Change (DECC, 2005) has identified the Blue Mountains western escarpment as a wildlife corridor for fauna movement. This corridor passes through the vegetated areas of Victoria Pass at the eastern boundary of the study area and plays an important role in funnelling wildlife to the north and south of the study area, connecting both sides of the Great Western Highway.

As part of the previous corridor studies, planning for biodiversity connectivity was carried out to identify key fauna movement zones based on priority fauna habitats, fauna population hotspots for both arboreal and terrestrial fauna and important links in the landscape between fragmented vegetation patches (MV2L Alliance, 2011a). Connectivity zones are shown in Figure 6-2.
6.1.3 Potential impacts

Construction

Construction of the proposal would result in a number of impacts and potential impacts on native flora and fauna. These impacts are presented below.

*Loss of vegetation/habitat*

The construction footprint associated with the proposal would impact on a total of about 4.4 hectares of native and modified vegetation. Of this, 3.2 hectares (about 73 per cent) is remnant vegetation (refer to Table 6-8). The remaining vegetated lands are native and exotic plantings and disturbed land in the form of pastures and weedy roadsides (modified habitat).

Table 6-8 Direct impacts on vegetation and fauna habitat during construction

<table>
<thead>
<tr>
<th>Vegetation community type</th>
<th>Fauna habitat type</th>
<th>Biometric vegetation type</th>
<th>Conservation status/ percentage cleared (Tozer, 2010)</th>
<th>Condition</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map Unit 1: Mountain Gum – Peppermint Open Forest</td>
<td>Sheltered Dry Sclerophyll Forest</td>
<td>Narrow-leaved Peppermint – Silvertop Ash – Mountain Grey Gum shrubby open forest of the upper Blue Mountains, Sydney Basin.</td>
<td>10–30% of original extent estimated to be cleared.</td>
<td>High</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Moderate</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very low</td>
<td>0.08</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.58</td>
</tr>
<tr>
<td>Map Unit 2: Thin-leaved Stringybark Woodland</td>
<td>Grassy Woodland</td>
<td>Grey Gum – Thin-leaved Stringybark grassy woodland of the southern Blue Mountains gorges, Sydney Basin.</td>
<td>&lt;10% of original extent estimated to be cleared.</td>
<td>High</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Moderate</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Map Unit 3: Brittle Gum – Stringybark Woodland</td>
<td>Grassy Woodland</td>
<td>Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands and South East Corner.</td>
<td>60–80% of original extent estimated to be cleared.</td>
<td>High</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Moderate</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
<td>0.91</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.17</td>
</tr>
<tr>
<td>Map Unit 4: River Oak Forest</td>
<td>Riparian Forest</td>
<td>River Oak open forest of major streams, Sydney Basin and South East Corner.</td>
<td>15–40% of original extent estimated to be cleared.</td>
<td>High</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Vegetation community type</td>
<td>Fauna habitat type</td>
<td>Biometric vegetation type</td>
<td>Conservation status/ percentage cleared (Tozer, 2010)</td>
<td>Condition</td>
<td>Area (ha)</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-------------------</td>
<td>------------------------------------------------------------------</td>
<td>-----------------------------------------------------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Map Unit 5: Ribbon Gum Grassy Woodland</td>
<td>Grassy Woodland</td>
<td>Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north-east of the South Eastern Highlands.</td>
<td>Endangered (Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions) (TSC Act) 65–80% of original extent estimated to be cleared.</td>
<td>High</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Moderate</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very low</td>
<td>0.05</td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.86</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.21</td>
</tr>
</tbody>
</table>

Map units 6 and 7 (TECs) would not be affected by the proposal.

**Threatened ecological communities**

The proposal would result in the direct removal of about 0.86 hectares of the ecological community Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions, which is listed as Endangered under the TSC Act (Map Unit 5). There would be impacts on about 0.14 hectares of moderate condition vegetation and about 0.18 hectares of high condition vegetation on the northern side of the highway near Jenolan Caves Road. The broader study locality has about 45,000 hectares of vegetation (Tozer et al, 2010), which has affinities to the Tablelands Grassy Woodland Threatened Ecological Community. The potential impact of the proposal therefore represents a loss of less than one per cent of the broader population within the study area.

There would be no direct impacts to White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland (Map Unit 6 and 7), as this TEC does not occur within the proposal area. This community is critically endangered under the EPBC Act and endangered under the TSC Act.

**Threatened flora**

The only threatened flora species recorded in the study area was the Narrow-leaved Black Peppermint (*Eucalyptus nicholi*), which is listed as vulnerable under the TSC Act and the EPBC Act. However, these are located outside of the proposal area.
Threatened fauna

There is a high likelihood of threatened fauna occurring within the study area, due to the availability of suitable habitat. Accordingly, there is a potential risk of impacts on threatened species habitat, particularly habitat for species of birds, microbats and the Spotted-tailed Quoll, which have been recorded in the study area. The proposal would also have the following potential impacts on threatened fauna:

- The loss of about 2.5 hectares of Grassy Woodland, which is or could be used by Regent Honeyeater, Varied Sittella, Barking Owl, Powerful Owl, Scarlet Robin, Eastern False Pipistrelle, Eastern Bentwing Bat, Eastern Freetail Bat, Southern Myotis, Spotted-tailed Quoll and Squirrel Glider. This clearing may reduce foraging and shelter opportunities and reduce the movement of these animals between forest patches.
- The removal of Eucalypt habitat trees with large hollows may reduce potential nesting sites for large owls.
- The removal of small hollows may decrease shelter habitat for microbats, which have a high potential to occur within the study area.

Significance assessments were conducted for threatened biodiversity that have been positively identified or that have a moderate or high likelihood of occurring in the study area (refer to Appendix C). These assessments found that the proposal would not be likely to cause a significant impact on the ecological communities (Map units 5, 6 or 7) or on any of the threatened species identified to as potentially occurring in the study area.

Loss of hollow-bearing trees and habitat trees

Hollow-bearing trees are present in habitats throughout the study area. Thirteen hollow-bearing trees were identified within the proposal area, ranging from the very large Monkey Gum (Eucalyptus cypellocarpa) to the smaller Red Stringybark (Eucalyptus macrocarpa). Six dead standing trees with small hollows within the proposal area would also be affected by the proposal.

Table 6-9 lists the threatened fauna species considered to likely occur within the study area that may be affected by the loss of these hollow-bearing trees. Impacts include potential loss of nesting (breeding), sheltering or roosting sites.

<table>
<thead>
<tr>
<th>Common name</th>
<th>Species</th>
<th>TSC Act</th>
<th>EPBC Act</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glossy Black-cockatoo</td>
<td>Calyptorhynchus lathami</td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Gang-gang Cockatoo</td>
<td>Callocephalon fimbriatum</td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Powerful Owl</td>
<td>Ninox strenua</td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Barking Owl</td>
<td>Ninox connivens</td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Spotted-tailed Quoll</td>
<td>Dasyurus maculatus</td>
<td>Vulnerable</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Eastern False Pipistrelle</td>
<td>Falsistrellus tasmaniensis</td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Eastern Freetail Bat</td>
<td>Mormopterus norfolkensis</td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Southern Myotis</td>
<td>Myotis macropus</td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Common name</td>
<td>Species</td>
<td>TSC Act</td>
<td>EPBC Act</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>Yellow-bellied Glider</td>
<td><em>Petaurus australis</em></td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Yellow-bellied Sheathtail Bat</td>
<td><em>Saccolaimus flaviventris</em></td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Greater Broad-nosed Bat</td>
<td><em>Scoteanax rueppelli</em></td>
<td>Vulnerable</td>
<td>-</td>
</tr>
<tr>
<td>Squirrel Glider</td>
<td><em>Petaurus norfolcensis</em></td>
<td>Vulnerable</td>
<td>-</td>
</tr>
</tbody>
</table>

Loss of foraging habitat

The loss of habitat is a key threatening process listed as ‘Clearing of native vegetation’ under Schedule 3 of the TSC Act.

The proposal would require clearing of about 3.2 hectares of native vegetation, which would affect fauna habitat areas. It would require the loss of about 2.5 hectares of habitat in grassy woodland, 0.6 hectares of sheltered dry sclerophyll forest mainly along the lower slopes below Victoria Pass and 0.1 hectares of riparian forest along the River Lett. The condition of these habitats varies from low to high and comprises foraging habitat for a wide diversity of fauna species, particularly folivores (a herbivore that specialises in eating leaves) and nectarvores, such as gliders, and a diversity of common and threatened bird species.

Koala habitat

Table 6-10 summarises the impacts on potential Koala habitat. Potential impacts on the species include permanent loss, modification and fragmentation of habitat, increased incidence of fires, road kill by vehicles, and predation by feral and domestic dogs. Currently, connectivity for the Koala is highly limited in the study area (there are no suitable underpasses below the existing highway). No evidence of the Koala was observed in the study area or in the larger patches of Ribbon Gum dominated woodland in the Hartley Valley area.

Table 6-10 Potential Koala habitat and impacts in the proposal area

<table>
<thead>
<tr>
<th>Koala habitat</th>
<th>Habitat food tree species</th>
<th>Loss of habitat (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary habitat</td>
<td>Over 30% of trees in Map Unit 5 are Ribbon Gum (<em>Eucalyptus viminalis</em>), which is the primary food tree for Koala. Map Unit 5 also supports the following secondary food species for Koala: Yellow Box (<em>E. melliodora</em>), Snow Gum (<em>Eucalyptus Pauciflora</em>) and Apple-topped box <em>Eucalyptus bridgesiana</em>.</td>
<td>0.86</td>
</tr>
<tr>
<td>Secondary habitat</td>
<td>Map Unit 3 supports over 50% of secondary food trees for Koala. These are mainly Brittle Gum (<em>E. mannifera</em>).</td>
<td>1.17</td>
</tr>
<tr>
<td>Tertiary habitat</td>
<td>Tertiary habitat is found in Map Unit 1, 2 and 4. (Tertiary habitat is defined as habitat where primary feed species are absent and secondary food trees comprise less than 50% of trees present.)</td>
<td>1.18</td>
</tr>
</tbody>
</table>

Injury and mortality

Construction of the proposal has the potential to result in the injury or death of fauna as a result of vegetation clearing. This would affect fauna species that take refuge in trees, are ground-dwelling, or are less mobile. These include ground-dwelling
mammals, microbats, possums, reptiles, birds (particularly fledglings) and frogs. Larger, more mobile species, such as macropods, larger reptiles and adult birds, are less likely to be affected as they could flee to unaffected areas of suitable habitat.

**Weeds**

During construction, there is potential to disperse weed seeds or other propagules into areas of remnant vegetation where weeds do not currently occur. Clearing vegetation, stockpiling of contaminated mulch and topsoil during earthworks and the movement of soil and attached seeds and propagules to construction vehicles and machinery are activities that can disperse weeds.

**Pests and pathogens**

The proposal is not likely to increase the invasion of pest species. Foxes (*Vulpes vulpes*) are known to occur in the study area but are not expected to increase in number as a result of the proposal. However, there is a risk that foxes may prey on native fauna that may be displaced by construction activities. Increased vegetation clearing may lead to greater colonisation by rabbits (*Oryctolagus cuniculus*), which take advantage of disturbed and modified environments. Revegetation with native species following construction of the proposal would help to reduce potential habitat for rabbits.

The proposed upgrade is not expected to directly increase feral honey-bee numbers, but the removal of hollow-bearing trees may indirectly increase competition for hollows with native fauna.

The study area is susceptible to the pathogen *Phytopthora cinnamomi*, which results in native plant dieback via root rot. It is known to occur in specific areas around Mount Victoria and the upper Blue Mountains plateau. It is unknown whether *Phytopthora cinnamomi* is present in the study area. As a precaution, it would be important to prevent infected soil or plant material from locally affected areas being spread to and from the proposal area.

**Changed hydrology**

The proposal is not expected to change the current stream flow regime, velocities or depths of the River Lett or other waterways (refer to **Section 6.3** for further detail regarding hydrology).

**Groundwater-dependent ecosystems**

As discussed in **Section 6.1.2**, the majority of vegetation communities in the study area are considered to have a low level of groundwater dependence. Accordingly, intersection of the water table in cut areas on elevated lands is considered unlikely, while potential groundwater dependence of vegetation communities surrounding cut areas is considered to be low. Construction in floodplain areas would be largely limited to fill batters. Considering groundwater levels are unlikely to be altered as a result of the proposal, potential groundwater-dependant ecosystems on floodplains and riparian areas are not expected to be affected.

**Aquatic impacts**

The construction of the proposal has the potential to impact the aquatic habitat of the River Lett. Proposed changes to batters next to the existing highway bridge may result in water quality impacts due to earthworks, placement of the road surface, disposal of wastewater, equipment and chemical storage areas and erosion from exposed ground and stockpiles.
**Noise and vibration**

Construction noise and vibration could have impacts on all local fauna groups, which may result in fauna temporarily avoiding habitats next to the proposal area.

**Impact on relevant key threatening processes**

A threat can be listed under the TSC Act as a 'key threatening process' if it adversely affects threatened species, populations or ecological communities or if it could cause species, populations or ecological communities that are not threatened to become threatened.

Key threatening processes associated with the proposal are those causing habitat degradation. Habitat degradation includes vegetation clearing, bushrock removal, and removal of hollow-bearing trees and fallen timber. There is also potential for other key threatening processes to be increased (such as weed invasion, the introduction of pests and diseases, and alteration of hydrological regimes).

The proposal includes mitigation measures to minimise the impact of these key threatening processes (refer to Section 6.1.4). These include the relocation of important fauna habitats.

**Operation**

The biodiversity impact of the proposal, once it is operational, would mainly relate to vehicle strike and habitat fragmentation, as outlined below.

**Injury and mortality**

During operation, vehicles travelling on the highway have the potential to strike fauna species, leading to injury and death. This has the potential to affect fauna species at the sub-population level. In general, rates of vehicle strike mortality are likely to be directly proportional to the distance that animals need to cross the road to reach native vegetation/fauna habitat (Forman et al, 2000).

Since the proposal generally entails the marginal widening of an existing road corridor, it is not anticipated that the rate of vehicle strike will substantially increase as a result of the proposal.

Fauna mortality rates would also be affected by other factors such as the design of the road, associated earthworks, fences, safety barriers, fauna crossings, and the proximity of vegetation and cleared areas.

**Wildlife connectivity and habitat fragmentation**

Habitats within the study area vary in size from large forested areas to small roadside patches. In general, the proposal would impact areas closest to the existing roadside. It would not bisect vegetated areas that form wildlife pathways or broader movement corridors.

By widening the highway, the proposal would increase the distance for any wildlife crossing the road. Although this would not affect gliders, which can glide up to 140 metres, this would create a greater barrier for some terrestrial fauna movements. The main species potentially impacted by the increased width of the road would be terrestrial species such as Spotted-tail Quoll, reptiles and macropods, as well as arboreal species such as Koala, possums and gliders. However given the limited extent of the widening (two to six metres), the incremental change in the overall width
of the highway would be limited and accordingly the safety upgrade would not be anticipated to markedly exacerbate the existing barrier effect to quolls and koalas.

**Noise, vibration and light**

It is unlikely there would be a significant increase in the existing levels of noise, vibration and light from the highway that would result in any significant impacts on native fauna species.

### 6.1.4 Safeguards and management measures

**Table 6-11** identifies safeguards and management measures that will be implemented to address potential impacts of the proposal on biodiversity. Management of potential erosion and sediment impacts associated with the proposal is discussed in Sections 6.4.5 and 6.8.3.

**Table 6-11 Safeguards and management measures for biodiversity**

<table>
<thead>
<tr>
<th>ID</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI-1</td>
<td>General impacts on threatened species and ecological communities</td>
<td>Potential impacts will be avoided and minimised during detailed design by:</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Avoiding design solutions which require broadscale vegetation clearing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Minimising vegetation/habitat clearing where possible to reduce impacts on</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>threatened fauna species that rely on these habitats.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Minimising impacts on threatened ecological communities and habitat features</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(particularly habitat trees) through appropriate refinements to the road design.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Minimising habitat fragmentation and reduced connectivity and avoiding the use of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>barriers to fauna movement.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI-2</td>
<td>Loss of wildlife connectivity</td>
<td>Maintain or improve connectivity in areas of the proposal where connectivity has been</td>
<td>Roads and Maritime or design contractor</td>
<td>Detailed design, pre-construction, construction, operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>identified as important.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI-3</td>
<td>Vegetation and habitat removal</td>
<td>A Flora and Fauna Management Plan will be prepared in accordance with Roads and</td>
<td>Construction contractor</td>
<td>Pre-construction, construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maritime’s Biodiversity Guidelines (RTA, 2011a) and will include:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Maps identifying the location of threatened flora and/or fauna species,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>threatened ecological communities and habitat.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clearing procedure, which in turn will specify the requirements for pre-clearing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The location of exclusion zones to be installed before clearing. The location of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>exclusion fencing to be installed will be identified on plans in the CEMP and the</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>function and importance of the exclusion zones communicated to construction personnel.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• A staged habitat removal process, which will be implemented consistent with procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>in Roads and Maritime’s Biodiversity Guidelines (RTA, 2011a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<td>---------------------</td>
</tr>
<tr>
<td>BI-4</td>
<td>Vegetation and habitat removal</td>
<td>Pre-clearing surveys will be carried out by an experienced ecologist before construction in accordance with Roads and Maritime’s Biodiversity Guidelines (RTA, 2011a) to:</td>
<td>Construction contractor</td>
<td>Pre-construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Confirm the location and extent of important habitats in the proposal area.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identify items in the proposal area to be salvaged for reuse/relocation, such as bushrock, hollow trees and woody debris.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identify the location of threatened flora and/or fauna (if present) that have potential to occur within the proposal area (informed by database searches outlined in Section 6.1.2).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identify and mark habitat features to be protected during construction in retained areas, particularly habitat trees.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identify nearby habitats on both sides of the existing highway along the length of the proposal suitable for the release of fauna that may be encountered during the pre-clearing process or habitat removal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Determine the number and type of nest boxes required post-construction based on the number, quality and size of the hollows that would be removed from the proposal area.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI-5</td>
<td>Vegetation and habitat removal</td>
<td>A Vegetation Management Plan would be developed as part of the CEMP. It would provide specific details for the re-establishment of native vegetation on batters, cut faces and other areas disturbed during construction. It would also include procedures for the reuse of woody debris and bushrock on site for habitat improvement. These details would be in accordance with Roads and Maritime’s Biodiversity Guidelines (RTA, 2011a).</td>
<td>Construction contractor</td>
<td>Pre-construction, construction</td>
</tr>
<tr>
<td>BI-6</td>
<td>Vegetation and habitat removal</td>
<td>A Nest Box Management Strategy will be developed as part of the Flora and Fauna Management Plan. The number and type of nest boxes required will be determined during the pre-clearance surveys based on the number, quality and size of the hollows that will be removed. The nest box management strategy will require the installation of 70% of nest boxes at least 3–6 months before the removal of any</td>
<td>Construction contractor</td>
<td>Pre-construction, construction</td>
</tr>
<tr>
<td>ID</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>----------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>BI-7</td>
<td>Injury and mortality of fauna during the clearing of vegetation</td>
<td>A licensed wildlife carer and/or ecologist will be present to supervise vegetation clearing and capture and relocate fauna where required. Fauna handling and vegetation clearing will be carried out in accordance with the procedures provided in Roads and Maritime’s Biodiversity Guidelines (RTA, 2011a).</td>
<td>Roads and Maritime or construction contractor</td>
<td>Pre-construction, construction</td>
</tr>
</tbody>
</table>
| BI-8| Spread of weeds                                                        | Actions for weed management will be developed as part of the Vegetation Management Plan. The plan will detail the following to ensure that weeds are managed during construction:  
  - Taxa and potential sources of the weed species.  
  - Weed management priorities and objectives.  
  - Sensitive environmental areas within or next to the site.  
  - The location of weed-infested areas.  
  - Mechanical weed control methods such as slashing or mowing, as well as a range of herbicides to avoid the development of herbicide resistance.  
  - Measures to prevent the spread of weeds.  
  - A monitoring program to measure the success of weed management.  
  - Communication strategies to improve contractor awareness of weeds and weed management.  
  - The appropriate disposal of weed-infested materials and soils. | Construction contractor | Pre-construction, construction |
| BI-9| Introduction or spread of pests and disease-causing agents, such as bacteria and fungi | Measures to confirm the presence of pathogens and disease-causing agents will be carried out before construction. Should pathogens and/or disease-causing agents be found, measures will be implemented to prevent their introduction and/or spread. These measures are provided in Roads and Maritime’s Biodiversity Guidelines (RTA, 2011a) and include:  
  - Procedures to ensure vehicles and footwear are free of soil before entering or exiting the site.  
  - Ensuring that the risk of spreading pathogens and the mitigation measures required on site are regularly communicated to staff and contractors during inductions and toolbox talks.  
  - Programming construction work so that it moves from uninfected areas to any known infected areas.  
  - Restricting vehicles to designated tracks, trails and parking areas. | Construction contractor | Pre-construction, construction, operation |
6.2 Non-Aboriginal heritage

An assessment has been prepared to identify the extent and magnitude of potential impacts of the proposal on non-Aboriginal heritage items. This assessment is presented in the Statement of Heritage Impact for the Hartley Valley safety upgrade (Casey & Lowe, 2013) provided in Appendix D. A summary of the assessment is provided in this section.

6.2.1 Methodology

Proposal area
For the heritage assessment, the proposal area has been refined to reflect areas where the extent of the construction footprint will be reduced to avoid direct impacts on abutting heritage properties.

Review of literature, mapping and government databases
The non-Aboriginal heritage items discussed in this section were originally identified in the Non-Aboriginal Heritage – Preferred Route Corridor Study for the Great Western Highway Upgrade (Casey & Lowe, 2012) and confirmed as part of the current investigation. The assessment was limited to identified heritage items within or next to the proposal area that may potentially be affected. The potential and known heritage items were identified through:

- A review of previous reports prepared for the Mount Victoria to Lithgow Great Western Highway upgrade.
- A review of heritage items listed under the Lithgow City LEP and the Draft Lithgow LEP (this was carried out on 2 July 2013).
- A review of the State Heritage Inventory for Stage Heritage (SHR) items and other heritage items.
- A review of relevant heritage registers, including Section 170 registers (Section 170 of the Heritage Act 1977 requires agencies to identify, conserve and manage heritage assets owned, occupied or managed by that agency).
- Site visits and visual inspection carried out by Mary Casey and Warwick Mayne-Wilson on 11 July 2013.

The heritage assessment was carried out in accordance with the principles and guidelines of the Burra Charter, the NSW Heritage Manual (NSW Heritage Office 1996) and Assessing Heritage Significance guidelines (NSW Heritage Office 2001).

6.2.2 Existing environment

There is a rich and highly valued history throughout the Hartley Valley and surrounding area. The development of this region largely coincides with the numerous attempts to cross the western escarpment that traverses the region. The arrival of Europeans to the Blue Mountains was closely followed by the building of the first road across the Blue Mountains in 1814–15 by William Cox’s convicts (Coxs Road). The unlocking of inland Australia was a necessary step in the transition from penal settlement to a free colony. This first road also opened up the valley for grazing and agriculture. Once the Blue Mountains were successfully crossed, the Central West of NSW was opened up for further development.

Following William Cox’s first attempt to cross the Blue Mountains, additional attempts to find a route down from Mount Victoria, Mount York and the Darling Causeway resulted in numerous other attempts including Coxs Road (1814–15), Lawsons Long Alley (1822), Bells Line of Road (1823), Lockyers Road (1828), Mitchells Road
(1830s), and Berghofers Pass (1907–12). Many of these routes extended beyond just the initial crossing of Victoria Pass as far as the area currently known as Forty Bends (and beyond).

The use of these transport routes, in conjunction with the establishment of the oil shale mines and accompanying growth in population, encouraged the development of inns and other service centres within the region from the 1820s. As a result, Hartley Valley, with attractive grazing potential, was more densely populated in the early Victorian period than the Blue Mountains plateau above. The plateau became a holiday ground for ‘city folk’. Villages only began to develop after the western railway was fully functioning in the 1870s.

With the coming of the two world wars, the decline of the oil shale mines in the valley and the increasing use of the motor vehicle, a series of changes began to occur within the Hartley Valley throughout the 20th century. The result of all this sporadic change was a remarkable concentration of over 100 significant heritage items across the greater Hartley Valley, as well as roads and railways within and next to this region. More than half of these sites are in the urban area of Mount Victoria (to the east of the proposal area), which was the gateway to the west both by road and by rail.

**Heritage items**

The heritage items and potential archaeological sites within or close to the construction footprint are shown in Figure 6-5a to Figure 6-5c and listed in Table 6-12. Eleven items are located directly next to the proposal area, while three items are partially located within the proposal area. These items include cottages and a historic culvert. Each item, and its significance is discussed below.
<table>
<thead>
<tr>
<th>Mapping/SHI NO</th>
<th>Item</th>
<th>No</th>
<th>Street address</th>
<th>Locality</th>
<th>Significance</th>
<th>Date</th>
<th>LEP</th>
<th>SHR</th>
<th>S170</th>
<th>NT</th>
<th>RNE</th>
<th>Relationship to the proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Little Hartley Heritage Conservation Area</td>
<td>-</td>
<td>-</td>
<td>Little Hartley</td>
<td>Local</td>
<td>Draft</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Partially within the proposal</td>
</tr>
<tr>
<td>1960145</td>
<td>Rosedale, Little Hartley</td>
<td>-</td>
<td>Great Western Highway</td>
<td>Little Hartley</td>
<td>State</td>
<td>1839</td>
<td>1994</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td>Reg</td>
<td>Directly next to the proposal</td>
</tr>
<tr>
<td>1960146</td>
<td>Nioka, Little Hartley</td>
<td>2209</td>
<td>Great Western Highway</td>
<td>Little Hartley</td>
<td>State</td>
<td>1856</td>
<td>Draft</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Directly next to the proposal</td>
</tr>
<tr>
<td>1960144</td>
<td>Billesdene Grange and convict causeway, Little Hartley</td>
<td>2272</td>
<td>Great Western Highway</td>
<td>Little Hartley</td>
<td>State</td>
<td>1831</td>
<td>Draft</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td>-</td>
<td>Directly next to the proposal</td>
</tr>
<tr>
<td>1960147</td>
<td>Log Cabin Farmhouse Village Shop, Little Hartley</td>
<td>2297</td>
<td>Great Western Highway</td>
<td>Little Hartley</td>
<td>Local</td>
<td>1860</td>
<td>Draft</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Directly next to the proposal</td>
</tr>
<tr>
<td>1960149</td>
<td>Harp of Erin (Williams Store)</td>
<td>2329</td>
<td>Great Western Highway</td>
<td>Little Hartley</td>
<td>State</td>
<td>1832</td>
<td>1994</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td>Reg</td>
<td>Directly next to the proposal</td>
</tr>
<tr>
<td>1960143</td>
<td>Ambermere, Little Hartley</td>
<td>5</td>
<td>Ambermere Drive</td>
<td>Little Hartley</td>
<td>State</td>
<td>1831</td>
<td>1994</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td>-</td>
<td>Directly next to the proposal</td>
</tr>
<tr>
<td>1960141</td>
<td>Meades Farm, Little Hartley</td>
<td>2366</td>
<td>Great Western Highway</td>
<td>Little Hartley</td>
<td>State</td>
<td>1857</td>
<td>1994</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td>Reg</td>
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<tr>
<td></td>
<td>Kerosene Cottage, Little Hartley</td>
<td>2360</td>
<td>Great Western Highway</td>
<td>Little Hartley</td>
<td>Local</td>
<td>-</td>
<td>Draft</td>
<td>-</td>
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<td>CA1</td>
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<td>-</td>
<td>Hartley Valley</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>Y</td>
<td>-</td>
<td>-</td>
<td>Partially within the proposal</td>
</tr>
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<td>Item</td>
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<td>Street address</td>
<td>Locality</td>
<td>Significance</td>
<td>Date</td>
<td>LEP</td>
<td>SHR</td>
<td>S170</td>
<td>NT</td>
<td>RNE</td>
<td>Relationship to the proposal</td>
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</tr>
<tr>
<td>-</td>
<td>Hartley Historic Site (general area)</td>
<td>-</td>
<td>Great Western Highway</td>
<td>Hartley</td>
<td>State</td>
<td>1858</td>
<td>-</td>
<td>992</td>
<td>NPWS</td>
<td>Y</td>
<td>Reg</td>
<td>Directly next to the proposal.</td>
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<tr>
<td>-</td>
<td>SHR listing on northern side of the highway, Hartley</td>
<td>-</td>
<td>Old Great Western Highway</td>
<td>Hartley</td>
<td>Local</td>
<td>19/20th century</td>
<td>-</td>
<td>992</td>
<td>NPWS</td>
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<td>1960151</td>
<td>Royal Hotel</td>
<td>10</td>
<td>Old Great Western Highway</td>
<td>Hartley</td>
<td>State</td>
<td>1841</td>
<td>1994</td>
<td>992</td>
<td>NPWS</td>
<td>Y</td>
<td>Reg</td>
<td>Directly next to the proposal.</td>
</tr>
<tr>
<td></td>
<td>Royal Hotel rubbish dump within SHR boundary may also survive within road corridor</td>
<td></td>
<td>Great Western Highway</td>
<td>Hartley</td>
<td>Local</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Partially within the proposal.</td>
</tr>
</tbody>
</table>

LEP: Local Environmental Plan, SHR: State Heritage Register, NT: National Trust, RNE: Register of the National Estate, Reg: Registered, Ind: Indicative
FIGURE 6-5a | NON-ABORIGINAL HERITAGE ITEMS

LEGEND
- Proposal area
- Existing highway
- Heritage item
- Heritage Conservation Area
- Potential heritage item
- Heritage curtilage

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DATA SOURCES
Sinclair Knight Merz does not warrant that this document is definitive nor free of error and does not accept liability for any loss caused or arising from reliance upon information provided herein.

DATA SOURCES
Little Hartley draft heritage conservation area

Little Hartley draft heritage conservation area is listed in the Draft Lithgow LEP as an area of local significance. The relationship of the heritage buildings to the Great Western Highway and its importance are emphasised in this listing. Little Hartley is a series of discrete buildings (mostly old inns) spaced along the Great Western Highway, and includes Meades Farm, Kerosene Cottage, Ambermere, Harp of Erin and Billesdene Grange.

Harp of Erin

The Harp of Erin was built in 1839 and operated both as an inn and store (refer to Photo 6-1). It is on the southern side of the highway and faces another former inn, Ambermere. It is considered to have State heritage significance and is the oldest inn and longest operating store on the Great Western Highway. The Harp of Erin has a potential view to the north of Mount York, in the distant background, which is partly screened by vegetation.

Photo 6-1 View of the Harp of Erin
Ambermere

Photo 6-2 View of Ambermere
Ambermere, formerly the Rose Inn, is a State significant historic inn built in 1845 by Joseph Collits, son of Pierce Collits, immediately opposite the Harp of Erin (refer to Photo 6-2).

Meades Farm and Kerosene Cottage

Photo 6-3 Meades Farm
Meades Farm (also known as Meads Farm) is an early farmhouse inn located at the western end of the Little Hartley draft heritage conservation area (refer to Photo 6-3). It is considered to be of State heritage significance. It was built in 1850s and converted into an inn in 1866 to service oil shale workers from Hartley Vale. Kerosene Cottage (refer to Photo 6-4) is located next to the Meades Farm. It was also built in the 1850s with later additions.

Heritage in Little Hartley outside the Draft Heritage Conservation Area

Rosedale

Rosedale is a State significant former inn which was designed and built in 1839 as an inn, next to Mitchell’s line of the roadway at the foot of Victoria Pass. Rosedale is an essential element in the development of the Great Western Highway in the 1830s and has a longer continuous licence than the other inns along the highway. It was operated by significant people and owned by Berghofer (of Berghofers Pass, who was the first president of Blaxland Shire).

Rosedale is located on flat land and enjoys a pleasant view northward across Butlers Creek dams and meadows to the Mount York escarpment. Although the significance of the former inn does not depend on the maintenance of this view, it does play a supporting role in indicating the close proximity of the escarpment, from which many 19th century travellers would rest at the inn before moving on.
Nioka was built as a single story inn in 1856. A second story was later added (refer to Photo 6-5). It is considered to be State significant. No identified curtilage is listed, but a curtilage was previously suggested by Casey and Lowe (2009) and is used for the purposes of this assessment. The view from Nioka is completely different from that at Rosedale. This former inn is located on a small hill, set back from the highway, and was built in a small cutting through the footslope of the hill. Although Nioka’s location on a hilltop and orientation to Mount York were apparently important considerations to its original owners, this view has been almost completely obscured by dense plantings of pines and cypresses in the 20th century. This suggests that the view has not been considered important for half a century or more. The stronger motivations seem to have been privacy and a sense of enclosure in an otherwise broad, sweeping landscape and/or protection from strong northerly sunlight; and protection from road noise.

Hartley Historic Site

Hartley Historic Site is located in the lower slopes of a north–south ridge on the southern side of the Great Western Highway (refer to Figure 6-5a to Figure 6-5c). The original village was laid out in 1836 on both sides of the River Lett, and comprised 16 streets. It is an early rural village, comprised of loosely spaced buildings with substantial yards with setbacks of varying distances from the original highway. Buildings are arranged around the 1830s courthouse. The surviving key heritage buildings of the village include the courthouse, Royal Hotel, St Bernard’s Catholic Church and Presbytery, St John the Evangelist Anglican Church, the former Shamrock and Farmers inns, the Finn residence of Bungarribee, Carney’s cottage and garage and Ivy cottage.
Land owned by the NPWS within Hartley Historic Site is gazetted on the State Heritage Register. In addition, most of this land has State heritage significance. The heritage properties are associated with individual curtilages, but there is no separate curtilage for the overall site. A number of the heritage items in the village are also listed on the Draft Lithgow LEP.

Due to topography, Hartley Historic Site cannot be viewed from the east. Accordingly, the view from the west is considered to be unique.

The heritage items located within the proposal area and Hartley Historic Site include the Royal Hotel and the vacant land to the north of the highway, which are both SHR listed. These items are discussed in more detail below.

**Land on northern side of the highway**

This land (Lot 204 DP 751644) is located to the north of the Great Western Highway, almost directly next the Hartley Road intersection and within the Historic Hartley Site. It was originally part of the rear yard of the Royal Hotel, and is believed to have functioned as a rubbish dump because it was out of sight on the steep bank sloping towards the river. This land is also identified as being part of the Police Paddock on the conservation management plan for Hartley, but there is no evidence that the area contained any structures other than fencing.

This site is included within the curtilage of the Hartley Historic Site and is listed on the SHR as part of that listing. Due to the numerous potential rubbish dumps along the main roads and highways leading to and from Sydney, rubbish dumps and sites of inns are typically considered to be of local heritage significance. Thus, despite its listing on the SHR, this property would appear to have local rather than State heritage significance.

**Royal Hotel**

The Royal Hotel was first licensed in 1841 as the Albion Hotel. It became the Royal Hotel in 1858 and was the booking office for coaches in the early 1860s. It was originally surrounded by a complex of buildings that included stables, a teacher’s residence and school, forge, kitchen and servants’ quarters. None of these buildings have survived to the present day. Much of the rear yard of the property has been removed with the cutting for the current highway. Accordingly, any surviving archaeology is possibly quite impacted, but there may be potential for deeper subsurface remains.

The Royal Hotel is listed on the SHR and on the Draft Lithgow LEP.

**6.2.3 Potential impacts**

**Construction**

Table 6-13 outlines the heritage significance of each of the potential items identified in Section 6.2.2, and an assessment of the potential impacts on each item associated with the construction of the proposal. Recommendations for identified potential impacts are outlined in Section 6.2.4.
### Table 6-13 Heritage items and potential impacts associated with the proposal

<table>
<thead>
<tr>
<th>Mapping/SHI NO</th>
<th>Item name</th>
<th>Significance</th>
<th>Proposed upgrade work</th>
<th>Archaeological</th>
<th>Visual</th>
<th>Vibration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Little Hartley Draft Conservation Area</td>
<td>Local</td>
<td>Safety barriers, batters.</td>
<td>No impact.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960145</td>
<td>Rosedale, Little Hartley</td>
<td>State</td>
<td>Safety barriers to the east of frontage.</td>
<td>No impact.</td>
<td>Minor visual impact due to the installation of safety barriers next to a vegetated area east of the front of the building. This impact is not considered to be substantial as the safety barrier finish would allow integration with surrounding vegetation and be consistent with safety barriers used in the proposal area (refer to Section 6.6.4).</td>
<td>Minor impact (within 50 m of work which may cause vibration).</td>
</tr>
<tr>
<td>1960146</td>
<td>Nioka, Little Hartley</td>
<td>State</td>
<td>Larger batter on southern side of the highway.</td>
<td>No impact.</td>
<td>Minor visual impact, due to the application of a natural finish to the batter.</td>
<td>Minor impact (within 50 m of work which may cause vibration).</td>
</tr>
<tr>
<td>Mapping/SHI NO</td>
<td>Item name</td>
<td>Significance</td>
<td>Proposed upgrade work</td>
<td>Archaeological Impact</td>
<td>Visual Impact</td>
<td>Vibration Impact</td>
</tr>
<tr>
<td>---------------</td>
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<td>-----------------------</td>
<td>--------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>1960144</td>
<td>Billesdene Grange and convict causeway, Little Hartley</td>
<td>State</td>
<td>Increased batter/retaining wall to the east, and road work within road corridor.</td>
<td>No impact.</td>
<td>No impact.</td>
<td>No impact.</td>
</tr>
<tr>
<td>1960147</td>
<td>Log Cabin Farmhouse Village Shop, Little Hartley</td>
<td>Local</td>
<td>Increased batters on the northern side of the highway.</td>
<td>No impact.</td>
<td>No impact.</td>
<td>Minor impact (within 50 m of work which may cause vibration).</td>
</tr>
<tr>
<td>1960149</td>
<td>Harp of Erin (Williams Store)</td>
<td>State</td>
<td>Next to proposal.</td>
<td>No impact.</td>
<td>No impact.</td>
<td>Minor impact (within 50 m of work which may cause vibration).</td>
</tr>
<tr>
<td>1960143</td>
<td>Ambermere, Little Hartley</td>
<td>State</td>
<td>Next to proposal.</td>
<td>No impact.</td>
<td>No impact.</td>
<td>Minor impact (within 50 m of work which may cause vibration).</td>
</tr>
<tr>
<td>1960141</td>
<td>Meades Farm, Little Hartley</td>
<td>State</td>
<td>Next to proposal.</td>
<td>No impact.</td>
<td>No impact.</td>
<td>Minor impact (within 50 m of work which may cause vibration).</td>
</tr>
<tr>
<td>-</td>
<td>Kerosene Cottage, Little Hartley</td>
<td>Local</td>
<td>Next to proposal.</td>
<td>No impact.</td>
<td>No impact.</td>
<td>Minor impact (within 50 m of work which may cause vibration).</td>
</tr>
<tr>
<td>-</td>
<td>Vacant land (site of new Coxs River Road access), Little Hartley</td>
<td>-</td>
<td>New access to Coxs River Road.</td>
<td>No impact.</td>
<td>Visual impacts at Coxs River Road would be limited due to extensive plantings at road boundary and along the highway.</td>
<td>No impact.</td>
</tr>
<tr>
<td>Mapping/SHI NO</td>
<td>Item name</td>
<td>Significance</td>
<td>Proposed upgrade work</td>
<td>Potential impact</td>
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<td>------------------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>Hartley Historic Site (general area)</td>
<td>State</td>
<td>Next to proposal.</td>
<td>Archaeological: No impact. Visual: No impact. Vibration: Potential minor impact to some buildings within Hartley Historic Site (within 50 m of work which may cause vibration).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>Suspected rubbish dump on land on the northern side of the highway, Hartley,</td>
<td>Listed as of State significant but would appear to have only local significance.</td>
<td>Widening of road shoulder, new retaining wall, construction.</td>
<td>The Royal Hotel rubbish dump may extend into the road reserve and may be impacted by construction activities. These remains are likely to be of local significance and are therefore relics under S140 of the Heritage Act. Testing and salvage (if required) would need to be carried out before construction to confirm the impact of the proposal on this heritage item (refer to Section 6.2.4). The proposal would be isolated from viewers in this area, and would only be visible from two nearby houses.</td>
<td>No impact.</td>
<td></td>
</tr>
<tr>
<td>1960151</td>
<td>Royal Hotel and Hartley generally</td>
<td>State</td>
<td>Some trimming of the slope to the east but not immediately next to the hotel.</td>
<td>No impact.</td>
<td>A change in slope at the Hartley Historic Site curve would have a minor visual impact. The cutting would be treated with a finish that would be appropriate with the setting (ie natural rock surface where possible) (refer to Section 6.6.4).</td>
<td>Minor impact (within 30 m of work which may cause vibration).</td>
</tr>
</tbody>
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