M1 Pacific Motorway intersection upgrade at Weakleys Drive and John Renshaw Drive

Review of environmental factors

November 2016

BLANK PAGE

Roads and Maritime Services

M1 Pacific Motorway intersection upgrade at Weakleys Drive and John Renshaw Drive

Review of environmental factors

November 2016

Prepared by Aurecon and Roads and Maritime Services
RMS 16.538
ISBN: 978-1-925582-19-2

Executive summary

The proposal

Roads and Maritime Services proposes to upgrade the M1 Pacific Motorway, Weakleys Drive and John Renshaw Drive intersection at Beresfield (the proposal).

The proposal includes:

- Replacing the existing roundabout with traffic lights
- Two through lanes on all approaches
- Additional turning lanes on all approaches including two right turn lanes from the M1 Pacific Motorway to John Renshaw Drive
- Extending the two northbound lanes on Weakleys Drive from the traffic lights to Enterprise Drive
- Upgrading the existing left slip lane from John Renshaw Drive to the M1 Pacific Motorway
- An additional left turn lane from John Renshaw Drive to the M1 Pacific Motorway to manage peak holiday southbound traffic
- Installing drainage, lighting, signage, barriers, fencing and Intelligent Traffic Systems (ITS)
- Landscaping, utility relocations and ancillary works such as stockpiling and construction work areas
- Closing the informal car park located in the south-western corner of the existing intersection, which operates as a Driver Reviver during peak holiday periods
- Closing the oversize overmass (OSOM) truck stop bay on the M1 Pacific Motorway southbound.

The proposal is part of the Australian and New South Wales government's M1 Pacific Motorway Productivity Package, which also includes upgrading the M1 Pacific Motorway between the Tuggerah and Doyalson interchanges and between the Kariong and Somersby interchanges.

Need for the proposal

The M1 Pacific Motorway is an important link in the National Land Transport Network which includes the Sydney to Brisbane corridor. Located at the northern end of the M1 Pacific Motorway, the proposal links the M1 Pacific Motorway and the A1 Pacific Highway. The proposal also provides connections between the M1 Pacific Motorway, New England Highway, the Hunter Expressway and local industrial and commercial precincts.

The existing two lane roundabout is used by about 4000 vehicles per hour in peak periods and can't effectively cater for the current level of demand. This results in delays, queuing and increased travel times.

A concept design is currently being developed for the proposed M1 Pacific Motorway extension through to the A1 Pacific Highway at Raymond Terrace (M1 extension to Raymond Terrace), which would allow northbound and southbound motorway traffic to bypass the proposal. Timing for construction of the M1 extension to Raymond Terrace is not confirmed and would be dependent on planning approval, future traffic needs and funding availability.

The intersection upgrade is needed to improve traffic flow, travel times and safety for motorists.

Proposal objectives

The objectives of the proposal are to:

- Improve freight efficiency and commuter movement at the intersection of the M1 Pacific Motorway, John Renshaw Drive and Weakleys Drive, which is an important part of the land transport network between Sydney and Brisbane

- Ensure compatibility with the proposed M1 extension to Raymond Terrace project, both from a constructability and value management perspective
- Improve safety at the intersection by reducing the risk of crashes
- Achieve best value for money over the project life cycle
- Minimise the impacts to the existing environment.

Options considered

Options considered include:

- Do nothing option
- Option 1 – Upgrade the existing roundabout
- Option 2 – Replace the roundabout with traffic lights (strategic design option 4D)
- Option 3 – Replace the roundabout with a larger set of traffic lights and include left slip lanes on all approaches (strategic design option 5A)
- Option 4 – Replace the roundabout with a grade-separated interchange.

Option 2 is preferred as it would best satisfy the proposal objectives and meet the need of improving traffic flow. This option would achieve the best overall balance between environmental, technical, value for money and safety considerations.

Statutory and planning framework

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) applies and under clause 94 the proposal is considered development for the purposes of a road or road infrastructure facilities. ISEPP allows Roads and Maritime to carry out this type of development without development consent from Newcastle City Council. Therefore, Roads and Maritime is the proponent and the determining authority for the proposal and is required to prepare this review of environmental factors (REF) under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

An assessment of the proposal's potential impact on matters of national environmental significance (MNES) has been conducted in accordance with the *Commonwealth Government's Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Community and stakeholder consultation

Roads and Maritime has consulted with a range of community members and key stakeholders, including Newcastle City Council, Maitland City Council, Cessnock City Council and government agencies, including:

- NSW Office of Environment and Heritage
- NSW Environment Protection Authority
- NSW Department of Primary Industries (Fisheries)
- NSW Department of Primary Industries (Water)
- Emergency services.

The strategic concept design was placed on public display between 18 May and 14 June 2015. In total, 42 submissions were received and were generally supportive of the proposal. The three most common issues raised related to intersection design, congestion and the Driver Reviver.

Community and stakeholder consultation would continue during the public display of this REF, and detailed design and construction phases of the proposal.

Environmental impacts

Detailed technical investigations have been carried out to assess, manage and mitigate the potential impacts of the proposal. The key areas of investigation include biodiversity, traffic and

transport, noise, Aboriginal heritage, hydrology, flooding and water quality, and landscape and visual impacts.

The following outlines the main environmental impacts of the proposal.

Traffic, transport and access
During construction there would be some delays impacting on all road users. Roads and Maritime would build the upgrade in stages and work with road users to ensure any adverse impacts or delays are minimised.

To reduce impacts leading up to and during peak hours, work would be carried out away from traffic and behind safety barriers. The intersection would be fully operational with a speed limit of 60km/h during these times. This arrangement would also be in place during peak holiday periods.

Work involving lane or shoulder closures would be carried out in non-peak periods with a reduced speed limit of 40km/h. Traffic control would be in place to minimise traffic disruptions and ensure the safety of both road workers and road users.

Temporary cyclist routes would be provided during construction except during any construction activities which may be unsafe for cyclists. These activities would be carried out overnight wherever possible.

The proposal involves permanently limiting access to the former Boral asphalt facility on the western side of the motorway to left in/left out movements only.

The OSOM vehicle stopping bay on the motorway would be permanently removed to accommodate the upgraded southbound slip lane.

Another left turn lane from John Renshaw Drive to the motorway would be provided to manage periods of peak holiday southbound traffic.

Once built, the traffic, transport and access benefits of the proposal would include:

- Improved traffic capacity and safety at the intersection
- Improved traffic flow and more reliable travel times through the intersection
- Compatibility with future upgrades across the road network, including the proposed M1 extension to Raymond Terrace
- Improved safety for cyclists
- Improved freight efficiency on the National Land Transport Network Sydney to Brisbane corridor.

Noise and vibration
The construction phase of the project may result in temporary noise and dust impacts.

Work would be carried out 24 hours a day seven days a week, separated into peak times and non-peak times to reduce traffic impacts.

Peak times would be between 4.30am and 9.30am and 2.30pm and 7pm and non-peak times would be between 7pm and 4.30 am and 9.30am and 2.30pm.

Construction noise and vibration would have a low impact on nearby businesses. Management measures to reduce noise and vibration impacts would include limiting high level noise related work and minimising noise generated by machinery wherever possible.

One commercial/industrial premises may exceed noise management levels during earthworks.

Mitigation measures include implementation of standard erosion and sedimentation controls to prevent dust, and consultation about noise and dust impacts with potentially affected premises before and during construction activities.

Biodiversity
The proposal involves removal of native vegetation including several vulnerable bottle brush plants*, Callistemon linearifolius*, hollow bearing trees and a small amount of an Endangered Ecological Community (EEC), Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion.

A total of 121 *Callistemon linearifolius* specimens were recorded during targeted surveys and up to 16 specimens may be directly impacted by the works. Five habitat trees may be cleared by the proposal.

Where possible, impacts would be minimised by protecting areas from over clearing during construction. Impacted hollow-bearing trees would be replaced with nest boxes.

Initiatives to reduce clearing of native vegetation would be investigated in detailed design.

The environmental assessment identified there would not likely be any significant impact on flora and fauna if all mitigation measures are adopted. A species impact statement is not required for this proposal.

Socio-economic
The proposal requires road widening into the informal car park on the south-western corner of the intersection, which operates as a Driver Reviver during peak holiday periods. This site would be permanently closed as part of the upgrade.

Roads and Maritime is investigating alternative sites for a Driver Reviver. Any new site would be considered under a separate proposal and environmental assessment.

On street parking opportunities exist within the Beresfield industrial estate.

Environmental impacts would be minimised by the mitigation measures outlined in this REF. This would include a Construction Environmental Management Plan (CEMP), which would be developed in accordance with Roads and Maritime specifications.

Justification and conclusion

The proposal is recommended to reduce congestion, improve safety at the intersection and improve freight efficiency. The current lack of capacity for traffic operation, together with high volumes of mixed traffic, results in delays, queuing and increased travel times.

The proposal to upgrade the M1 Pacific Motorway, Weakleys Drive and John Renshaw Drive intersection at Beresfield in the Newcastle local government area (LGA) is subject to assessment under Part 5 of the EP&A Act. This REF has examined and taken into account to the fullest extent possible all matters affecting, or likely to affect, the environment by reason of the proposed activity.

The need for the proposal has been considered against its potential benefits and impacts, and it is considered that the beneficial outcomes outweigh the potential negative outcomes, provided adequate mitigation is implemented. On balance the proposal is considered justified.

The proposal would be unlikely to have a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. The proposal would not significantly affect threatened species, populations or ecological communities or their habitats within the

meaning of the Threatened Species Conservation Act 1995 or Fisheries Management Act 1994. Therefore a Species Impact Statement is not required.

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of the Environment is not required.

Display of the review of environmental factors

This review of environmental factors is on display for comment until Wednesday 7 December 2016. You can access the documents in the following ways:

Internet

The documents will be available to view or download on the Roads and Maritime website at *http://www.rms.gov.au/projects/hunter/m1-pacificmotorway-weakleys-drive-intersection-upgrade/index.html*

Display

The documents will be on display at the Roads and Maritime Newcastle office, 59 Darby Street Newcastle and can be viewed during office hours, Monday to Friday, between 9am and 4pm.

Purchase

The documents are available for purchase in hard copy ($25.00) or CD/USB ($10.00) by contacting Roads and Maritime Project Development Manager Damien Grace on (02) 4924 0616.

How can I make a submission?

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

Roads and Maritime Services
Project Development Manager
Damien Grace
Locked Bag 2030
Newcastle NSW 2300

Submissions must be received by Wednesday 7 December 2016.

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 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 Roads and Maritime Services, 59 Darby Street, Newcastle 2300.

What happens next?

Following the submissions period, Roads and Maritime will collate submissions. Acknowledgments 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 about this Roads and Maritime determination.

If the proposal is approved, Roads and Maritime proceeds with final design and tenders are called for construction of the proposal.

If you have any queries, please contact Project Development Manager, Damien Grace, on (02) 4924 0616.

Contents

Appendices

1 Introduction

1.1 Proposal identification

Roads and Maritime Services proposes to upgrade the M1 Pacific Motorway, Weakleys Drive and John Renshaw Drive intersection at Beresfield (the proposal). The upgrade involves replacing the existing roundabout with traffic lights to address existing and forecasted traffic congestion.

The M1 Pacific Motorway is an important link in the National Land Transport Network and Sydney to Brisbane corridor. Located at the northern end of the M1 Pacific Motorway, the proposal links the M1 Pacific Motorway and the A1 Pacific Highway. The proposal also provides connections between the M1 Pacific Motorway, New England Highway and local industrial and commercial areas.

The existing two lane roundabout is used by about 4000 vehicles per hour in peak periods and can't meet the current traffic demand. This results in delays, queuing and increased travel times.

By 2019, traffic volumes are expected to exceed the maximum capacity of the roundabout causing long delays and increased queue lengths at peak times. This would reduce the reliability of a key intersection within the local, state and national transport network.

The proposal is required to improve traffic flow road safety and to cater for forecast future traffic growth before the proposed extension of the M1 Pacific Motorway to the A1 Pacific Highway at Raymond Terrace. The need and justification for the proposal is discussed in more detail in Chapter 1.2.

The proposal is part of the Australian and NSW government's M1 Pacific Motorway Productivity Package, which also includes upgrading the M1 Pacific Motorway between the Tuggerah and Doyalson interchanges and between the Kariong and Somersby interchanges.

The proposal includes the following key elements:

- Replacing the existing roundabout with traffic lights
- Two through lanes on all approaches
- Additional turning lanes on all approaches including two right turn lanes from the M1 Pacific Motorway to John Renshaw Drive
- Extending the two northbound lanes on Weakleys Drive from the traffic lights to Enterprise Drive
- Upgrading the existing left slip lane from John Renshaw Drive to the M1 Pacific Motorway
- An additional left turn lane from John Renshaw Drive to the M1 Pacific Motorway to manage periods of peak holiday southbound traffic
- Installing drainage, lighting, signage, barriers, ITS
- Landscaping, utility relocations and ancillary works such as stockpiling and construction works areas
- Closing the informal car park located in the south–western corner of the existing intersection which operates as a Driver Reviver during peak holiday periods
- Closing the OSOM truck stop bay on the M1 Pacific Motorway southbound.

The proposal is located in the Newcastle local government area (LGA). The location of the proposal is shown in Figure 1-1 and an overview of the proposal is provided in Figure 1-2. Chapter 3 describes the proposal in more detail. The 80 per cent concept design drawings for the proposal are included as Appendix C.

Figure 1-1: Location of the proposal

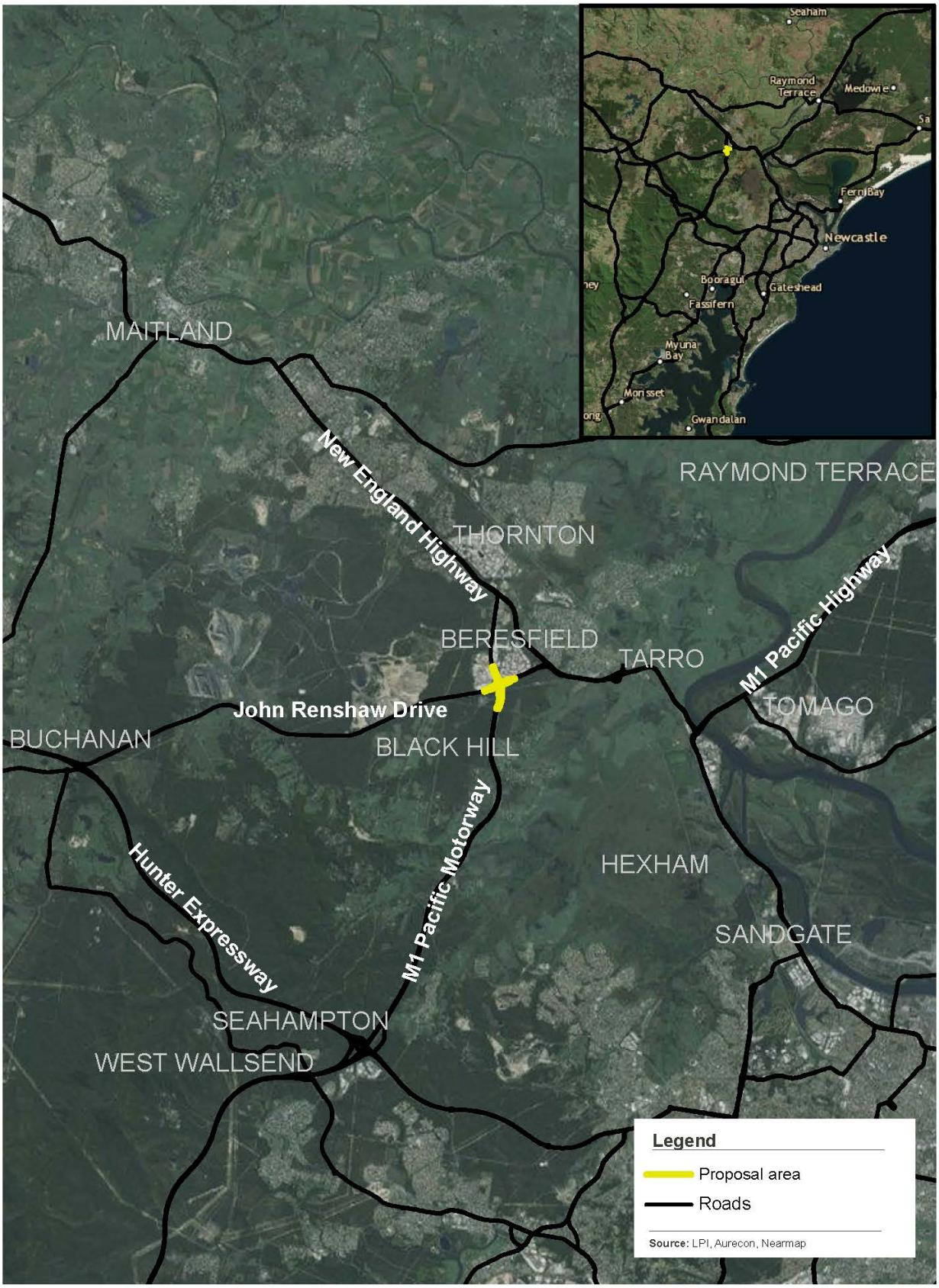


Figure 1-2: The proposal

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Aurecon Australasia (Aurecon) on behalf of Roads and Maritime. 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 have been undertaken in the context of clause 228 of the *Environmental Planning and Assessment Regulation 2000*, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS required? guidelines) (DUAP, 1995/1996), 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 examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

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

2.1 Strategic need for the proposal

The M1 Pacific Motorway is an important link in the National Land Transport Network and is part of the Sydney to Brisbane corridor, one of the busiest transport corridors in Australia. Located at the northern end of the M1 Pacific Motorway, the proposal is a critical connection linking the M1 Pacific Motorway to the A1 Pacific Highway and servicing the northern coast of NSW and south–eastern coast of Queensland. The proposal also provides an important connection between the M1 Pacific Motorway, Hunter Expressway, A1 Pacific Highway and the New England Highway.

The existing intersection does not efficiently allow for the nearly 4000 vehicles per hour currently travelling through during peak periods (Roads and Maritime, 2015). In addition, the intersection experiences congestion caused by a mix of commercial, tourist, inter-regional and local traffic. This results in delays, queuing and increased travel times.

The opening of the Hunter Expressway has temporarily eased congestion due to less vehicles using the intersection. However traffic volumes are predicted to return to levels experienced pre-opening by 2019 (Roads and Maritime, 2015a).

A revised concept design is currently being developed for the proposed M1 Pacific Motorway extension to Raymond Terrace (M1 extension to Raymond Terrace) which would allow northbound and southbound motorway traffic to bypass the proposal.

The proposal is required to improve the capacity at the existing intersection and also reduce potential negative economic, social, environmental and safety impacts associated with the expected congestion.

The proposal is part of the Australian and NSW government's M1 Pacific Motorway Productivity Package, which also includes upgrading the M1 Pacific Motorway between the Tuggerah and Doyalson interchanges and between the Kariong and Somersby interchanges.

The upgrade strongly aligns with a number of NSW and Australian government goals related to:

- *Improving the performance of the NSW economy* – Reducing delays at the intersection would reduce freight operating costs and improve productivity for heavy vehicles and light commercial vehicles travelling on the Sydney to Brisbane corridor
- *Improving urban amenity/liveability* – Reducing delays at the intersection would reduce travel times to people, employment and services in the Hunter, Mid-North Coast and New England regions. Improved traffic flows would also reduce vehicle emissions, crashes and vehicle operating costs.

NSW and Australian strategic documents relevant to the proposal are considered below.

National Land and Transport Network Determination 2014

The National Land Transport Network (NLTN) is a defined network of important road and rail infrastructure links, and connections between transport types, determined by the Minster for Infrastructure and Transport under the *National Land Transport Act 2014.*

The proposal would service freight traffic on the Sydney to Brisbane corridor via the A1 Pacific Highway and the inland Sydney to Brisbane corridor connecting traffic to the New England Highway via John Renshaw Drive. The proposal is of high strategic importance to the NLTN as it would improve the efficiency of freight movement on the network.

National Road Safety Strategy 2011-2020

The *National Road Safety Strategy 2011–2020* (Australian Transport Council, 2011) aims to reduce death and serious injury on Australian roads. A target of this strategy is to reduce fatalities and crashes on roads by at least 30 per cent between 2011 and 2020.

Reducing the number of crashes is one of the proposal objectives. The proposed improvements would be designed, built and operated in accordance with the Safe System principles which are outlined in the strategy. The proposal would also generally reduce congestion which is likely to reduce the frequency of crashes caused by fluctuating speeds and queuing.

NSW 2021: A Plan to Make NSW Number One

The proposal directly addresses two of the transport and infrastructure goals identified in the State Government's *NSW 2021: A Plan to Make NSW Number One* (Department of Premier and Cabinet, 2011), including reducing travel times and improving road safety.

To achieve the goal of reducing travel times for those travelling by car, bus or truck, the NSW Government aims to ease transport congestion by improving the efficiency of the road network. This is achieved through the delivery of road infrastructure that improves and expands capacity on road corridors.

To achieve the goal of improving road safety, the NSW Government aims to reduce fatalities to 4.3 per cent per 100,000 population in 2016 by carrying out road development, upgrades, maintenance and safety work that address crash risks.

The proposal helps to fulfil the NSW 2021 transport aims identified above by improving road safety and the efficiency of the road network in the vicinity of the proposal by:

- Replacing the existing roundabout with traffic lights
- Providing two through lanes and right turn lanes on all approaches
- Providing two right turn lanes on the northbound approach from the M1 Pacific Motorway to accommodate for a heavy vehicle right turn movement.

NSW Government State Infrastructure Strategy

The *NSW Government State Infrastructure Strategy 2012 – 2032: First Things First* (Department of Premier and Cabinet, 2012) is a strategy to plan and fund the infrastructure that the NSW Government delivers. The plan states that investment is needed to ensure sufficient road capacity is available and is utilised effectively, particularly along the motorway network. The proposal would help in fulfilling the infrastructure priorities of the *State Infrastructure Strategy 2012 – 2032* by improving road access into the Hunter from the M1 Pacific Motorway.

Rebuilding NSW State Infrastructure Strategy 2014 – Update

The *Rebuilding NSW State Infrastructure Strategy 2014 – Update* (NSW Department of Premier and Cabinet, 2015) is the NSW Government's response to the recommendations made by Infrastructure NSW in the *State Infrastructure Strategy 2012 – 2032* (Infrastructure NSW, 2012). This 20 year strategy identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth in NSW.

This strategy states the freight industry is critical to the NSW economy and by 2031 the amount of freight travelling in NSW will nearly double. The investment in better roads would deliver an economic dividend to regional communities through improved access to employment opportunities and regional businesses more readily attracting business investment. Regional road upgrades were a prominent theme in the Rebuilding NSW consultation. The improved road safety and efficiency objectives of the proposal are consistent with the priorities of this strategy.

2.2 Existing infrastructure

The existing intersection is a roundabout, with two lanes on approach and departure, except for a single lane departure onto Weakleys Drive. Northbound and southbound approaches are on the M1 Pacific Motorway and Weakleys Drive and westbound and eastbound approaches are on John Renshaw Drive.

A left turn slip lane connects John Renshaw Drive westbound to the M1 Pacific Motorway southbound, removing some heavy traffic from the intersection. This slip lane develops into a priority lane on the M1 Pacific Motorway southbound. An over-dimension vehicle curfew stopping bay (also used as a heavy vehicle parking bay) is also provided next to this slip lane. This stopping bay is no longer required to meet over-dimension curfew restrictions.

The existing intersection does not provide dedicated cycle lanes or off-road cycle paths, other than a short section of off-road path at the M1 Pacific Motorway departure. There is no provision for pedestrians across any part of the intersection.

The only private access point in the proposal area is to the former Boral asphalt facility, south-west of the intersection. This access provides right and left turns to and from the M1 Pacific Motorway. The proposal would remove the right turns in and out of the property and close the existing access across the median. The existing left turn in and out of the property would remain.

A 60km/h speed zone applies to most of the proposal area. There is an 80km/h speed zone on the M1 Pacific Motorway southbound which applies after the existing merge. There are higher speed zones outside the proposal area, with adjoining speeds zones on John Renshaw Drive at 80km/h eastbound and 100km/h westbound. Adjoining speed zones on the M1 Pacific Motorway are 80km/h in both directions which increases to 110km/h southbound.

Surface water drainage at the intersection and adjoining roads is provided by a mix of median and shoulder drainage pits. A drainage channel passes beneath the M1 Pacific Motorway via a concrete box culvert to the south of the intersection and then passes beneath John Renshaw Drive just to the east of the intersection. The drainage channel drains to an artificial swale/drainage channel between Weakleys Drive and the industrial development to the north-east of the intersection. This channel forms a topographic low area just east of the intersection, collecting much of the surface runoff across most of the site. A deep open drain exists at the north-western corner of the intersection with water flow draining under Weakleys Drive by two pipe culverts just to the north of the intersection.

Existing utilities in the proposal area include water, underground and overhead electrical lines, street lighting and underground telecommunications. Existing utilities would need to be relocated as detailed in Section 3.5. There are existing accesses to a Hunter Water easement from the M1 Pacific Motorway southbound and northbound.

The existing Variable Message Signs (VMS) on the M1 Pacific Motorway northbound and eastern section of John Renshaw Drive westbound do not meet current standards. The VMS on the M1 Pacific Motorway northbound close to the intersection is no longer needed due to nearby the installation of a VMS at Black Hill on the motorway northbound.

An informal car parking area is located at the south-western corner of the existing intersection. This area is used as a Driver Reviver site during peak holiday periods and is operated by the Morisset Lions Club.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal are to:

- Improve freight efficiency and commuter movement at the intersection of the M1 Pacific Motorway, John Renshaw Drive and Weakleys Drive, which is an important part of the land transport network between Sydney and Brisbane
- Ensure compatibility with the proposed M1 extension to Raymond Terrace project, both from a constructability and value management perspective
- Improve safety at the intersection by reducing the risk of crashes
- Achieve best value for money over the project life cycle
- Minimise the impacts to the existing environment.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

Roads and Maritime has carried out extensive studies and investigations as part of the identification and development of options. These include:

- *M1 Weakleys Drive Intersection Treatment Options: Value Management Review of Options Report* (Roads and Maritime, 2014a)
- *M1 Pacific Motorway intersection Upgrade at Weakleys Drive and John Renshaw Drive Strategic Design Report* (Roads and Maritime, 2015b)
- *M1 Pacific Motorway Intersection Upgrade at Weakleys Drive & John Renshaw Drive, Traffic Modelling on Strategic Concept Design* (Hyder, 2015)
- *Upgrade of M1 Pacific Highway intersection with John Renshaw Drive and Weakleys Drive Beresfield: Preliminary Environmental Investigation* (Advitech, 2014)
- *John Renshaw Drive/Weakleys Drive Intersection Modelling* (Jacobs, 2016).

Options were assessed against the proposal objectives outlined in Section 2.3. The options selection process also assessed the performance of each option with and without the future M1 extension to Raymond Terrace. The preferred option was selected on the basis that it would best meet the proposal objectives.

The Preliminary Environmental Investigation (Advitech, 2014) identified the presence of the Endangered Ecological Community (EEC) Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion and the listed threatened flora species *Callistemon linearifolius* (Netted Bottle Brush) within the proposal. Minimising impact to this EEC and threatened flora species was a key consideration balanced against the remaining proposal objectives.

In addition to the above process, Roads and Maritime sought community feedback on the preferred strategic design option (refer to Option 2 below) between 18 May and 14 June 2015. Feedback received during this community consultation informed further development and refinement of the proposal during concept design phase.

2.4.2 Identified options

The options considered are described below:

Do nothing option

The ‘do nothing’ option considered retaining the existing roundabout and lane configuration. Routine road maintenance activities would also continue as required.

Option 1: Upgrade existing roundabout

This option was investigated in the *Treatment Options: Value Management Review of Options Report* (Roads and Maritime, 2014a). This option considered a minor upgrade to the existing roundabout. This included:

- Addition of a third northbound lane on the M1 Pacific Motorway approach through the roundabout to Weakleys Drive
- Two northbound lanes on Weakleys Drive from the traffic lights to Enterprise Drive.

Option 1 would reduce the size of the existing informal car parking area.

Option 2 Traffic lights A

Option 2 was investigated in the *Treatment Options: Value Management Review of Options Report* (Roads and Maritime, 2014a) and further developed and assessed in the *M1 Pacific Motorway intersection Upgrade at Weakleys Drive and John Renshaw Drive Strategic Design Report* (Roads and Maritime, 2015b).

This option included:

- Traffic lights with two right turn lanes for the M1 Pacific Motorway northbound
- Two through lanes and one left turn on all approaches, except for Weakleys Drive southbound
- Two northbound lanes on Weakleys Drive from the intersection to Enterprise Drive
- Provisions for cyclists and future provision for pedestrian crossings at the traffic lights when required.

Option 2 would remove the informal car parking area.

Option 3 Traffic lights B

Option 3 was investigated in the *Treatment Options: Value Management Review of Options Report* (Roads and Maritime, 2014a) and further developed and assessed in the *M1 Pacific Motorway intersection Upgrade at Weakleys Drive and John Renshaw Drive Strategic Design Report* (Roads and Maritime, 2015b).

This option included a larger traffic light intersection, compared to Option 2, providing left turn slip lanes on all approaches and also included:

- Two northbound lanes on Weakleys Drive from the intersection to Enterprise Drive
- Two right turn lanes for the M1 Pacific Motorway northbound shorter than those in Option 2 (about 175 metres compared to about 300 metres in Option 2)
- Provisions for cyclists and future provision for pedestrian crossings at the traffic lights when required.

Option 3 would remove the informal car parking area.

Option 4 Interchange

This option was investigated in the *Treatment Options: Value Management Review of Options Report* (Roads and Maritime, 2014a) and involved construction of a grade separated overpass from the M1 Pacific Motorway northbound to John Renshaw Drive eastbound over the existing roundabout. The roundabout would continue to operate unchanged for the remaining approaches.

Option 4 would remove the informal car parking area.

2.4.3 Analysis of options

Do nothing option

The ‘do nothing’ option would not meet the proposal objectives as it would not provide any improvements to the existing traffic conditions. Traffic congestion would deteriorate as predicted traffic volumes increase. This option was not considered further.

Option 1 – Roundabout upgrade

When considering Option 1 against the proposal objectives, it was found that this option would:

- Not improve freight efficiency and commuter movement on all approaches to the intersection. Freight efficiency would be improved on the M1 Pacific Motorway approach to the roundabout. However excessive queuing on John Renshaw Drive and Weakleys Drive would potentially still occur
- Not improve overall safety for road users, including cyclists
- Be compatible with the future M1 extension to Raymond Terrace
- Not provide value for money. Carrying out a low-cost interim solution would not represent value for money as it would not perform well enough to justify the cost
- Minimise impact to the existing environment. Unlike the other assessed options, no vegetation clearance and only minimal disturbance of the existing road surface would be required. This option would reduce the size of the informal car parking area Driver Reviver site.

Although this option would minimise impacts to the existing environment, it was not considered further as it would not adequately meet the remaining proposal objectives.

Option 2 Traffic lights A

When considering Option 2 against the proposal objectives, it was found that this option would:

- Improve freight efficiency and commuter movement by increasing the capacity of the intersection
- Improve overall safety for road users by reducing crash rates through provision of a traffic light controlled intersection and removal of the existing right turn out of the former Boral asphalt facility onto the M1 Pacific Motorway southbound. This option would also improve the safety of cyclists through the provision of designated bike lanes
- Be compatible with the future M1 extension to Raymond Terrace
- Provide value for money. This option represented the best value for money of the assessed options as it increased the capacity of the intersection without representing an over investment when the proposed M1 extension to Raymond Terrace would be operational
- Minimise impacts to the existing environment. Vegetation clearance and removal of the informal car parking area and Driver Reviver site would be required to accommodate road widening. However these impacts would be less than the impacts of Options 3 and 4.

This option was considered to best satisfy the proposal objectives and therefore selected as the preferred option.

Option 3 Traffic lights B

When considering Option 3 against the proposal objectives, it was found that this option would:

- Improve freight efficiency and commuter movement by increasing the capacity of the intersection
- Improve overall safety for road users by reducing crash rates through the provision of a traffic light controlled intersection. However this option would retain the right hand turn from the former Boral asphalt facility to the M1 Pacific Motorway southbound
- Be compatible with the future M1 extension to Raymond Terrace
- Have a larger footprint and more construction work, materials and drainage infrastructure, representing less value for money compared to Option 2
- Impact on significantly more EEC and threatened flora species compared to Option 2 and greater impacts on existing utilities including drainage infrastructure. This option would also remove the informal car parking area and Driver Reviver site.

Option 3 was rejected in preference to Option 2 due to greater impacts on the existing environment and higher cost.

Option 4 Interchange

When considering Option 4 against the proposal objectives, it was found that this option would:

- Improve freight efficiency and commuter movement on all approaches to the intersection before operation of the proposed M1 extension to Raymond Terrace
- Not represent an overall improvement to road user safety for a number of reasons including retention of the existing roundabout, the possible safety hazard associated with locating a bridge pier for the overpass in the roundabout island, and constraints on the provision of safe cycling facilities
- Not be compatible with and may compromise the development of the proposed link to the M1 extension to Raymond Terrace
- This option would be significantly more expensive than other assessed options due to the construction costs of the overpass
- Not minimise impacts to the existing environment. This option would require the greatest amount of vegetation clearance compared to the other assessed options and would result in the greatest impact to existing underground and overhead utilities. This option would impact on the existing informal car parking area and Driver Reviver site.

This option was not considered further as it did not adequately address four of the five proposal objectives.

2.5 Preferred option

Option 2 was selected as the preferred option as it would best satisfy the proposal objectives and meet the strategic need for improved traffic flows at the intersection as outlined in Section 2.1. This option would achieve the best overall balance between environmental, technical, value for money and safety considerations. It would also be compatible with the proposed M1 extension to Raymond Terrace.

2.6 Design refinements

A number of design refinements have been made to the preferred option during concept design to improve safety and traffic flow including:

- Increasing the road curve on the left turn slip lane from John Renshaw Drive to the M1 Pacific Motorway southbound to provide a safer design speed
- Removing the over-dimension vehicle curfew stopping bay to allow for proposed road widening and improve intersection safety
- Simplifying lane movements
- Adding a left turn lane from John Renshaw Drive westbound to the M1 Pacific Motorway southbound to manage peak holiday traffic and any incidents which may result in closure of the southbound slip lane
- Reducing the proposal footprint width on John Renshaw westbound and the M1 Pacific Motorway to minimise native vegetation clearing.

3 Description of the proposal

3.1 The proposal

The proposal involves upgrading the intersection at Beresfield by replacing the existing roundabout with traffic lights. Figure 1-2 shows the proposed layout and the 80 per cent concept design drawings for the proposal are included as Appendix C. The concept design would be further refined during detailed design.

The proposal includes:

- A traffic light controlled intersection with two through lanes on all approaches
- Additional turning lanes on all approaches including two right turn lanes from the M1 Pacific Motorway to increase flow for traffic turning right onto John Renshaw Drive
- Two northbound lanes on Weakleys Drive between the traffic lights and Enterprise Drive
- Improved intersection layout and safety on M1 Pacific Motorway and Weakleys Drive approaches
- Upgrading the existing left turn slip lane to the M1 Pacific Motorway southbound to improve safety
- An additional left turn lane from John Renshaw Drive westbound to the M1 Pacific Motorway southbound to manage peak holiday southbound traffic and incidents which close the southbound slip lane
- The two southbound through lanes on the M1 Pacific Motorway merge just to the south of the intersection to form one lane and the slip lane continues in its own lane. This arrangement is the same as the existing layout
- Extension of existing drainage culverts under the slip lane from John Renshaw Drive westbound to the M1 Pacific Motorway southbound and an existing culvert under Weakleys Drive. These culvert extensions would be required to allow road widening work
- Additional drainage, lighting, signage, barriers, fencing and landscaping
- Installation of ITS
- Ancillary work such as stockpiling and construction work areas
- Utility relocations via trenching and boring under the existing road pavement
- Closing the informal car park located in the south–western corner of the existing intersection which operates as a Driver Reviver site during peak holiday periods, to allow for proposed road widening work
- Closing the OSOM truck stop bay on the M1 Pacific Motorway southbound. This would increase the radius of the left turn lane from the M1 Pacific Motorway to John Renshaw Drive westbound
- Removal of redundant Variable Message Signs (VMS) which do not meet current standards on the M1 Pacific Motorway northbound and eastern section of John Renshaw Drive westbound
- Clearing of State listed EEC Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion and individuals of the threatened *Callistemon linearifolius* (Netted Bottle Brush) to allow for proposed road widening and construction work.

Within the proposal, areas have been selected for equipment laydown, stockpile and plant parking. These would be located in the north–western, south–western and south–eastern corners of the intersection. These equipment laydown areas may also operate as satellite construction compounds to a main construction compound. A construction compound outside of these areas is not included in this assessment and more information is contained in Section 3.4.

3.2 Design

The next sections provide a description of the design criteria, major design features and engineering constraints. These features have been based on the refined concept design and may be subject to further refinement during detailed design.

3.2.1 Design criteria

The concept design for the proposal was prepared in accordance with Roads and Maritime road design standards and guidelines. The guidelines used to reference design parameters were in order of priority:

- Roads and Maritime standards and documents
- Austroads guidelines to be read in conjunction with Roads and Maritime supplements
- Australian Standards
- Standards Australia handbooks.

The design criteria for the proposal are outlined in Table 3-1.

Table 3-1 Proposal design criteria

Design features	Requirement
Design speed:	60km/h
Posted speed limit:	60km/h (subject to 80km/h speed zone towards the end of the southbound merge being approved for relocation)
Lane width:	3.5 metres
Shoulders:	3 metres along M1 Pacific Motorway southbound shoulder 2 metres on other shoulders
Central medium widths:	1.5 metres
Turning movement Design vehicle: Check vehicle:	 26 metre B-double 36.5 metre B-triple
On-road cycleway widths:	1.7–2 metres
Design Life Structures: Pavements:	 100 years 40 years
Expected Traffic Volumes Vehicles: Estimated growth rate: Heavy vehicles:	 About 4000 vehicles per hour during peak periods in 2019 Variable internal and external growth rates (land use scenario three) 10 –15 per cent of traffic volume

3.2.2 Engineering constraints

Key constraints affecting the concept design of the proposal include:

- Large 66 kilovolt overhead powerlines east of Weakleys Drive and M1 Pacific Motorway
- An underground 1200 millimetre water main across M1 Pacific Motorway south of the intersection
- Compatibility with the proposed M1 extension to Raymond Terrace design.

3.2.3 Major design features

The proposal involves upgrading the existing two lane roundabout to traffic lights. The typical cross sections of the proposal's approaches to the intersection as well as proposed drainage works are described below.

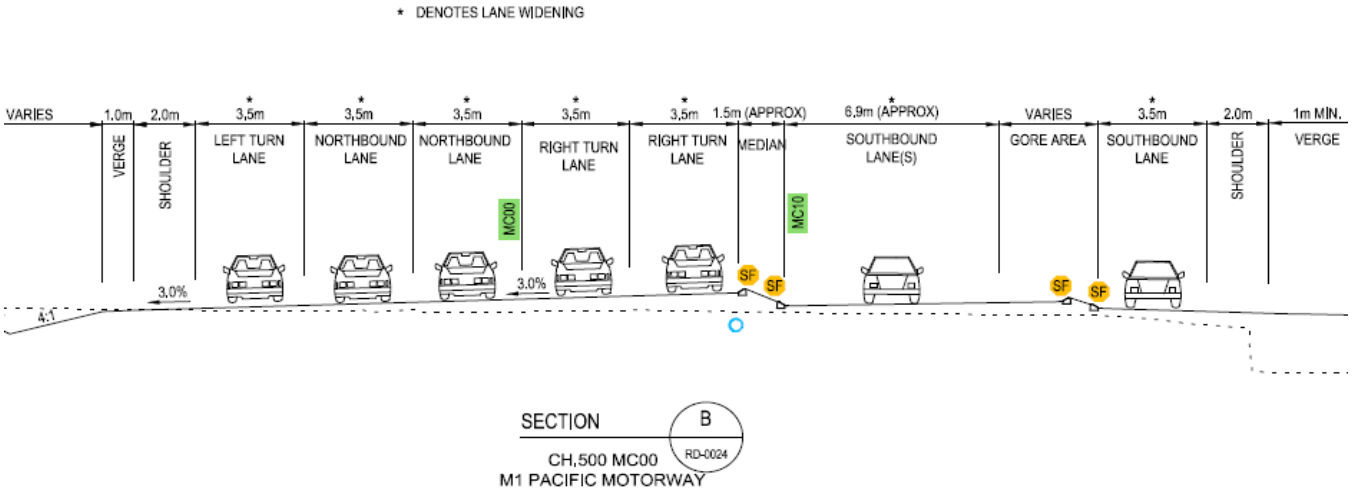
Typical cross sections

M1 Pacific Motorway

The typical cross section of the M1 Pacific Motorway is shown in Figure 3-1 and would consist of:

- Two 3.5 metre through lanes northbound
- Two 3.5 metre right turn lanes northbound
- One 3.5 metre left turn lane northbound
- Two 3.5 metre departure lanes southbound
- Southbound slip lane from John Renshaw Drive to the M1 Pacific Motorway.

Figure 3-1 Typical proposed cross section on M1 Pacific Motorway

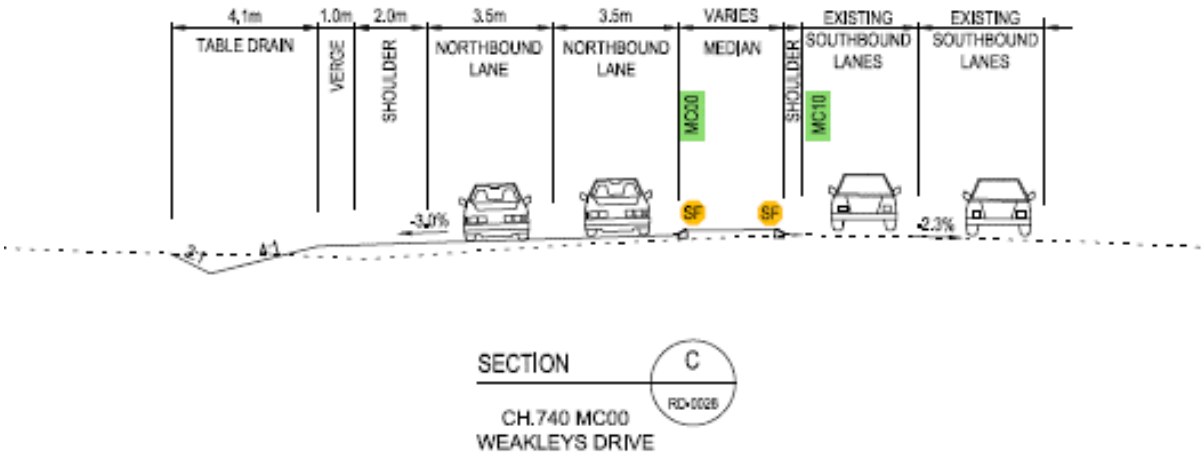


Weakleys Drive

The typical cross section of Weakleys Drive is shown in Figure 3-2 and would consist of:

- One 3.5 metre right turn lane southbound
- One 3.5 metre through/left turn lane southbound
- Two 3.5 metre departure lanes northbound.

Figure 3-2 Typical proposed cross section Weakleys Drive

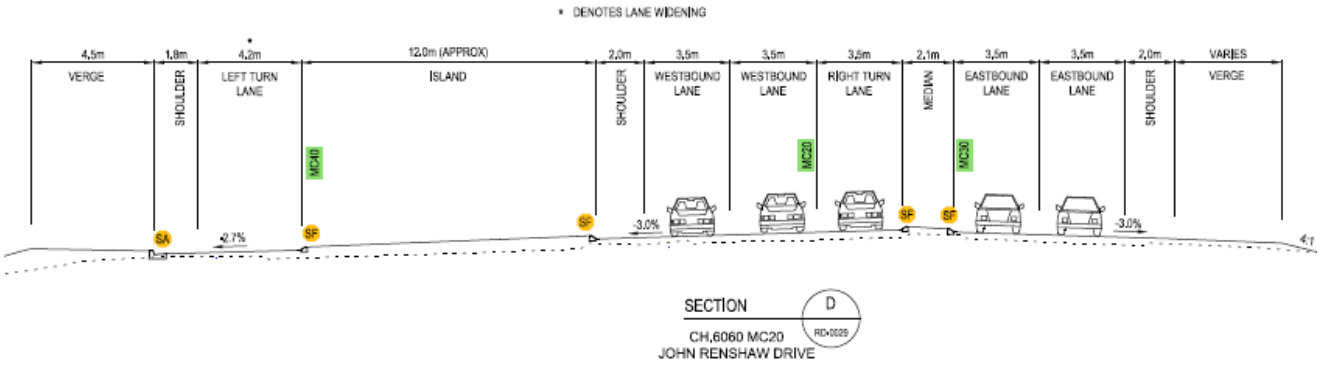


John Renshaw Drive east

The typical cross section of John Renshaw Drive east is shown in Figure 3-3 and would consist of:

- Two 3.5 metre through lanes westbound
- One 3.5 metre right turn lane westbound
- One 3.5 metre left turn lane westbound
- Two 3.5 metre departure lanes eastbound.

Figure 3-3 Typical cross section John Renshaw Drive east

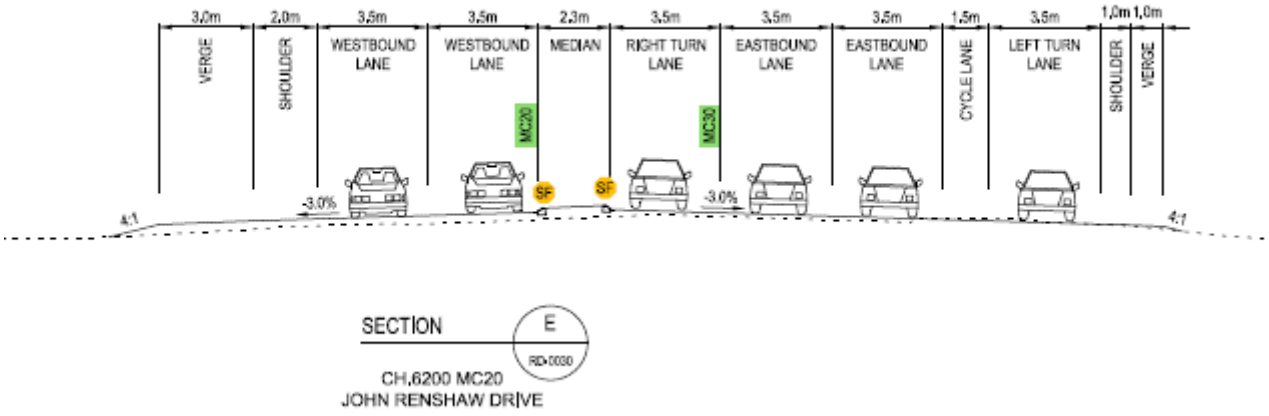


John Renshaw Drive west

The typical cross section of John Renshaw Drive west is shown in Figure 3-4 and would consist of:

- Two 3.5 metre through lanes eastbound
- One 3.5 metre right turn lane eastbound
- One 3.5 metre left turn lane eastbound
- Two 3.5 metre departure lanes westbound.

Figure 3-4 Typical cross section John Renshaw Drive west



Drainage

The proposal would use the existing stormwater and road pavement drainage system where possible. Additional drainage works are summarised below, and are subject to detailed design:

- Extend the existing 1200 millimetre diameter culverts under John Renshaw Drive east of the intersection to allow for the realigned M1 Pacific Motorway slip lane
- Replace existing median drainage on the M1 Pacific Motorway where it is affected by the proposal

- Additional pavement drainage (longitudinal drainage) on all approaches to the intersection. This additional pavement drainage has been designed to flow into existing transverse drainage culverts to avoid the need to trench across traffic lanes
- Minor extension of the existing culvert on the western side of Weakleys Drive
- Install scour protection on the upgraded culverts, except for the 600 millimetre diameter culvert at the northern end of Weakleys Drive
- Install debris deflections upstream of the major M1 Pacific Motorway culvert inlet work to minimise potential blockage and improve flood immunity
- Install new table drains along the western side of the M1 Pacific Motorway and Weakleys Drive and along the southern and northern side of John Renshaw Drive.

3.3 Construction activities

Construction of the proposal would be carried out by one or more approved Roads and Maritime contractors. The general work methodology and other construction activities are summarised in the next sections.

3.3.1 Work methodology

The proposed work methodology would be refined during the detailed design phase and developed by the selected contractor in accordance with the Roads and Maritime conditions of contract and the requirements of the following Roads and Maritime specifications:

- G36 Environmental Protection
- G40 Clearing and Grubbing
- R179 Landscape Planting.

Construction phase requirements outlined in Chapter 6 and 7 would be included in the contract documentation and a Construction Environmental Management Plan (CEMP) will be prepared in accordance with G36.

The proposal would be constructed in a number of stages with work separated into offline and online work. Offline work would be carried out behind safety barriers, with the intersection maintaining full capacity and a speed limit of 60km/h, in the times leading up to and during peak hours (4.30am to 9.30am and 2.30pm to 7pm).

Online work involving lane or shoulder closures would occur between 7.30pm and 4am, and 9.30am and 2.30pm with a reduced speed limit of 40km/h. This work methodology would minimise traffic disruptions, maintain traffic flows and ensure the safety of both road workers and road users.

Temporary cyclist routes would be provided during construction. During peak construction and high risk activities access for cyclists may not be achievable due to the risk posed to cyclists. Where possible, such activities would be programmed to take place overnight.

The final speed limits, hours of construction and temporary cyclist routes may vary in accordance with the Road Occupying Licence (ROL) issued for the project.

All work for the proposal would be carried out within the proposal area shown in Figure 1-2. The final scope of work for each construction phase would be developed and confirmed with the selected contractor. An indicative scope of works is provided below.

Early works package

Certain parts of the proposal may be carried out as part of an early works package which would prepare for the main construction activities.

An early works package may include activities such as installing necessary environmental controls, utilities relocation (telecommunications and power), drainage work, clearing and grubbing, fencing,

street light relocation, ITS installations and work to prepare for ancillary areas, such as site access and utility connections.

Preconstruction activities

Preconstruction activities would include the above early works activities, site establishment and implementation of environmental controls as required before construction starts. This may include the identification and marking of environmental sensitive areas; installation of temporary erosion, sediment and water quality controls and the establishment of laydown areas and pads (a temporary earth foundation for construction plant used to allow work in damp areas). Preconstruction activities would be carried out as offline work during standard working hours.

Stage 1 Construction

During this stage traffic arrangements and the existing roundabout layout would remain however lanes and shoulders would be narrowed to allow safer construction. Work would be mostly carried out as offline work during the day, however some online work involving lane closures would be required overnight to allow construction next to existing traffic lanes.

Work during this stage may include:

- The majority of earth work, road widening and associated pavement work on all approaches to and from the intersection, including the realignment of the left turn from John Renshaw Drive to the M1 Pacific Motorway
- Start of pavement work on the existing roundabout and traffic islands on Weakleys and John Renshaw drives
- Utility relocations as required (refer Section 3.5)
- Drainage work including installing table drains and extension of existing culverts (refer Section 3.2.3).

Stage 2

During this stage, the intersection would continue to function as a roundabout with some approaches to and from the intersection being realigned to the new road. Traffic lanes would generally remain narrowed next to construction zones. The existing roundabout may be realigned during this stage to allow the installation of traffic lights. Work during this stage of construction would mostly be carried out overnight as online work.

Work during this stage may include:

- Further pavement and overlaying work on all approaches to the intersection
- Progressive pavement overlay work to provide smooth connections from new pavement areas to existing pavement areas
- Median island construction
- Potential installation of new traffic lights (temporary lights may need to be installed during the work)
- Drainage work including installing median drainage on the M1 Pacific Motorway as required by the proposal and pavement drainage (longitudinal drainage) on all intersection approaches
- Utility relocations as required (refer Section 3.5).

Stage 3

During stage 3 the intersection would start to operate under the new traffic lights in the final traffic arrangements. However the right turn lanes on John Renshaw Drive could potentially be closed to allow completion of median islands. Work during this phase would be carried out as offline and online work as required.

The scope of work during this stage may include:

- Final median work
- Installation of final traffic lights
- Final pavement work and line marking
- Finishing work including landscaping, safety barrier installation and signposting.

3.3.2 Construction hours and duration

The main construction activities of the proposal would take about nine months to complete, weather permitting. An early works package may be carried out for the proposal and take less time to complete. Construction timing is subject to project approval.

Due to the critical role the proposal plays in the national, regional and local road network and to minimise the extent of traffic disruption, construction work would be separated into offline and online work. These construction hours are defined as follows:

Offline work – 24 hours a day, seven days a week
Online work – 7pm to 4.30am and 9.30am to 2.30pm, seven days a week.

Excluding early works, construction of the proposal would take about nine months to complete, weather permitting.

Subject to the requirements of the ROLs, safety and Traffic Management Plants and approvals, it is proposed to maintain traffic flows and ensure the safety of road users. The intersection would maintain full capacity and a speed limit of 60 km/h during offline work with all works being conducted behind safety barriers. Lane/shoulder closures would occur during online work with a reduced speed limit of 40 km/h.

The proposed construction hours and distinction between offline and online work is appropriate considering the nearby land use, the absence of residential dwellings in the locality and the importance of minimising impacts to traffic during construction.

Public and school holiday construction restrictions

During peak holiday traffic, only offline work would be carried out and would be done behind safety barriers. This would maintain the full capacity of the intersection and a speed limit of 60km/h.

Final construction periods and speed limits during holiday periods would be the subject of a ROL.

3.3.3 Plant and equipment

Typical plant and equipment likely to be used during construction are listed below. Plant and equipment requirements would be refined during the construction planning phase by the construction contractor.

General

- Excavators
- Bulldozers
- Graders
- Bobcats
- Water carts
- Light vehicles
- Haulage trucks
- Delivery vehicles
- Traffic management devices
- Jack hammers
- Rollers
- Mobile rock crusher
- Concrete saws
- Water pumps.

Road pavement construction

- Milling machine
- Grader
- Smooth drum roller
- Bitumen sprayer
- Haulage trucks
- Line marking machine
- Asphalt paver.

Drainage construction including culvert extension/replacement

- Excavator
- Concrete pump
- Trenching machine
- Crane
- Pad foot and smooth drum roller
- Compactor.

Utility relocation

- Excavator
- Horizontal borer.

3.3.4 Earthworks

Earthworks are limited as the proposal consists of a pavement overlay on the existing road, rather than excavation. The majority of earthworks would be associated with road widening activities outside the existing road pavement and would include stripping and stockpiling of topsoil (about 3600 cubic metres of material), removal of unsuitable material offsite and importation of suitable fill material. The volume of general cut and fill earthworks required for the proposal would be about 5700 cubic metres.

The estimated total area of additional road pavement as a result of road widening is about 11,500 square metres. These areas would require foundation treatments involving the excavation and re-compaction of earth and cold milling of road pavement materials.

About 1500 cubic metres of excavation would also be required to install drainage works such as the culvert extensions and pavement drainage identified in Section 3.2.3. Minor earthwork would also be required for the proposed utility work as outlined in Section 3.5.

3.3.5 Source and quantity of materials

The construction contractor would confirm the source and quantity of materials before the start of work. Where possible, excavated material would be reworked and used to meet general fill requirements. Other materials to be sourced by the construction contractor which would be required include:

- Select fill
- Sub base
- Concrete
- Sealing aggregate
- Asphalt
- Precast culverts
- Other precast drainage structures.

The majority of materials would be sourced from local quarries and asphalt batching plants. Precast concrete culverts, traffic lights and other prefabricated materials would be sourced from suitable suppliers.

3.3.6 Traffic management and access

Traffic management

A Traffic Management Plan (TMP) would be prepared and implemented as part of the CEMP. The TMP would be prepared in accordance with the Roads and Maritime *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Roads and Maritime, 2008). The TMP would provide details on how traffic would be staged and managed during construction to maintain traffic flow.

Staging construction would allow the full use of the intersection and existing speed limit of 60km/h to be maintained between 4.30am and 9.30am and 2.30pm and 7pm, and during peak holiday periods. This would reduce potential impacts to traffic during construction. Final speeds would be subject to TMPs and approvals.

Road signs, notices and the Transport for NSW (TfNSW) Live Traffic website would notify road users of construction work and traffic changes to ensure driver and road worker safety.

Lane closures

No lane closures would occur during offline work between 4.30am and 9.30am and 2.30pm and 7pm, and during peak holiday periods. Closure of lanes on the M1 Pacific Motorway would only be permitted during night work (from 7pm to 4.30am) and would be subject to ROL requirements. A minimum lane width to be specified in the ROL would be maintained on all approaches except during online work under active traffic control. Lane closure limits would be carried out in accordance with the ROL issued for the project.

Heavy vehicles

John Renshaw Drive is the primary approach from the north to the Hunter Expressway and therefore heavy vehicles, including oversized loads, would be accommodated throughout construction.

Construction vehicle movements

Transporting of construction machinery, equipment and materials to the proposal would generate heavy vehicle movements. Construction vehicles would access the site via arterial roads. The construction contractor's TMP would confirm proposed haulage routes and controlled access points. It is estimated about 40 heavy vehicle movements would enter and leave the proposal area each day.

Construction vehicle movements would also occur between the construction site and the construction compound. These movements would be limited where practicable, by establishing construction laydown areas on the north–western, south–western and south–eastern corners of the existing roundabout (refer to Section 3.4 below). Potential impacts of construction vehicle movements are considered in Section 6.2.3.

In addition, light vehicles would be required to transport construction staff and specialist supervisory personnel.

Access to surrounding land uses

The Beresfield industrial estate to the north of John Renshaw Drive is accessed via Yangan Drive and Enterprise Drive off Weakleys Drive, and Kinta Drive off John Renshaw Drive east. These roads are outside the proposal area and as such minimal impact on access to businesses in the industrial estate is expected as a result of the proposal.

The only private access point in the proposal area is to the former Boral asphalt facility located on land owned by Coal and Allied to the immediate south–west of the intersection. This provides full access, with right and left turns, to and from the M1 Pacific Motorway. The proposal would remove the right turn into and out of the property and close the existing access across the median. The existing left turn into and out of the property would be maintained. Coal and Allied have been consulted on these proposed changes.

Current access from the M1 Pacific Motorway to the existing Hunter Water Corporation (HWC) easement running parallel to John Renshaw Drive would be closed as part of the proposal. This proposed closure has been developed in consultation with HWC. Alternative access points exist along the easement which provide safer access and do not require access from the M1 Pacific Motorway.

3.4 Ancillary facilities

Ancillary facilities for the proposal include a temporary construction compound as well as equipment laydown areas, stockpile sites and plant parking areas. The equipment laydown, stockpile and plant parking areas would be located within the proposal area in the north–western, south–western and south–eastern corners of the existing roundabout on Roads and Maritime owned land, and also next to the proposed works within the road reserve.

A temporary construction compound would be required to support construction activities and would be established near the existing intersection. The construction compound would include:

- Site offices and amenities
- Stockpile sites for topsoil, earthworks, materials, and unsuitable or contaminated materials
- Stockpile of redundant materials (pavement, guard rails etc)
- Equipment storage
- Material deliveries
- Vehicle and plant parking.

The laydown areas on the in the north–western, south–western and south–eastern corners of the existing roundabout may operate as satellite construction compounds to a main compound. This would improve safety by reducing vehicle, material and personnel movements in the construction zone and surrounding road network.

The location of the main site compound is not included in this assessment. The site would be confirmed during detailed design and would be subject to separate assessment and approval by Roads and Maritime.

3.5 Public utility adjustment

Consultation with relevant utility providers has been carried out as part of the development of the concept design to identify and locate existing utilities and incorporate into the design utility authority requirements for relocations or adjustments. The location of utilities is shown on the concept design drawings in Appendix C.

A summary of the consultation carried out to date with relevant utility providers is provided in Section 5.5. Utility design in accordance with the NSW *Streets Opening Conference Guide to Codes and Practices for Streets Opening* and other utility specific design codes has been coordinated with all project disciplines including alignment, drainage, structures, pavement and environmental.

Service providers with assets located within the proposal area are summarised in Table 3-2. Only underground electrical and communications assets would be impacted as a result of the proposal. The affected service providers would continue to be consulted during detailed design to determine methods and staging of relocation if required.

Table 3-2 Affected services and associated asset owners

Utility asset	Owner
Water	Hunter Water Corporation (HWC)
Electrical overhead and underground	Ausgrid
Underground electrical and telecommunications	Roads and Maritime
Underground telecommunications and optic fibre	Telstra
Underground telecommunications and optic fibre	Optus
Street lighting	Newcastle City Council & Ausgrid

Telecommunications - Telstra

There is a Telstra cable crossing John Renshaw Drive to the west of the roundabout and along the west side of Weakleys Drive which may require relocation where sufficient cover is not achieved. There is also a Telstra cable located south of the roundabout on the eastern side the M1 Pacific Motorway Highway. A 100 millimetre Telstra cable and twin concrete pit are located south of the roundabout on the eastern side the M1 Pacific Highway.

These assets would be relocated with in the proposal to allow for the proposed road widening, subject to detailed design.

Telecommunications - Optus

There are Optus cables crossing John Renshaw Drive to the west of the roundabout and along the west side of Weakleys Drive which may require relocation where sufficient cover is not achieved. There is also an Optus cable crossing Weakleys Drive within the proposed construction zone. This asset has sufficient cover and would not need to be relocated. The remaining Optus assets in the vicinity of the roundabout would be unaffected by the proposal, subject to detailed design.

Water - Hunter Water Corporation

A 1200 millimetre HWC water main is located under the M1 Pacific Motorway within the proposed construction zone. This water main would be retained in its existing location as it has sufficient cover. An existing 1500 millimetre concrete encased pipe extends past the proposed road widening and would be unaffected by the proposal.

Electrical underground - Ausgrid

There are multiple underground electrical mains owned by Ausgrid in the vicinity of the roundabout. Cables for existing street lighting are located under the proposed road widening and would need to be relocated. Other Ausgrid underground electrical assets in the vicinity of the roundabout are not expected to be impacted by the proposal, subject to detailed design.

Electrical overhead - Ausgrid

There is an existing 66 kilovolt overhead electrical line which crosses the M1 Pacific Motorway about 500 metres south of the existing roundabout. The proposal has been designed to avoid impact on this asset. There are also existing 11 kilovolt and 33 kilovolt electrical assets along the eastern side of Weakleys Drive which cross John Renshaw Drive before continuing about 80 metres along the eastern side of the M1 Pacific Motorway. The 11 kilovolt asset then crosses the M1 Pacific Motorway. These assets would need to be relocated to allow for the proposed road widening.

Electrical and telecommunication – Roads and Maritime

Roads and Maritime own existing telecommunications and underground electrical assets within the proposal area. Affected assets located on the M1 Pacific Motorway would require relocation. The remaining Roads and Maritime assets in the proposal area are not expected to be impacted by the proposal except a small section of underground electrical main crossing John Renshaw Drive east of the roundabout, which may require relocation.

Additional Roads and Maritime electrical and communications assets associated with proposed street lighting and ITS would also be installed as part of the proposed work. A new VMS is being considered for John Renshaw Drive westbound as part of a separate project. This would be subject to separate assessment and approvals.

3.6 Property acquisition

The proposal would be carried out completely within the cadastral boundary of Roads and Maritime owned land, therefore no land acquisition is required.

In the event that the detailed design results in the need to temporarily access nearby properties, leasing or partial acquisition of these properties may be required and may be subject to additional Roads and Maritime environmental assessment. Any land acquisition would be in accordance with the Roads and Maritime Acquisition Policy and compensation would be based on the requirements of the *Land Acquisition (Just Terms) Compensation Act 1991*.

4 Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

The NSW EP&A Act and its associated regulations provide the framework for assessing environmental impacts and determining planning approvals for developments and activities in NSW. The EP&A Act also establishes State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs) which may include provisions relevant to the proposal.

The proposal does not require development consent under Part 4 of the EP&A Act due to permissibility in S*tate Environmental Planning Policy (Infrastructure) 2007* (ISEPP) (refer to section 4.1.1 below), and is not classified as state significant infrastructure under Part 5.1. Therefore, the proposal may be assessed under Part 5 of the EP&A Act. Under Part 5 of the EP&A Act, Roads and Maritime is classified as a proponent and a determining authority.

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

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

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

As the proposal is for an intersection upgrade and is to be carried out by or on behalf of Roads and Maritime, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*. Development consent from Newcastle 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 (Major Development) 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 (where applicable), is discussed in Section 5.4 of this REF.

State Environmental Planning Policy No 44 Koala Habitat Protection

Schedule 1 of NSW *State Environmental Planning Policy 44 – Koala Habitat Protection* (SEPP 44) identifies Newcastle as LGAs to which this planning instrument applies. In accordance with clause 6(b), SEPP 44 does not apply to proposals assessed under Part 5 of the EP&A Act, nevertheless consideration of this SEPP has been included in this REF.

In accordance with SEPP 44, it must be ascertained whether the proposal area contains potential Koala (*Phascolarctos cinereus*) habitat and if so, whether it contains core Koala habitat.

The ecological assessment completed for the proposal determined that the study area surveyed in the assessment contained one listed Koala feed tree however the area does not constitute ‘core Koala habitat’ or ‘potential Koala habitat’ as defined by SEPP 44. This is further discussed in Section 6.1.

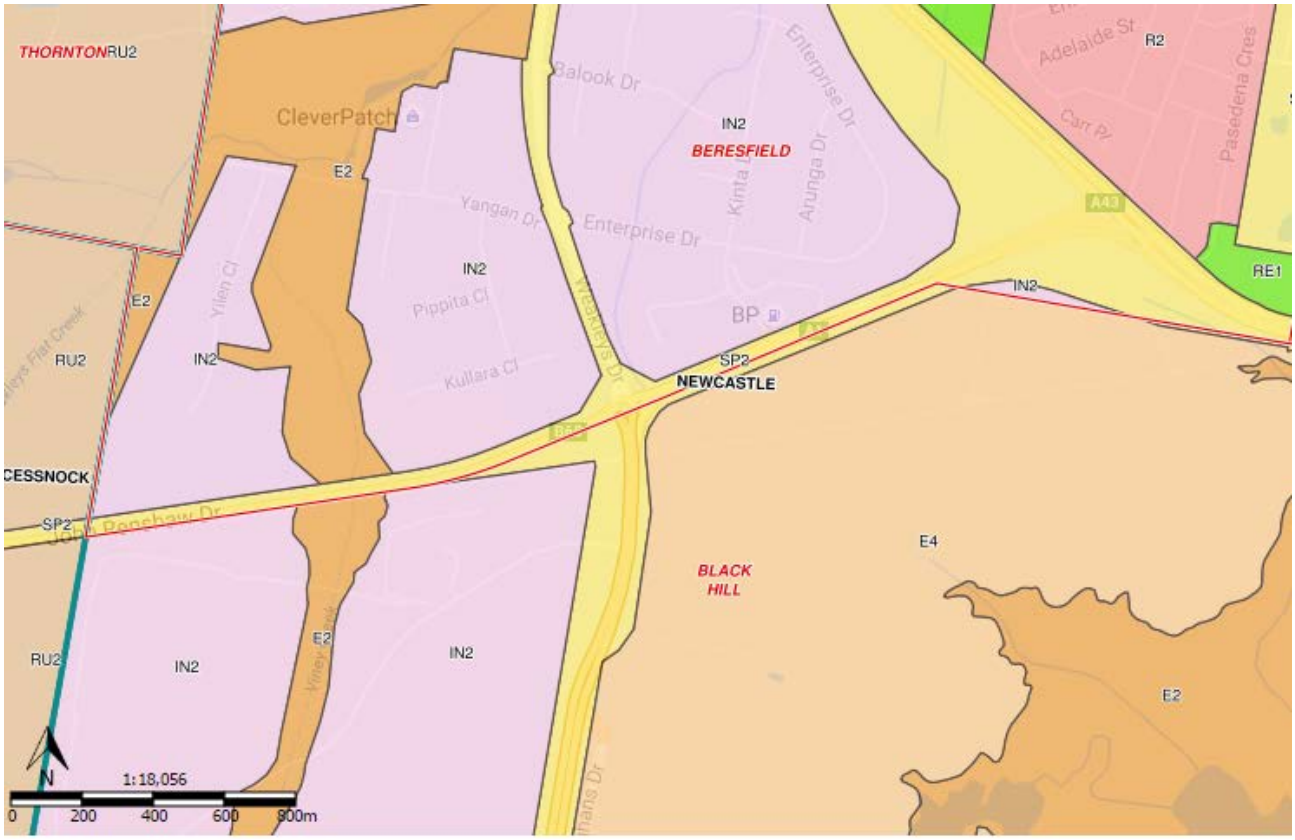
4.1.2 Local Environmental Plans

Newcastle Local Environmental Plan 2012

The proposal is located within the Newcastle LGA and the *Newcastle Local Environmental Plan 2012* (Newcastle LEP) applies. The proposal is within the dedicated road reserve zoned SP2 – Infrastructure. Land zones near the proposal are show in Figure 4-1 and include the following zonings:

- IN2 – Light Industrial
- E4 – Environmental Living
- E2 – Environmental Conservation.

Figure 4-1 Newcastle LEP zones



Source: NSW Planning and Environment Panning viewer tool.

4.2 Other relevant NSW legislation

4.2.1 Threatened Species Conservation Act 1995

The Threatened Species Conservation Act 1995 (TSC Act) lists a number of threatened species, populations or ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. If any of these could be impacted by the proposal, an Assessment of Significance that addresses the requirements of Section 5A of the EP&A Act must be completed to determine the significance of the impact.

The endangered ecological community (EEC) Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion and the listed threatened flora species *Callistemon linearifolius* (Netted Bottle Brush) have been identified within the proposal area. Clearing of EEC and *Callistemon linearifolius* would be required as part of the proposal.

Assessments of significance completed for these species listed under the TSC Act have concluded the proposal would be unlikely to have a significant impact on the species, community or their

habitats. Therefore the impacts of the proposal would not trigger the need for a Species Impact Statement (SIS). This is further discussed in Section 6.1.

4.2.2 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides controls in relation to the protection of land reserved under the NPW Act as well as controls in relation to the protection of items of cultural heritage. It is an offence under the NPW Act to 'harm' Aboriginal objects or sites of Aboriginal significance without an Aboriginal Heritage Impact Permit (AHIP).

Aboriginal Heritage is considered in Section 6.9. One Aboriginal Heritage Information Management System (AHIMS) registered site (AHIMS #38-4-0551) has been identified nearby. This site is located outside of the proposal, to the north–west along John Renshaw Drive west. The site would be protected during construction by the establishment of a five metre fenced buffer zone along the edge of the proposal boundary. An AHIP is therefore not required for the proposal.

4.2.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) provides for the sustainable and integrated management of the State's water for the benefit of both present and future generations. The Act controls the extraction and use of water and any activity that is in or near water sources in NSW.

Typically a controlled activity approval would be required under section 91E(1) of the WM Act to allow for construction within 40 metres of a watercourse. However, clause 39A(1) of the Water Management (General) Regulation 2004, exempts public authorities such as Roads and Maritime and local councils from section 91E(1) of the WM Act in relation to all controlled activities that they carry out in, on or under waterfront land.

Accessing groundwater is regulated under Part 5 of the Water Act, and is subject to the NSW Department of Primary Industries (DPI) Water Aquifer Interference Policy. In the unlikely event that groundwater would be intercepted as part of the construction activities, the volumes would be determined and if required, Roads and Maritime would apply for a water access licence under Part 5 of the Water Act. The proposal would not intercept any known aquifer.

4.2.4 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) provides for the conservation of items of heritage in NSW. The Heritage Act defines heritage as items or places that are of State and/or local heritage significance and include: places, buildings, works, relics, moveable objects and precincts. The Heritage Act establishes a register including an inventory and list to protect the listed items.

Under section 139 of the Heritage Act, a person must not disturb or excavate any area if there is a known or suspected likelihood of the excavation resulting in a relic being discovered, exposed, moved, damaged or destroyed. In these cases, an excavation permit issued by the Heritage Council is required to carry out the proposed work.

The heritage assessment did not identify any heritage items or places of State and/or local heritage significance within or in the vicinity of the proposed works.

4.2.5 Fisheries Management Act

The objectives of the Fisheries Management Act 1994 (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. The FM Act includes provisions for threatened fish and marine vegetation and associated threatening processes and is administered by the NSW DPI.

The FM Act applies to all waters within the limits of the State, except where Commonwealth legislation applies. Part 7A Division 4 of the FM Act prohibits, without a licence, activities that damage habitats or harm threatened species, populations or ecological communities. Activities

which may require a permit under the FM Act include, but are not limited to, dredging works, reclamation work and works that would block fish passage.

The proposal would not impact on a 'Key Fish Habitat' as defined by DPI and therefore this Act does not apply to the proposal.

4.2.6 Noxious Weeds Act 1993

The Noxious Weeds Act 1993 (NW Act) provides for the declaration of noxious weeds by the Minister for Primary Industries. Noxious weeds may be considered noxious on a national, state, regional or local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act.

Six Class 4 Locally controlled noxious weeds were observed during the biodiversity assessment. Under the NW Act, the growth of a Class 4 weed must be managed in a manner that continuously inhibits the ability of the plant to spread. The relevance of this Act to the proposal is considered further in Section 6.1.2.

4.2.7 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) regulates the clearing of native vegetation on land in NSW except for excluded land (such as National Parks, State Forests and urban areas). Section 25(g) provides that the NV Act does not apply to any clearing that is, or is part of, an activity carried out by a determining authority within the meaning of Part 5 of the EP&A Act, if the determining authority has complied with that Part.

The proposal would not require approval under the NV Act as all clearing of native vegetation that would be required is permissible under Part 5 of the EP&A Act without consent provided the clearing occurs in accordance with a Part 5 approval. Clearing of native vegetation is assessed in Section 6.1.

4.2.8 Protection of the Environment and Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) aims to protect, restore and enhance the environments of NSW and reduce potential risks to human health and the environment.

The management of environmental impacts in relation to air, noise and water quality fall under the provisions of the POEO Act. The POEO Act identifies a number of pollution offences, including offences relating to:

- Wilful or negligent disposal of waste in a manner that is likely to harm the environment
- Wilful or negligent causing of a substance to leak, spill or otherwise escape in a manner that harms or is likely to harm the environment
- The pollution of water.

Under the provisions of the POEO Act, Roads and Maritime are required to notify the NSW Environmental Protection Authority (EPA) if a 'pollution incident' occurs that causes or threatens 'material harm' to the environment.

Environmental Protection Licences (EPL) are issued under section 122 of the POEO Act for various scheduled development and activities. The proposal does not involve undertaking any scheduled activities as listed under Schedule 1 of the POEO Act, therefore no EPL is required.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed actions that have the potential to significantly

impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix A and Chapter 6 of the REF.

A referral is not required for proposed road activities that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

Potential impacts to these biodiversity matters are also considered as part of Chapter 6 of the REF and Appendix A

Findings – matters of national environmental significance (other than biodiversity matters)

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

Findings – nationally listed biodiversity matters

The assessment of the proposal's impact on nationally listed threatened species, populations, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Chapter 6 of the REF describes the safeguards and management measures to be applied.

4.3.2 Native Title Act 1993

The Native Title Act 1993 (NT Act) is administered by the National Native Title Tribunal. The Tribunal is responsible for maintaining a register of native title claimants and bodies to whom native title rights have been granted. The NT Act prescribes that native title can be extinguished under certain circumstances, including the granting of freehold land.

A Native Title Claim on behalf of the Awabakal and Guringai People was lodged in 2013. This claim extends from the Hunter River in the north, to Hornsby in the south and covers most of the Newcastle, Maitland, Cessnock and Lake Macquarie LGAs including the proposal area. This claim is yet to be determined. In the event that this Native Title is found to exist within the claim area, this would not affect the proposal as Native Title has already been extinguished in the proposal area through the construction of public infrastructure and granting of freehold land.

4.3.3 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and/or road infrastructure facilities and is being carried out by or on behalf of a public authority. Under clause 94 of the ISEPP the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Part 5 of the EP&A Act.

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime's obligation under clause 111 of the EP&A Act to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity. Development consent from Council is not required.

5 Consultation

5.1 Consultation strategy

A Communications and stakeholder strategy was prepared in March 2015 for the proposal in accordance with the *Roads and Maritime Services Community Engagement and Communications Manual 2012.*

A summary of the consultation carried out to date is provided in the following sections.

5.2 Community involvement

Roads and Maritime consulted with the community and stakeholders in 18 May and 14 June 2015 on the strategic design to seek comment, feedback, ideas and suggestions for consideration when developing the proposal. Community members and stakeholders were encouraged to provide their feedback in person, by mail, email or phone contact with the project team.

The communication and consultation activities carried out are listed in Table 5-1. Community consultation materials are contained in Appendix D along with the *Community Consultation Report* (Roads and Maritime, 2015c).

Table 5-1 Community consultation activities

Activity	Stakeholder	When
Newspaper advertisements	Local residents, businesses and the wider community	Newcastle Herald - Monday 18 May 2015 Maitland Mercury - Monday 18 May 2015 Cessnock Advertiser - Wednesday 20 May 2015
Media activities	Local residents, businesses and the wider community	Media release issued by Roads and Maritime 18 May 2015
Project update	3200 properties including residences and businesses in Beresfield, Tarro and parts of Thornton and Black Hill. Direct mail to key stakeholders including emergency services, major landowners, Newcastle, Cessnock and Maitland councils and the Morisset Lions Club.	18 May 2015
Webpage	Local residents, businesses and the wider community	18 May 2015
Information session	Local residents, businesses and the wider community	A drop-in information session was held from 9am to 12pm on Saturday 30 May 2015 at East Maitland Library
Static displays	Local residents, businesses and the wider community	Roads and Maritime Motor Registry offices at Cessnock, Wallsend, Raymond Terrace and Newcastle; and Service NSW Centre at East Maitland.

Stakeholder briefings and meetings	Morisset Lions Club Driver Reviver operating committee Coal and Allied	6 June 2015 19 June 2015

The proposal was displayed between 18 May and 14 June 2015 with 42 submissions received about a range of issues from individual community members and motorists, including potentially affected property owners and business operators in the area.

The type of submissions provided were:
- 18 written submissions
- 3 telephone calls
- 21 discussions at the information session and Morisset Lions Club meeting.

The majority of feedback was generally supportive of the need for the proposal. A total of 16 issues were raised in the feedback received. The majority of submissions contained multiple issues of interest or concern as summarised in Figure 5-1 and discussed in Table 5-2.

The three most common issues raised by stakeholders related to:
- Intersection design (22 per cent)
- Congestion, including measures proposed to reduce average waiting times at the intersection (21 per cent)
- Driver Reviver operation (18 per cent).

Figure 5-1 Issues raised during community consultation and stakeholder feedback

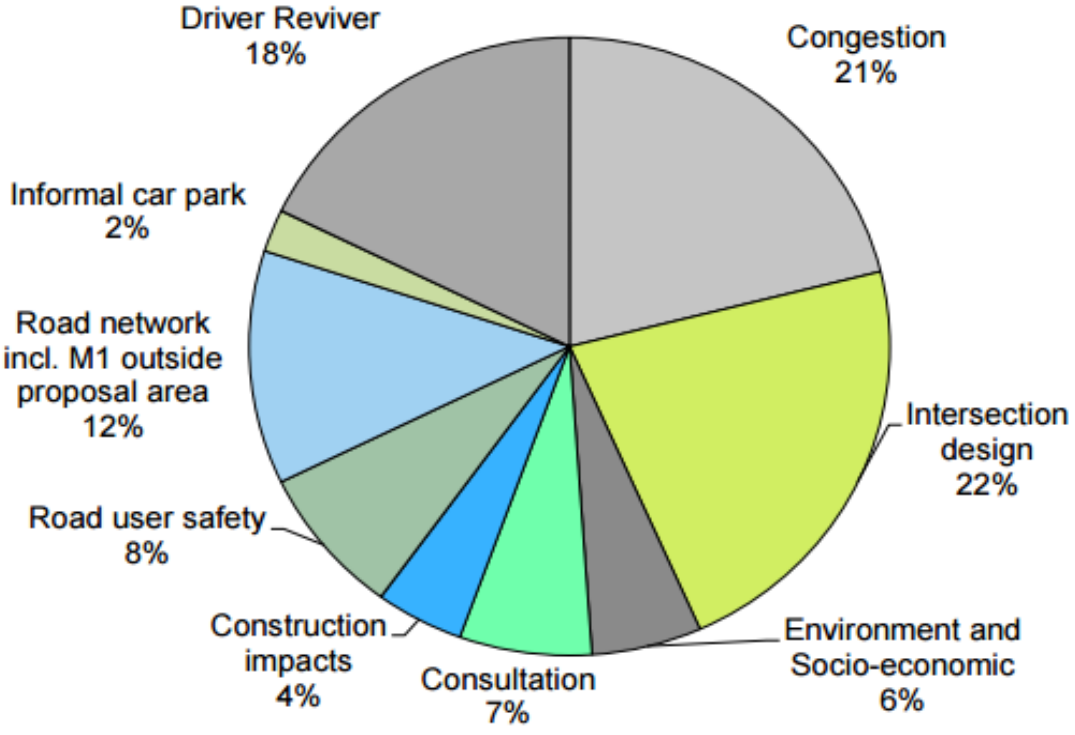


Table 5-2 Community consultation issues and responses

Issue	Number of comments	Issues raised	Response	Where addressed in REF
Construction impacts	4	Construction and duration	Construction is expected to start in 2017 and be completed in 2019. This would be confirmed during the detailed design phase and subject to funding availability.	Section 3.3
		Safety concerns due to road users driving at high speed through the work zone	Road signs, notices and the TfNSW Live Traffic website would notify road users of construction work and traffic changes to ensure driver and road worker safety.	Sections 3.3 and 6.2
Consultation	6	Support for ongoing consultation and provision of project notifications throughout the project	Support for ongoing consultation has been noted. Roads and Maritime would continue to work with the community and stakeholders throughout project planning and construction to keep the community informed, understand issues and minimise potential impacts. This includes providing directly impacted stakeholders with advance notice of work activities.	Chapter 5
Driver Reviver site	16	Concern for the existing Driver Reviver service provided at the intersection	The importance of maintaining this service for road users and the Morisset Lions Club is noted. A new location is being investigated and the outcome would be communicated to the club and the wider community.	Sections 5.2 and 6.6
Environmental impacts	5	Concern the proposal may impede access to local business and residential property	A TMP would be prepared and provide details of traffic management to be implemented during construction. This would ensure traffic flow through the intersection and access to local businesses are maintained. As described in Sections 3.3 and 6.2 staging of construction works would reduce potential impact to traffic during construction. Staging work would allow the intersection and existing speed limit of 60km/h to be maintained between 4.30am and 7.30pm throughout construction.	Sections 3.3 and 6.2

Issue	Number of comments	Issues raised	Response	Where addressed in REF
		Concern the proposal and construction process may harm the local ecology	Roads and Maritime avoids potential impacts on the environment wherever practicable. Where impacts are unavoidable, Roads and Maritime applies management measures to minimise the impact on the environment. Clearing of EECs and *C. linearfolius* specimens would need to be removed as part of the proposal. Assessments of significance for these species listed under the TSC Act have concluded the proposal would be unlikely to have a significant impact on the species, community or their habitats. This is further discussed in Section 6.1.3.	Section 6.1.3
		Concern operational road noise may worsen as a result of the proposal	The potential for any increased noise created by vehicles using the proposal was reviewed as part of this REF. Noise investigations considered existing levels and predicted noise levels. The investigations concluded that while there would be a minor increase in operational noise arising from the proposal, the increase was still well within the operational noise criteria detailed in the NSW Environment Protection Authority's Roads Noise Policy (DECCW 2011).	Section 6.3
Informal parking	2	Concern about the informal parking at the intersection	The proposal site is not a formal car park facility. While the proposal would remove the informal parking area to the south–west of the intersection there are alternative opportunities for parking in the industrial area. This is a safer road environment with lower volumes of traffic and slower posted speed limits.	Sections 6.6.2 and 6.2.3

Issue	Number of comments	Issues raised	Response	Where addressed in REF
Proposed intersection design	20	Suggestions for alternative design details including different roundabout and traffic management options	The proposed design was selected from a wide range of options as is compatible with future upgrades including the proposed M1 extension to Raymond Terrace. The design takes into account growth in the surrounding areas, future road and network upgrades, north–south and east-west traffic flow, local industrial areas. Australian road design and road user safety standards have been applied to all aspects of the design and traffic management options.	Section 2.4
		Suggestions that a flyover from the M1 Pacific Motorway heading northbound onto John Renshaw Drive would be a better option	The proposed design was selected from a wide range of options. One of these options included a flyover. Investigations showed a flyover and/or other major structures would constrain future upgrade options on the road network. The proposed design improves existing traffic conditions and maintains future flexibility.	Section 2.4
		Concern the northbound approach to the intersection from the M1 Pacific Motorway will get congested	The proposed design provides five lanes on the M1 Pacific Motorway northbound approach to the intersection, including dual right hand turn lanes and a dedicated left turn lane. Traffic congestion and road safety would be improved by providing dedicated lanes for turning and through travel.	Section 3.1
		Suggestions for road signs and ITS to improve traffic congestion and safety	Additional road signs including ITS, would be installed on the M1 Pacific Motorway northbound and John Renshaw Drive eastern approach to the M1 Pacific Motorway.	Sections 3.1 and 6.2
Road network	11	Suggestions for the road network, including M1 Pacific Motorway, outside proposal area	Suggestions for M1 Pacific Motorway projects outside the proposal area were shared with appropriate staff at Roads and Maritime.	Not applicable to the current proposal

Issue	Number of comments	Issues raised	Response	Where addressed in REF
Road user safety	7	Concern for road user safety based on current rate of accidents at the intersection	Safety for road users is a key consideration when planning and delivering road projects. The proposal would provide traffic lights to improve safety for all road users by controlling traffic movements through the intersection.	Section 6.2
Traffic congestion	19	Concerns about current congestion at the intersection	The existing two lane roundabout is used by about 4000 vehicles per hour in peak periods and can't effectively cater for the current level of demand. The proposal aims to ease traffic congestion and improve travel times by providing additional traffic lanes and more capacity at the intersection. The proposal also includes traffic lights to control traffic movements and distribute traffic more evenly.	Sections 3.1 and 6.2

5.2.1 Beresfield Driver Reviver site consultation

Roads and Maritime carried out a survey of Driver Reviver users in the December 2015 and January 2016 holidays. The aim of the survey was to understand the origins and destinations of users and why they stopped at the site.

The surveys were carried out on 26 and 28 December 2015 and 22 and 24 January 2016. These dates were selected to capture outgoing and returning holiday traffic. In total, 132 people were surveyed.

Figure 5-2 shows:

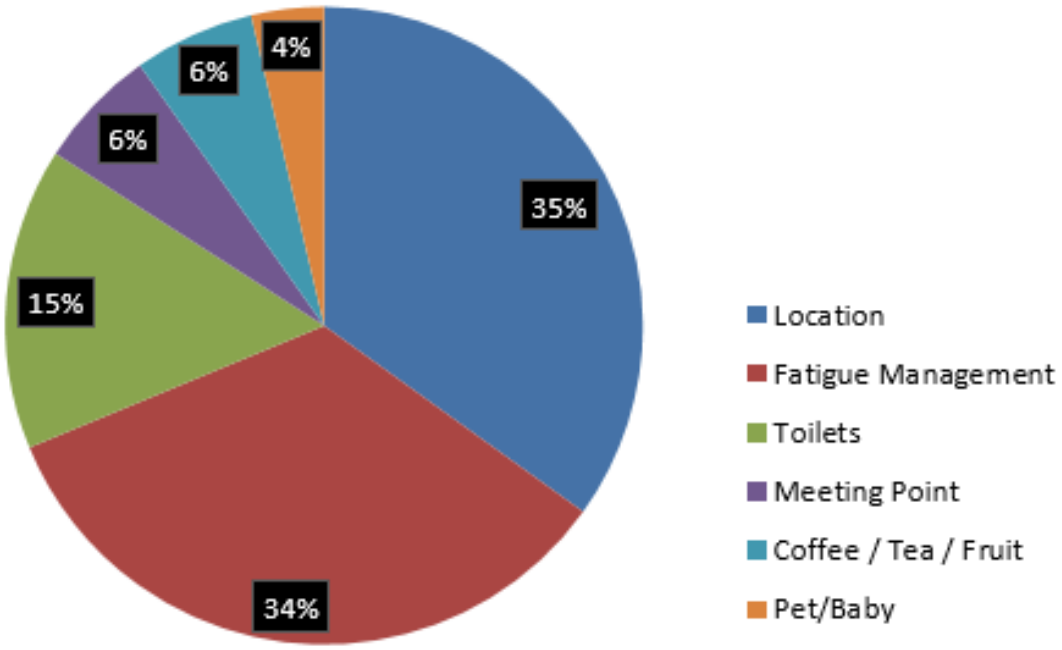
- The majority of surveyed users had travelled from the south (84 per cent) and were heading to northern destinations via John Renshaw Drive (78 per cent)
- Eleven per cent of users had travelled from northern destinations via John Renshaw Drive and were heading south along the M1 Pacific Motorway (2 per cent)
- The majority of users originated from Sydney (69 per cent), heading to destinations on the Mid North Coast (39 per cent), Port Stephens (21 per cent) or Queensland (14 per cent).

Figure 5-2 Roads and Maritime survey: Driver Reviver site visitors by direction of travel

The survey also asked motorists why they had stopped at the Driver Reviver site. As shown in Figure 5-3, key reasons for stopping included:

- Location (35 per cent)
- Fatigue management (34 per cent)
- Toilets (15 per cent)
- A meeting point or area to exchange passengers (6 per cent).

Figure 5-3 Reasons for stopping at the Beresfield Driver Reviver site – Roads and Maritime survey



The operators of the Driver Reviver site, the Morisset Lions Club, also collected data during the December 2015 and January 2016 holidays. This data recorded the home address and destination of about 2700 users and also doubled as a petition. The information collected by the Lions Club was generally consistent with the Roads and Maritime survey results, although the Lions Club data recorded a higher number of southbound motorists using the site (18 per cent).

The Lions Club petition noted the importance of providing a Driver Reviver site for road users at the northern end of the M1 Pacific Motorway. The petition requested Roads and Maritime provide a permanent facility, including a service building, shelter, amenities and a sealed car park.

Consideration of the potential traffic and socio-economic impacts arising from the proposed closure of the site are contained in Sections 6.2.3 and 6.6.2 of this REF.

5.3 Aboriginal community involvement

All Aboriginal community involvement in Roads and Maritime proposals is governed by the provisions of the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) (Roads and Maritime, 2011) relevant legislation and guidelines. PACHCI provides a consistent means of effective consultation with Aboriginal stakeholders regarding activities which may impact on Aboriginal Cultural Heritage and is generally consistent with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010).

Roads and Maritime carried out a Stage 2 PACHCI assessment on the proposal during development of the strategic and concept design (Advitech, 2015). This assessment concluded the proposal activities are unlikely to affect Aboriginal Cultural Heritage. A representative of the Mindaribba Local Aboriginal Land Council attended the site survey on 17 March 2015. Further details on the PACHCI carried out for the proposal and a discussion on the cultural heritage value of the site is contained in Section 6.9.

5.4 ISEPP consultation

Part 2, Clauses 13 to 16 of the Infrastructure SEPP specify the requirements for consultation with Councils and other public authorities for infrastructure developments carried out by or on behalf of a public authority. Consultation is required for development which impacts on:

- Council related infrastructure or services (Clause 13)
- Local heritage (Clause 14)
- Flood liable land (Clause 15)
- Other specified development (Clause 16).

The proposal would not impact on any of the above and therefore consultation under ISEPP is not required. Appendix B contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered.

5.5 Government agency and Emergency Services stakeholder involvement

The following government agencies and utility authorities have been identified as stakeholders with respect to the proposal:

- Newcastle City Council
- Maitland City Council
- Cessnock City Council
- NSW Office of Environment and Heritage
- NSW Environment Protection Authority
- NSW Department of Primary Industries (Fisheries)
- NSW Department of Primary Industries (Water)
- NSW Mine Subsidence Board
- NSW Trade and Investment Division of Resource and Energy
- NSW Police
- NSW Ambulance service
- Fire Service
- Ausgrid
- Hunter Water Corporation
- Transgrid
- Telstra/Optus.

Letters inviting comment on the proposal were sent to the identified stakeholders on 16 June 2016.

Issues raised during consultation with these agencies and stakeholders are outlined below in Table 5-3.

Table 5-3 Issues raised during stakeholder consultation

Agency	Issue raised	Response	Where addressed in REF
Newcastle City Council	Sought clarification of additional shorter M1 Pacific Motorway slip lane in concept design	The proposal provides for an additional 'offline' left turn from John Renshaw Drive westbound to the M1 Pacific Motorway southbound which would be used to manage peak holiday traffic and any incidents which result in closure of the southbound slip lane.	Section 3.1
	Relocation of Driver Reviver site should be considered as part of current proposal	Roads and Maritime is investigating alternative sites for a Driver Reviver. Any new site would be considered under a separate proposal and environmental assessment.	Sections 3.1, 6.2 and 6.6
	Roads and Maritime should verify the extent of 'park and ride' occurring at the informal car park area and request provision considered for a formal off-road parking facility	The existing informal car park is not considered safe. The proposal would close the site to remove these existing safety concerns. Safer road environments for commuter car parking exist in the Beresfield industrial estate.	Sections 6.2 and 6.6
	Roads and Maritime to ensure parking only occurs in designated areas	The design of the proposal would remove existing opportunities for informal parking.	Section 6.2
	Provision for pedestrian facilities on all legs of the intersection should be made in advance of demand. How this is done should be addressed in the REF.	There is no current identified demand for pedestrian facilities. The intersection design allows for the provision of pedestrian facilities on the northern and western approaches which would be installed if demand requires. There is no provision of pedestrian facilities on the southern and eastern approaches due to safety concerns associated with the John Renshaw Drive left turn slip lane to the M1 Pacific Motorway. There is also no forecasted demand for pedestrian facilities on these approaches.	Section 6.2
	Clarification sought on the cycling transition arrangements on the eastern approach for cyclists travelling left onto the M1 Pacific Motorway and through the intersection westbound	Cycle lanes/shoulders are provided on all approaches to the intersection. This includes provisions for cyclists on the eastbound approach travelling left onto the M1 Pacific Motorway and westbound through the intersection.	Section 6.2

Agency	Issue raised	Response	Where addressed in REF
	Need for bike lane on the southern leg of the intersection for cyclists continuing north	A cycle lane is provided on the southern approach to the intersection for cyclists turning left as well as cyclists continuing north.	Section 6.2
	Request to consider cyclist storage boxes on all approaches to allow cyclists turning right to perform hook turns.	Cyclist storage boxes are line markings on the road to position cyclists in a highly visible location. These are not included due to the existing low numbers of cyclists using the intersection and the impact such arrangements would have on other road users. On-road cycling lanes have been provided on all approaches to the intersection.	Section 6.2
	Avoid impact on Lot 12 DP1186448 due to environmental values.	The proposal would be carried out completely within the cadastral boundary of Roads and Maritime owned land.	Section 3.6
	Appropriate controls of stormwater quality and quantity should be implemented on Roads and Maritime land to minimise stormwater discharges to neighbouring properties	The Erosion and Sediment Control Plan would specify appropriate measures to be implemented and maintained during construction. The proposal would not alter the existing stormwater drainage.	Section 6.7
	Consider landscaping batters with locally indigenous species to improve the aesthetics of the area	Revegetation of areas disturbed by the proposed work would be carried out in accordance with Roads and Maritime QA Specification R178 – Vegetation and the *RTA Biodiversity Guidelines - Guide 3: Re-establishment of native vegetation*.	Section 6.1 and 6.5
	Request to be kept informed and have further discussions with council concerning the relationship between council owned land and the M1 extension to Raymond Terrace and M1 Pacific Motorway proposals with respect to impacts and future access arrangements	Roads and Maritime will continue carrying out consultation with key stakeholders, including Newcastle City Council.	Chapter 5

Agency	Issue raised	Response	Where addressed in REF
	Unless prior authorisation is granted, encroachment onto neighbouring properties should be avoided, particularly during construction.	The proposal would be carried out completely within the cadastral boundary of Roads and Maritime owned land.	Section 3.6
Maitland City Council	No response received	N/A	N/A
Cessnock City Council	Is the length of M1 Pacific Motorway right turn lanes onto John Renshaw Drive adequate to prevent spill into through motorway lanes?	Based on predicted traffic volumes, the proposal would cater for the majority of queue lengths at peak times.	Section 6.2
	Concern there is no signalised left turn from the M1 Pacific Motorway onto John Renshaw Drive	Traffic would be required to give way at this location. This is considered appropriate given low traffic volumes (less than 50 vehicles per hour during peak times), and existing measures to reduce traffic speed on the approach to the intersection from the M1 Pacific Motorway.	Chapter 3 and Section 6.2
	Consideration should be given to a chicane movement on M1 Pacific Motorway northbound approaching the intersection to address speed of approaching northbound traffic on M1 Pacific Motorway	Rumble strips and flash light message signage are already provided at the M1 Pacific Motorway approach to the intersection to address speed of approaching northbound traffic.	Section 6.2
	If a second slip lane is required onto M1 Pacific Motorway, suggest a high angle entry to the M1 Pacific Motorway with clear directives on right of way	The proposal provides for a left turn from John Renshaw Drive westbound to the M1 Pacific Motorway southbound which would only be used to manage periods of peak holiday traffic and any incidents which result in closure of the southbound slip lane.	Chapter 2

Agency	Issue raised	Response	Where addressed in REF
	Concern whether the John Renshaw Drive westbound right hand turn lane into Weakleys Drive is of adequate length	Options for the right turn lane from the eastern section of John Renshaw Drive into Weakleys Drive are now being reviewed. These may include providing signs instructing westbound vehicles on John Renshaw Drive to use the New England Highway corridor to access the Beresfield Industrial Area.	Section 6.2
	Safety concerns about John Renshaw Drive eastbound approach if queues extend back to the crest and sweeping left curve about 450 meters before the intersection.	Traffic modelling has indicated queues would not extend to the crest and did not identify any safety concerns with the eastbound approach.	Section 6.2
	Concern about existing informal vehicle shortcuts being made across northern road reserve from John Renshaw Drive to Weakleys Drive	This is a potential risk however it may be infrequent and could be prevented by retrofitting a physical barrier if the need arises.	Noted
	Concern whether Weakleys Drive southbound right turn lane to John Renshaw Drive is of adequate length	Based on predicted traffic volumes, the proposal would cater for the majority of queue lengths at peak times.	Section 6.2
	Concern no signalised left turn off Weakleys Drive to John Renshaw Drive	Traffic would be required to give way at this location. This is considered appropriate given low traffic volumes (less than 50 vehicles per hour during peak times).	Section 6.2
	Concern no pedestrian facilities provided	There is no current identified demand for pedestrian facilities. The intersection design allows for the provision of pedestrian facilities on the northern and western approaches which would be installed if demand requires. There is no provision of pedestrian facilities on the southern and eastern approaches due to safety concerns associated with the John Renshaw Drive left turn slip lane to the M1 Pacific Motorway. There is also no forecasted demand for pedestrian facilities on these approaches	Section 6.2

Agency	Issue raised	Response	Where addressed in REF
	Concern over provision of cycling facilities	Cycle lanes/shoulders are provided on all approaches to the intersection. This includes provisions for cyclists on the eastbound approach travelling left onto the M1 Pacific Motorway and westbound through the intersection including a road cycle crossing point across the M1 Pacific Motorway southbound slip lane.	Section 6.2
	Concern over provision of bus stop for Route 160 Cessnock to Newcastle	The existing 160 bus service from Cessnock to Newcastle is a school bus service and generally does not stop along John Renshaw Drive at Beresfield. The proposal does not provide designated bus stops on John Renshaw Drive due to safety concerns about the proximity of the intersection. There is a designated bus stop and shelter in the BP service centre which could be used if future bus routes service the Beresfield industrial estates.	Section 6.2
	Concern over impact to existing Driver Reviver site	Roads and Maritime is investigating alternative sites for a Driver Reviver. Any new site would be considered under a separate proposal and environmental assessment.	Section 6.2
	Recommend upgrade and extension of existing street lighting.	An upgrade of existing street lighting is being carried out as part of the proposal.	Section 3.5
NSW Office of Environment and Heritage	REF to address impacts to Aboriginal cultural heritage	While the proposal has the potential to impact on an AHIMS registered isolated artefact (#38-4-0551) located just north of the proposal area boundary on John Renshaw Drive, it is considered appropriate safeguards, including provision of a five metre fenced buffer zone around the artefact, would ensure there would be no impact on this registered site. Therefore no Aboriginal Heritage Impact Permit (AHIP) would be required for the proposal.	Section 6.9
	REF to address impacts to the OEH estate	The proposal would not result in any impacts to the OEH estate.	N/A

Agency	Issue raised	Response	Where addressed in REF
	REF to address threatened biodiversity and offsetting	The proposal would clear a small area of Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC as well as *C. linearfolius* specimens. Assessments of significance (seven part tests) undertaken for the EEC and threatened flora species determined the proposal was unlikely to result in a significant impact and therefore a species impact statement was not required.	Section 6.1
	REF to address flooding, floodplain management and coastal erosion	The proposal is not located on a floodplain or area subject to coastal erosion. The proposal's drainage has been designed to accommodate stormwater flows generated from the upgraded road sections, as well as the existing roads and landscape features that contribute to local flows. As a result, the operation of the proposal would have no adverse impacts on drainage or hydrology.	Section 6.7
NSW Environment Protection Authority	Confirmed EPA licence not required for the proposal	Noted.	N/A
NSW Department of Primary Industries (Fisheries)	No response received	N/A	N/A
NSW Department of Primary Industries (Water)	Determine volume of surface water and groundwater to be taken	No surface or groundwater is proposed to be taken for the proposal.	Section 6.7
	Determine source of construction water	No secure water supply would be required by the proposal.	Section 6.7
	Assessment of surface water and groundwater impacts	An assessment of potential surface and groundwater impacts is contained in Section 6.7 of the REF. Management measures to mitigate potential impacts are also outlined in this section.	Section 6.7

Agency	Issue raised	Response	Where addressed in REF
	Full technical details and data of all surface and groundwater modelling	The project would not interfere with groundwater as earthworks are limited to an above ground road formation. No groundwater modelling has been undertaken. Surface water modelling was carried out to assess potential construction and operational impacts of the proposal.	Section 6.7
NSW Mine Subsidence Board	Proposal is not within a proclaimed mine subsidence district or subject to any building restrictions imposed by the mine subsidence board.	Noted.	N/A
NSW Trade and Investment Division of Resources and Energy	Proposal is not currently subject to a resource title but is within 200 metres of a coal exploration licence held by Donaldson Coal. The proposal is not considered likely to impact on future coal extraction.	Noted.	N/A
	No objection to or further comments on the proposal.	Noted.	N/A
NSW Police Force	Suggestions for improvements to existing layout and measures to improve peak traffic flows.	The proposed design was selected from a wide range of options, including adjusting the existing roundabout, as it represents best overall balance between environmental, technical, value for money and safety considerations. The proposal provides for an additional left turn from John Renshaw Drive westbound to the M1 Pacific Motorway southbound which would only be used to manage peak holiday southbound traffic.	Section 6.2
	Rethink current controls on access roads to re-divert/restricting local traffic away from the intersection during peak holiday flows.	Noted.	N/A

Agency	Issue raised	Response	Where addressed in REF
NSW Ambulance Service	No issues raised	N/A	N/A
NSW Fire Service	No response received	N/A	N/A
Ausgrid	No response received	N/A	N/A
Hunter Water	A section of the Chichester Trunk Gravity Main (DN1200 water main) is located beneath the M1 Pacific Motorway in the location of the intersection upgrade	This water main would be retained in its existing location as it has sufficient cover. Existing 1500 millimetre concrete encasing pipe extends past proposed road widening and would be unaffected by the proposal.	Section 3.5
Transgrid	No response received	N/A	N/A
Morisset Lions Club	Noted the importance of providing a Driver Reviver at the northern end of the M1 Pacific Motorway. Requested a permanent site with improved facilities.	Roads and Maritime is investigating alternative sites for a Driver Reviver. Any new site would be considered under a separate proposal and environmental assessment.	Section 6.2.3 and 6.6.2

5.6 Ongoing or future consultation

5.6.1 Public display of REF

This REF will be placed on public display and community, government agency and other interested parties would be invited to make a written submission on the proposal. Information on how to make a submission and details of display dates, times and locations will be advertised in local papers and on the Roads and Maritime website.

At the conclusion of the public display, submissions received by Roads and Maritime would be compiled for consideration. After reviewing all submissions, Roads and Maritime will prepare a submissions report documenting the submissions received and Roads and Maritime's response to them. The submissions report will published on the Roads and Maritime website and letters will be sent to respondents to advise them of this publication.

If design changes are required in response to submissions, these would be documented in the submissions report and any new impacts would be assessed. If these design changes are substantial, the community and stakeholders would be informed.

5.6.2 Consultation during further design and construction phases

Consultation would continue with the community and stakeholders throughout planning and construction of the proposal. Future consultation would include:

- Targeted consultation with community stakeholders to help manage potential impacts during construction
- Updates and work notifications throughout planning and construction to the nearby community, businesses and road users. Updates would be provided through a range of media including, but not limited to, letters, static and mobile variable message signage, and traffic alerts to advise motorists of major traffic changes
- Ongoing meetings with Newcastle City Council, government agencies, utility providers and the community stakeholders as required
- Ongoing updates as required on the Roads and Maritime website.

Ongoing and future consultation would be carried out in accordance with the *Roads and Maritime Services Maritime Community Engagement and Communications: A resource manual for staff* (Road and Maritime Services, 2012).

6 Environmental assessment

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

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

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Biodiversity

A biodiversity assessments report for the proposal was carried out as part of the Preliminary Environmental Investigation (Advitech, 2015). This assessment was updated in August 2016 based on new database searches, field verification, tree survey and assessment of the impacts of the revised proposal.

The updated report *Upgrade of M1 Pacific Motorway Intersection with John Renshaw Dr and Weakleys Dr Biodiversity assessment* (August 2016) was compiled in accordance with Roads and Maritime (2012) *Environmental Impact Assessment Practice Note: Biodiversity Assessment (EIA-N06)* and *Guidelines for Biodiversity Offsets* (2011). The assessment is summarised below and the report is contained in Appendix E.

6.1.1 Methodology

Proposal description

The following definitions are used in the Biodiversity Assessment to refer to locations for the assessment of the proposal:

- The proposal (shown in Figure 1-2) comprises of all areas that would be directly impacted by the works. This includes all areas subject to vegetation clearing and earthworks
- The study area shown in Figure 6-1 includes the proposal and areas that may be indirectly impacted by the proposed works
- The 'Vegetation Clearing Limit' refers to the boundary of the area assessed for clearing and is shown in Figure 6-1
- The 'search area' refers to a 10 kilometre area surrounding the proposal for the purpose of database searches.

Database searches and literature reviews

A desktop assessment included searches of databases and a review of literature relevant to the proposal, particularly:

- Office of Environment and Heritage (OEH) *Atlas of NSW Wildlife database* (licensed) for records of threatened species and endangered ecological communities which have been recorded within a 10 kilometre radius (locality) of the proposal (dated 11 April 2016)
- Department of the Environment (DoE) *Protected Matters Search Tool for Matters of National Environmental Significance* (MNES) listed under the EPBC Act within a 10 kilometre radius from the proposal (dated 11 April 2016)

- *Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy Technical Report and Updated Extant Map* (House, 2003)
- *Hunter, Central and Lower North Coast Vegetation Classification and Mapping Project - Vegetation Community Profiles* (Somerville, 2009)
- Previous reports of studies carried out within the study area.

Field survey

Field surveys were conducted on 27 February, 17 March, 2015 and 6 to 7 April 2016. The field survey targeted areas of the proposal that may be impacted and areas immediately next to the proposal.

A terrestrial flora survey was carried out across the proposal to identify and assess the vegetation present. Targeted searches for threatened flora species recorded in the local area were carried out as part of the survey.

Fauna surveys targeted species that may occur within the limited habitat available within the proposal. The availability of habitat was also assessed to evaluate the potential habitat for each of the threatened species considered and therefore the likelihood of occurrence of these species within the study area.

A further field survey including a tree survey was carried out on 6 and 7 April 2016. The tree survey identified all trees within the proposal that have a diameter at breast height (DBH) over 30 centimetres.

6.1.2 Existing environment

Vegetation communities

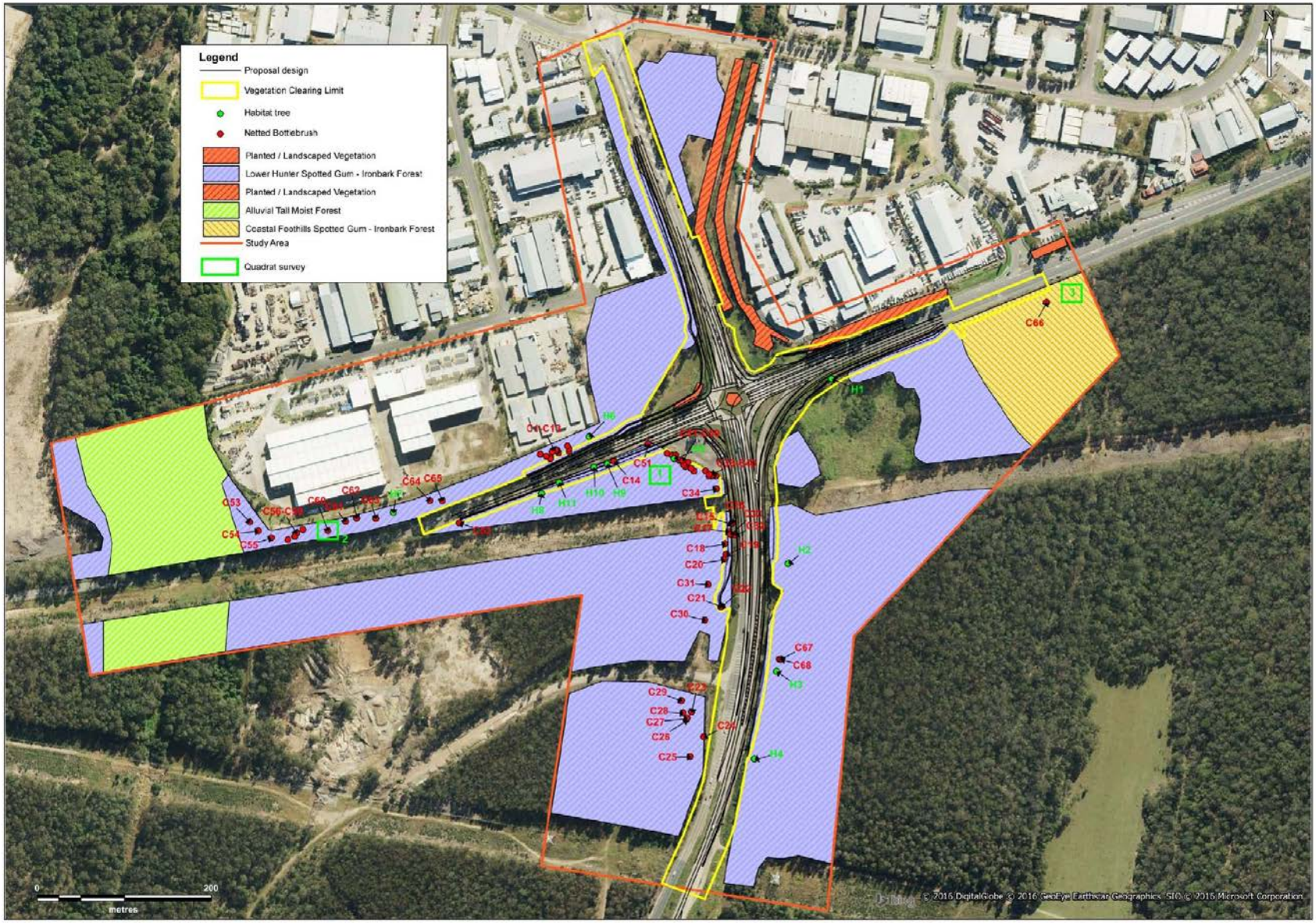
Local vegetation mapping (House, 2003) identifies three vegetation communities occurring in the vicinity of the study area. These included:

- MU15 – Coastal Foothills Spotted Gum – Ironbark Forest
- MU17 – Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion (LHSGIF) (ECC)
- MU5 – Alluvial Tall Moist Forest.

Field investigations confirmed that the majority of the native vegetation within the proposal is consistent with the endangered ecological community (EEC) Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion. This community is characterised by a dominance of *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark). The understory largely consists of native shrubs and grasses however edge effects including weed incursion and the dumping of waste was evident along the roadside. The vulnerable *Callistemon linearifolius* (Netted Bottlebrush) (TSC Act) was a relatively common component of the understorey.

Coastal Foothills Spotted Gum – Ironbark Forest also occurs in the study area along the hilly area in the east of the study area while Alluvial Tall Moist Forest occurs along Viney Creek in the west of the study area. Substantial weed growth particularly dense thickets of *Lantana camara* (Lantana) were associated with this latter community. Figure 6-1 shows the distribution of these vegetation communities within the study area.

Figure 6-1 Biodiversity



Threatened ecological communities

The Lower Hunter Spotted Gum Ironbark Forest assemblage recorded within the study area is consistent with the EEC Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion listed under the TSC Act.

About 2.2 hectares of this community has been identified within the proposal area as shown in Figure 1-2, however only 0.97 hectares of the EEC Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion would be cleared as shown by the vegetation clearing limit in Figure 6-1. An assessment of significance for this species was undertaken and is provided in Appendix E.

No other EECs were identified within the study area.

Threatened flora

Database searches identified 19 threatened flora species with the potential to occur within the locality of the proposal. A habitat assessment determining the likelihood of these species to be impacted by the proposed works is provided in Appendix E.

One threatened flora species, *Callistemon linearifolius* (Netted Bottle Brush), was identified within the proposal. A total of 121 specimens were recorded during targeted surveys of the study area and are shown on Figure 6-1. It is noted that this species often occurred with another similar species *Callistemon linearis* (Narrow-leaved Bottlebrush) and on occasion there appeared to be some overlap between leaf characteristics of the two species. As a precautionary measure, plants showing features common to both species were considered.

The proposed works have the potential to impact on 16 specimens recorded within the proposal and therefore an assessment of significance for this species was undertaken and is provided in Appendix E.

The habitat assessment also identified three threatened flora species, *Rutidosis heterogama* (Heath Wrinklewort), *Tetratheca juncea* (Black-eyed Susan) and *Melaleuca biconvexa* (Biconvex Paperbark) which were considered to have a moderate likelihood of occurring within the locality. However, given these species are absent from the study area and are unlikely to be impacted by the works, no further assessment is warranted.

Noxious and environmental weeds

Noxious weeds require appropriate control in order to comply with the NW Act (Section 4.2.6). The occurrence of noxious and environmental weeds was recorded during the field investigations.

Six Class 4 locally controlled noxious weeds were observed during the biodiversity assessment. These were *Ageratina adenophora* (Crofton Weed), *Asparagus aethiopicus* (Asparagus Fern), *Lantana camara* (Lantana), *Opuntia monacantha* (Smooth Tree Pear), *Rubus fruticosus* (Blackberry) and *Senecio madagascariensis* (Fireweed).

Ageratina adenophora (Crofton Weed) was the predominate weed observed within the study area occurring primarily within drainage areas, often forming dense clumps around the culverts. The remaining noxious weed species occurred sporadically throughout the roadside vegetation within the study area. In accordance with the NW Act, the growth of Class 4 weeds within the proposal should be managed in a manner that continuously inhibits the ability of the plant to spread.

Weeds recorded within the study area which are regionally prohibited in other parts of the state include *Ligustrum sinense* (Narrow-leaf Privet), *Ricinus communis* (Castor Oil Plant), *Ipomoea indica* (Morning Glory) and *Anredera cordifolia* (Madeira Vine). These species within the proposal should also be controlled accordingly to avoid further spread.

Other environmental weed species including *Bidens pilosa* (Cobbler's Pegs), *Sida rhombifolia* (Paddy's Lucerne), *Plantago lanceolata* (Ribwort) and a number of exotic grasses were also common along the roadsides throughout the study area.

Fauna

Fauna habitat recorded within the proposal is limited given the close proximity of the existing roads and considering much of the roadside vegetation has been subject to previous clearing and edge effects such as increased weed growth and rubbish dumping.

The roadside vegetation on the southern side of John Renshaw Drive is close to large tracts of native forest that extend to the south. Connectivity to the north of John Renshaw Drive is limited by industrial development although a link to extensive forest areas to the north is available along Viney Creek in the west of the study area.

Key habitat features of the proposal include:

- Hollow bearing trees occur sporadically throughout the study area and the proposed works may impact a small number of these trees. These may provide roosting and/or foraging and/or breeding habitat for a range of birds, mammals, reptiles and frogs.
- Roadside trees and shrubs may provide foraging habitat for a range of birds, mammals, reptiles and frogs. The trees within the proposal may also provide potential nesting sites for some birds
- Ground cover including areas of dense leaf litter and fallen logs may provide habitat and cover for a range of small terrestrial species.
- Viney Creek and the drainage line that extends along the east of the M1 Pacific Motorway and Weakleys Drive contain areas of dense emergent vegetation which may provide habitat for a range of common frogs, reptiles and wetland birds. These water features are somewhat degraded being subject to increased pollutant and sediment loads from road runoff with dense areas of weeds common within these waterways.
- The culverts within the study area provide potential nesting and roosting habitat for certain species of birds and microbats. No species were observed to be inhabiting or sheltering in the culverts during the proposal inspections although access was limited due to inundation and dense weed growth. Breeding habitat for microbats was unlikely to be present however culverts may provide temporary refuge/roosting habitat.

Habitat trees

Eleven habitat trees were recorded within the study area. Five of these trees, H1, and H8 to H11, would be cleared for the proposal and details of the trees are provided in Table 6-1 (trees to be cleared are in bold). The locations of the habitat trees are shown in Figure 6-1.

The habitat classification system employed in identifying habitat trees and their potential habitats available to different species refers to three classes of hollows:

- Class 1 – large sized hollow openings (ie greater than 15 centimetres) suitable for species such as Owls
- Class 2 – medium sized hollow-openings (ie 5 to 15 centimetres) suitable for species such as Gliders and Possums
- Class 3 – small sized hollow openings (ie less than 5 centimetres) suitable for species such as microchiropteran bats.

Table 6-1 Habitat trees

Tree No.	Species	DBH (cm)	
H1	**C. maculate**	**90**	**Three Class 3 hollows - suitable for bats only - Likely to be removed**
H2	E. acmenoides	60	Aboreal termite nest
H3	C. maculata	110	Very large tree with broken top. No hollows visible but possible Class 2 hollows within broken limb. Lace Monitor scratches on bole
H4	C. maculata	80	One Class 2 hollow
H5	C. maculata	40	One Class 2 hollow, many scratches on bole. Lace Monitor observed sunning itself at hollow entrance – Potentially impacted
H6	Stag	30	Cracks and crevices (Class 3) suitable for bats
H7	C. maculata	75	Hollow trunk with opening at base. Scratches on bole, likely Lace Monitor
H8	**C. maculata**	**100**	**Few Class 3 hollows suitable for bats – Likely to be removed**
H9	**C. maculata**	**150**	**Three Class 2 hollows and three Class 3 hollows. Scratches on bole - Likely to be removed**
H10	**C. maculata**	**60**	**Two Class 2 hollows**
H11	**E fibrosa**	**100**	**Multiple small hollows and fissures**

Note: Trees to be cleared are in **bold**

Threatened fauna

The database searches for the survey area identified 63 threatened fauna species with the potential to occur within the locality of the proposal. The habitat assessment identified 11 threatened fauna species with the potential to be impacted by the proposed works as follows:

- *Glossopsitta pusilla* Little Lorikeet
- *Neophema pulchella* Turquoise Parrot
- *Climacteris picumnus ssp. victoriae* Brown Treecreeper
- *Phascogale tapoatafa* Brush-tailed Phascogale
- *Petaurus norfolcensis* Squirrel Glider
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail bat
- *Mormopterus norfolkensis* East Coast Freetail-bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Miniopterus australis* Little Bentwing-bat
- *Myotis macropus* Southern Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat

The remaining 52 threatened species assessed were unlikely to occur within the proposal or the habitat available was not considered important for their survival and no further assessment is required.

SEPP 44 Koala habitat

A single *Eucalyptus tereticornis* (Forest Red Gum), a Koala feed tree, was recorded within the study area. The study area did not contain any other listed Koala feed trees and given the paucity

of known feed trees, the study area does not constitute 'core Koala habitat' or 'potential Koala habitat' as defined by SEPP 44.

EPBC Act draft referral guidelines

The proposal was assessed under the Draft EPBC Act referral guidelines for the vulnerable Koala (2013). It is considered that no important populations of Koala are likely to rely upon the habitat present within the study area and the proposal is unlikely to contain any areas of critical habitat for this species given the paucity of feed trees. With due consideration for the guidelines, the proposed works have a low risk of resulting in a significant impact and a referral is not required.

6.1.3 Potential impacts

Avoid and minimise impacts

The initial proposal design has been scaled back significantly in spatial extent from previous designs, primarily as a result of consideration of ecological impacts. Given the presence of the vulnerable Netted Bottlebrush and the Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC, the proposed footprint has been revised to minimise impacts to these features.

Previous designs involved the removal of more than two hectares of EEC vegetation, 59 Netted Bottlebrush specimens and up to 8 habitat trees. This proposal has now been revised and would impact up to 16 Netted Bottlebrush specimens, five habitat trees and 0.97 hectares of EEC vegetation. The proposal, now impacting less than one hectare of EEC, does not trigger the need for offsets to be considered according to the Roads and Maritime Biodiversity Offsets guideline.

Given the need for a minimum footprint area to achieve the desired road configuration, impacts on local biodiversity have been minimised as far as possible. There is no further scope to reduce the proposal footprint during the design phase of the proposal and the final design chosen achieves the minimum ecological impact possible.

Construction

Potential impacts to ecological values (flora, fauna and vegetation communities) as a result of the proposed works are detailed in Table 6-2. Figure 6-1 shows the areas of vegetation impacted by the proposed work.

Table 6-2 Potential construction impacts to ecological values

Impact	Comment
Loss of vegetation and habitat	The proposed works would result in the removal of up to 1.1 hectares of native vegetation. This includes: • 0.97 hectares of Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC • 0.08 hectares of Coastal Foothills Spotted Gum – Ironbark Forest • 0.09 hectares of Planted / Landscaped vegetation The removal of vegetation would impact up to 16 Netted Bottlebrush (vulnerable species) specimens and five habitat trees. The tree survey identified a total of 146 trees (minimum size of 30cm DBH) in the proposal clearing area.
Wildlife connectivity and habitat fragmentation	The removal of vegetation for the proposed works would add to the incremental fragmentation of vegetation within the locality. Consideration has been given as to the potential for Squirrel Gliders and other fauna to use the existing M1 Pacific Motorway as a link to habitat areas in the east and west of the study area. The existing gap between large trees (trees in excess of 30

Impact	Comment
	metres tall) on either side of the M1 Pacific Motorway is generally in excess of 50 metres and would not be suitable for regular glider movement (van der Ree et al., 2010). The heavy traffic along the M1 Pacific Motorway further degrades this option as a regular movement corridor, particularly for terrestrial species. The proposed widening of the M1 Pacific Motorway is unlikely to significantly impact local wildlife connectivity given the barrier the existing conditions create.
Weeds	The proposed construction activities would involve clearing and earthworks in areas subject to moderate levels of weed infestation. This would remove weeds in the short term. Weed removal and disposal would need to be managed to reduce the risk of infestation to areas outside of the proposal area ad management measures are discussed in Section 6.1.4.
Aquatic impacts	The proposed earthworks increase both the risk of erosion and sedimentation and also the risk of pollutants, such as fuels and oils, entering Viney Creek and the local drainage network. This could lead to increased sedimentation and/or pollution of downstream environments, particularly during periods of high or intense rainfall. This risk would be managed through the implementation of management measures discussed in Section 6.1.4.
Noise and light	The current noise and light levels at the intersection are high given the large volumes of traffic. Some of the proposed works would be performed during the night and this is likely to temporarily increase noise and light levels. Given the high noise and light levels already present, the potential impacts of increased noise and lighting on resident fauna is likely to be negligible.
Threatened Ecological Communities	The EEC Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion listed under the TSC Act occurs within the proposal and up to 0.97 hectares of this EEC would be directly impacted. EECs that have the potential to be impacted by the proposal have been assessed under the guidelines of Section 5A of the EP&A Act and this is provided in the form of an assessments of significance (seven-part test) which is provided in Appendix E. The assessment of significance for this EEC concluded the proposed works are unlikely to have a significant impact upon this community given the small area to be impacted and the abundance of this community in the search area. In accordance with the Roads and Maritime Offset Guideline, offsets would not need to be considered given the proposal requires the removal of less than one hectare of this EEC.
Threatened Flora Species	The threatened flora species, *Callistemon linearifolius* (Netted Bottle Brush), listed as vulnerable under the TSC Act, was identified within the proposal. A total of 121 specimens were recorded during targeted surveys and up to 16 specimens may be directly impacted by the works. Threatened species that have the potential to be impacted by the proposal have been assessed under the guidelines of Section 5A of the EP&A Act and this is provided in the form of an assessment of significance (seven-part test) which is provided in Appendix E. The assessment of significance for this species concluded the proposed works are unlikely to have a significant impact upon this flora species given the small number of plants to be impacted by the works.
Threatened Fauna	The habitat assessment identified the following eleven threatened fauna species with the potential to be impacted by the proposed works:

Impact	Comment
	• *Glossopsitta pusilla* Little Lorikeet • *Neophema pulchella* Turquoise Parrot • *Climacteris picumnus ssp. victoriae* Brown Treecreeper • *Phascogale tapoatafa* Brush-tailed Phascogale • *Petaurus norfolcensis* Squirrel Glider • *Saccolaimus flaviventris* Yellow-bellied Sheathtail bat • *Mormopterus norfolkensis* East Coast Freetail-bat • *Falsistrellus tasmaniensis* Eastern False Pipistrelle • *Miniopterus australis* Little Bentwing-bat • *Myotis macropus* Southern Myotis • *Scoteanax rueppellii* Greater Broad-nosed Bat The assessments of significance pursuant to the TSC Act for these species concluded that potential direct and indirect impacts to these species are unlikely to be significant given the small area of habitat to be impacted by the works and the abundance of habitat available in the local area.

Operation

Potential impacts to ecological values (flora, fauna and vegetation communities) as a result of the operation of the proposal are expected to be limited.

The current noise and light levels at the intersection are high given the large volumes of traffic experienced. Changes in noise and light levels as a result of the operation of the proposal, that may affect locally occurring fauna is not expected to be significant and the potential impacts of increased noise and lighting is likely to be negligible.

Additionally, change to the drainage design proposed as part of the proposal is minor. This is not expected to alter the existing hydraulic performance of the site and surrounds and subsequently there is unlikely to be a significant impact to the surrounding aquatic environment.

Conclusion on significance of impacts

The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required.

The proposal is not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*.

6.1.4 Safeguards and management measures

The safeguards and management measures for biodiversity impacts are listed in Table 6-3. Other safeguards and management measures that would address biodiversity impacts are identified in sections 6.4.3, 6.12.36.12.3 and 6.14.4.

Table 6-3 Safeguards and management measures for biodiversity issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
B01	General	A Flora and Fauna Management Plan would be prepared in accordance with Roads and Maritime's *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RTA, 2011) and implemented as part of the Construction Environmental Management Plan (CEMP). It would include, but not be limited to: • Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • Requirements set out in the *Landscape Guideline* (RTA, 2008) • Pre-clearing survey requirements • Procedures for unexpected threatened species finds and fauna handling • Procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013) • Protocols to manage weeds and pathogens.	Contractor	Detailed design / pre-construction	Standard safeguard Section 4.8 of QA G36 Environment Protection
B02	Reduce Vegetated Clearing Limits	Measures to further avoid and minimise the construction footprint and Vegetated Clearing Limits or hollow-bearing tree removal would be investigated during detailed design and implemented where practicable and feasible. The clearing of native vegetation must be minimised with the objective of reducing impacts to any threatened species, populations and ecological communities to the greatest extent practicable.	Contractor	Detailed design / pre-construction	Additional safeguard
B03	Pre-clearing process	This would be carried out in accordance with the requirements of the Roads and Maritime's Biodiversity Guidelines (RTA, 2011) - *Guide 1: Pre-clearing process*. Including: • Consult with an ecologist to determine the location of suitable nearby habitat for the release of fauna that may be encountered during the pre-clearing process or habitat removal. Mark the pre-determined	Contractor	Pre-construction/ construction	Standard safeguard

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		habitat identified for fauna release on a map. • Prior to clearing: a) Confirm the locations of biodiversity features including: ▪ Hollow-bearing trees ▪ Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC ▪ *Callistemon linearifolius* (Netted Bottle Brush) b) Identify fauna that have the potential to be disturbed as a result of clearing activities c) Ensure an ecologist checks for the presence of threatened flora and fauna species that were identified in the environmental assessment as likely to occur, including: ▪ *Rutidosis heterogama* (Heath Wrinklewort), ▪ *Tetratheca juncea* (Black-eyed Susan) ▪ *Melaleuca biconvexa* (Biconvex Paperbark) Undertake these checks during optimal conditions for the target species where possible. d) Record the details for all hollow-bearing trees, trees containing threatened fauna and threatened flora. e) Mark habitat features to be protected during construction f) Confirm the location of pre-determined habitat identified for the release of any fauna encountered on site g) Submit and updated maps/plans, habitat features and recommended clearing procedures to the project manager and/or environment manager (or equivalent) • Twenty-four hours before clearing: a) Licensed wildlife carers and/or ecologists should capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities b) Relocate fauna into pre-determined habitat identified for fauna release. c) All fauna handling should be carried out by licensed wildlife carers			

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		and/or ecologists and in accordance with Guide 9: fauna handling d) Inform clearing contractors of any changes to the sequence of clearing if required e) Carry out staged habitat removal as outlined in *Guide 4: Clearing of vegetation and removal of bushrock* where fauna habitat features have been identified and marked.			
B04	Exclusion Zones	Locations of the Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC, *Callistemon linearifolius* (Netted Bottle Brush) and hollow-bearing trees that are outside of the Vegetation Clearing Limit would be clearly marked and/or fenced to exclude access during construction. This would be carried out in accordance with the requirements of the Roads and Maritime's *Biodiversity Guidelines* (RTA, 2011) - *Guide 2: Exclusion Zones*; Including as a minimum: • Mark exclusion zones on a suitable plan • Select a suitable exclusion fence type • Allow enough lead time to establish exclusion zones before clearing • Mark out exclusion zones with temporary markings such as pegs or paint and where possible use a qualified surveyor • Place exclusion zone fencing outside tree protection zones • Erect signs to inform personnel of the purpose of exclusion zone fencing • Ensure all exclusion zones are regularly inspected and repairs to fencing are made where required • Communicate the importance of exclusion zones, and any changes to the zones, to all site staff and visitors (eg in toolbox talks and inductions) • Ensure that any breaches of the exclusion zone are reported through the Roads and Maritime environmental incident reporting procedure.	Contractor	Pre-construction/ construction	Standard safeguard
B05	Vegetation Clearing	Trees and vegetation would be removed in accordance with the Roads and Maritime's Biodiversity Guidelines - *Guide 4 – Clearing of Vegetation and Removal of Bushrock*. Vegetation clearing would include as a	Contractor	Pre-construction/ construction	Standard safeguard

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		minimum: • Develop a clearing and grubbing plan with reference to the Vegetation Clearing Limit (Figure 6-1) and Biodiversity Guidelines and communicate the requirements of the plan to site staff regularly • Document the selection of suitable work methods in a clearing and grubbing plan • Ensure clearing of vegetation and/or removal of bushrock does not go beyond the approved Vegetated Clearing Limits for the project • A staged habitat removal process is to be used when identified hollow-bearing trees, or bushrock is to be removed • Carefully clear vegetation so as not to mix topsoil with debris and to avoid impacts to surrounding native vegetation • Keep stockpiles of cleared vegetation under two metres high in accordance with the RTA's Stockpile Site Management Guideline • Non-woody vegetation (typically grasses and groundcover species) should be incorporated into the stripping of topsoil to retain any organic materials and nutrients within the topsoil layer.			
B06	Weed and Pathogen Management	Weed and Pathogen management would be done in accordance with the Roads and Maritime's Biodiversity Guidelines – Guide 6 and Guide 7. Including as a minimum: • Develop and implemented a weed management plan for the site • Separate weeds from native vegetation where native vegetation is to be used for mulch. Do not use weeds for mulch • All weed plant material and topsoil containing weed plant material should be disposed of to an appropriate waste management facility • Check the Department of Primary Industries (DPI) website (www.industry.nsw.gov.au) for the most up-to-date hygiene protocols for each pathogen and for the most recent locations of contamination.	Contractor	Pre-construction/ construction	Standard safeguard
B07	Nest boxes	Installation of nest boxes is to be undertaken in accordance with Roads and Maritime *Biodiversity Guidelines - Guide 8: Nest boxes.* Including as a minimum:	Contractor	Pre-construction/ construction	Standard safeguard

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		• Nest boxes are to replace the loss of hollows at a ratio of at least 1:1 (one nest boxes installed for each hollow removed) • Where nest boxes are required, an ecologist should be engaged to develop a nest box strategy • Consult with an ecologist to assist in the implementation of the nest box strategy including installation and monitoring of nest boxes • Nest boxes should be supplied for the following species, in line with Table 8.1 and Table 8.2 of Guide 8: a) Microbats b) Squirrel Gliders c) Yellow-bellied Gliders • The nest box lid should overhang the front and sides of the nest box by at least 25 millimetres to prevent water damage. For monitoring and maintenance purposes, consider using a hinged lid. Do not use metal lids or plates on the roof of the nest box lid • Paint the outside of the nest box with non-toxic, dark-coloured, outdoor, water-based acrylic paint. Avoid toxic substances. • To assist with drainage, drill three small holes in the base of the nest box • Non-toxic woodchips, wood shavings or sawdust could be placed into possum, glider and bird nest boxes to provide extra insulation in cold climates • An ecologist should be on site during the installation of nest boxes • The preferred method of attaching nest boxes to trees is the Habisure© system. Bolting nest boxes to trees is not recommended. • The density and quantity of each nest box type should reflect the proportion of tree hollow types being removed, the proportion of tree hollow types to be retained in adjacent habitat, the availability of adjacent food resources and the assemblage of hollow-dependant fauna known or likely to occur in the project locality • The location of nest boxes should be as close as possible to the			

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		original hollow-bearing tree, consider the type of bark preferred by the target species, be in close proximity to food or other resources, not be installed on trees with existing hollows or where there is a high density of Common Mynas (*Acridotheres tristis*) • Orientate nest boxes between north–west and east and so they are not facing lights from adjacent development • Install approximately 70 per cent of nest boxes up to one month before the start of any clearing. The remainder of nest boxes would be installed before completion of the project. • Record the nest box identification number, nest box type, GPS location, species and diameter at breast height of the host tree, nest box height and orientation • Undertake ongoing monitoring and maintenance of nest boxes in accordance with the nest box management strategy for the project.			
B08	Fauna Protection	Any fauna handling would be undertaken by an appropriately licenced ecologist in accordance with the Roads and Maritime's Biodiversity Guidelines - *Guide 9 – Fauna handling*. Including as a minimum: • If unexpected threatened fauna or flora species are discovered, stop works immediately and follow the Roads and Maritime *Unexpected Threatened Species Find Procedure* in the RTA Biodiversity Guidelines 2011 – Guide 1 (Pre-clearing process) • Allow fauna to leave an area without intervention as much as possible • Contact an animal rescue agency/wildlife care group or vet before works start to ensure they are willing and available to be involved in fauna rescue and assist with injured animals • Never deliberately kill a snake as all snakes are protected under the National Parks and Wildlife Act 1974 (NSW). If a snake must be handled to remove the risk of harm to the snake or people then handling should only be done by a licensed fauna ecologist or wildlife carer with skills and experience in snake handling • Follow the Hygiene Protocol for the control of disease in frogs	Contractor	Pre-construction/ construction	Standard safeguard

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		(Wellington and Haering 2008) for all frog handling • If handling bats, the handler must be vaccinated against the Australian Bat Lyssavirus (ABL) which is a form of rabies • Release fauna into pre-determined habitat identified for fauna release • Keep records of fauna captured and relocated.			
B09	Revegetation works	Revegetation of areas disturbed by the proposed works would be undertaken in accordance with Roads and Maritime Landscape Plantings QA Specification R179 and the Roads and Maritime Biodiversity Guidelines - *Guide 3: Re-establishment of native vegetation*. Including as a minimum: • Locally indigenous species would be included as part of landscaping and rehabilitation works to promote native fauna habitat. Species identified on site that are suitable for revegetation works are detailed in Appendix F. • Collect local native topsoil and leaf litter and store for use in revegetation works • Soils in areas to be revegetated should match surrounding soil conditions as closely as possible unless adjacent areas are weedy or contaminated • Consider appropriate shade and drainage conditions when planting. Provide mulching around plants for dry or potentially weedy sites to help retain moisture and suppress weeds.	Contractor	Pre-construction/ construction	Standard safeguard

6.2 Traffic and transport

6.2.1 Overview

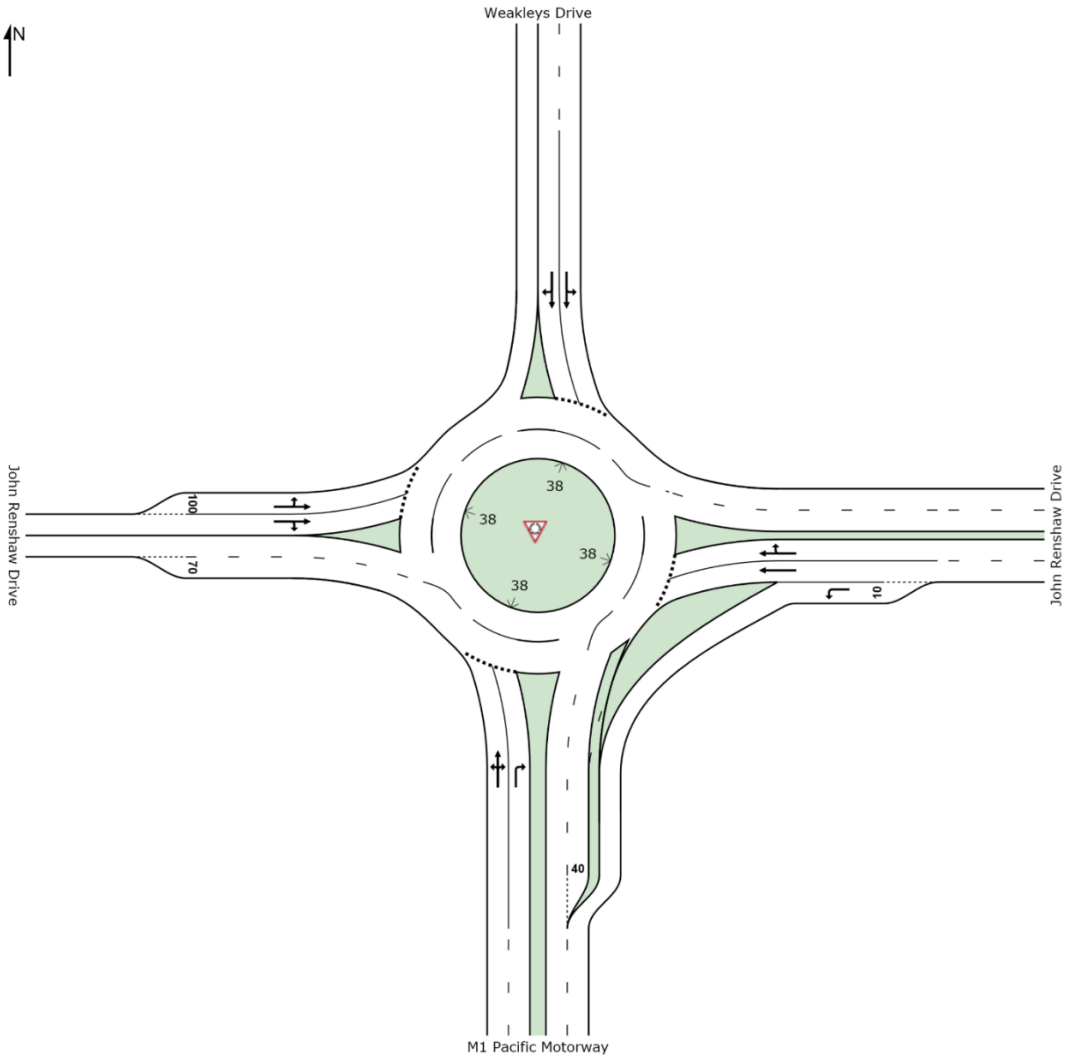
The information in this section is drawn from the results of traffic studies carried out for the proposal including:

- *John Renshaw Drive / Weakleys Drive Intersection Modelling – Technical note,* Jacobs (April 2016)
- *M1 Pacific Motorway intersection upgrade at Weakleys Drive and John Renshaw Drive Traffic and Transportation Assessment Report – 80% Concept Design issue,* Aurecon (June 2016)

6.2.2 Existing environment

A description of the existing traffic environment including intersection layout, signposted speed, existing capacity issues and private accesses within the proposal area is contained in Section 2.1. Figure 6-2 shows the existing lane configuration of the intersection.

Figure 6-2 Existing roundabout intersection layout



Existing traffic volumes

Roads and Maritime carried out a traffic survey at the proposal in October 2014 after the opening of the Hunter Expressway. Figure 6-3 shows existing 2014 morning and evening peak one hour turning volumes. The survey recorded 3141 vehicles per hour travelling through the intersection during the morning peak and 3367 vehicles per hour during the afternoon peak.

The major traffic movements recorded during the morning peak were as follows:

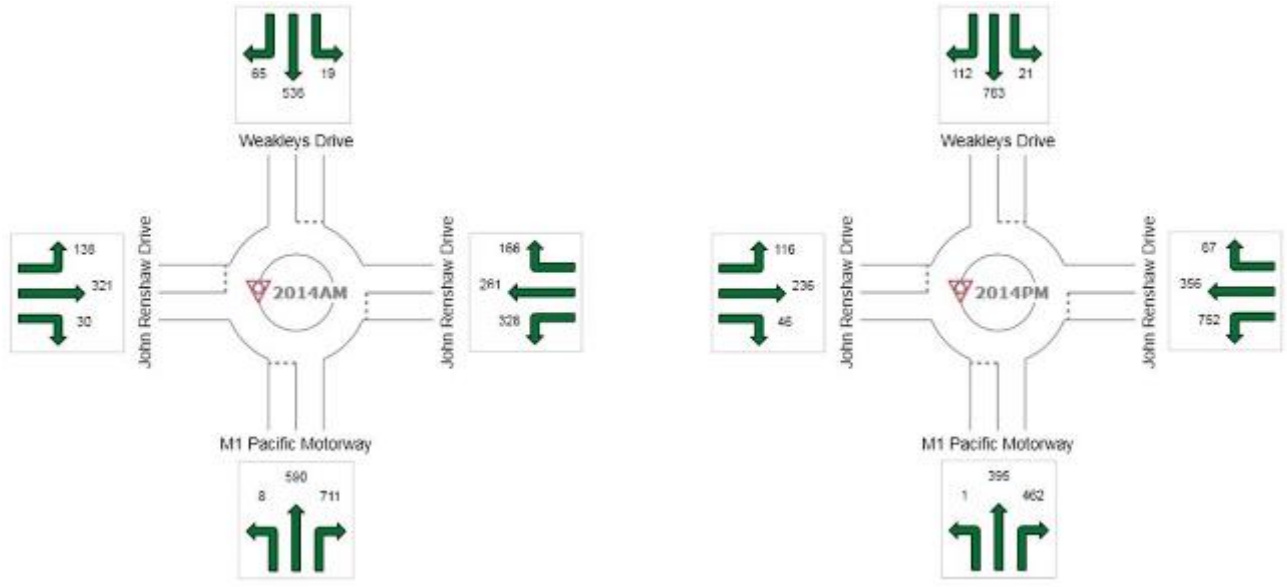
- About 711 vehicles per hour turned right off the M1 Pacific Motorway into John Renshaw Drive eastbound (the northbound connection between the M1 Pacific Motorway and Pacific Highway)
- About 590 vehicles per hour travelled through the roundabout from the M1 Pacific Motorway to Weakleys Drive
- About 536 vehicles per hour travelled through the roundabout from Weakleys Drive to the M1 Pacific Motorway southbound.

The major traffic movements recorded during the afternoon peak were as follows:

- About 783 vehicles per hour travelled through the roundabout from Weakleys Drive to the M1 Pacific Motorway southbound
- About 752 vehicles per hour turned left onto the M1 Pacific Motorway southbound from John Renshaw Drive (the southbound connection between the Pacific Highway and M1 Pacific Motorway)
- About 462 vehicles per hour turned right off the M1 Pacific Motorway into John Renshaw Drive eastbound.

Due to the intersection's location within the Brisbane to Sydney corridor, it has high heavy vehicle usage in the order of 10 to15 per cent (Aurecon June 2016).

Figure 6-3 Roads and Maritime October 2014 intersection peak turning counts (vehicles per hour)



Future traffic volumes

Prediction of future traffic volumes for the intersection were based on existing travel volumes and use of a variable growth referred to as 'Land use scenario 3'. This growth rate is based on a number of factors and considers local and external growth in traffic volumes separately. The predicted traffic volumes for the morning and evening peaks in 2019 and 2029 are shown in Table 6-4.

Table 6-4 Predicted 2019 and 2029 traffic volumes

Year	Vehicles per hour morning peak	Vehicles per hour evening peak
2019	3901	4292
2029	5138	5572

Current and predicted level of service of the existing roundabout

The level of service (LoS) is the standard measure used to assess the operational performance of the road network and intersections. There are six levels of service ranging from LoS A to LoS F. LoS A represents the best performance and LoS F the worst. A LoS D or better is considered to be an acceptable LoS.

The existing roundabout has a LoS of D during the morning peak period and a LoS of E during the evening peak period. The predicted LoS and delay per vehicles in seconds of the existing intersection layout into the future are summarised in Table 6-5.

Table 6-5 Predicted future LoS and delay of existing intersection layout

Year	AM peak		PM peak	
	Average delay (seconds)	LoS	Average delay (seconds)	LoS
2016	52	D	57	E
2019	185	F	88	F
2029	219	F	215	F

Crash history

The existing roundabout has a history of intersection related crashes. Roads and Maritime crash data identified 56 crashes within a 120 metre radius of the intersection between July 2010 and December 2015. Of the 56 identified crashes, 45 were in or within 10 metres of the roundabout. Table 6-6 provides a summary of crash history and contributing factors for the intersection.

As shown in the table, there are comparably high numbers of intersection related, rear end and parallel lanes turning crashes recorded at the intersection. This may be due to uncontrolled vehicle movements through the roundabout and queuing on intersection approaches.

Table 6-6 Crash history July 2010 to December 2015

Crash history	Number of recorded crashes
Total crashes	56
Fatal crashes	1
Crashes resulting in injuries	21 (35 per cent)
Crashes in or within 10 metres of the intersection	45 (80 per cent)
Rear end crashes	12 (21 per cent)

Crash history	Number of recorded crashes
Crashes where parallel lanes were turning	11 (19.6 per cent)
Crashes during lane change	4 (7 per cent)
Multi vehicle collision	44 (78.6 per cent)
Heavy vehicle crash	22 (39 per cent)
Speed a contributing factor	5 (8.9 per cent)
Fatigue a contributing factor	2 (3.6 per cent)
Crashes recorded at the entry of the informal car park off the M1 Pacific Motorway northbound	1 (rear end crash)
Crashes recorded at the exit of the informal car park on John Renshaw Drive west	2 (emerging from informal car park)

Public transport

Public Bus route 160 between Cessnock and Newcastle travels along John Renshaw Drive through the proposal area. The bus route is a school bus service with one morning Newcastle bound service and one afternoon westbound service. The service does not stop along John Renshaw Drive unless prior arrangements have been made with Rover Coaches, the service operator. The TfNSW designated bus stops associated with this service are located about 170 metres east of the intersection before Kinta Drive eastbound and opposite the BP service centre westbound. These stops are not signposted and are not used by the school bus service.

Existing provisions for cycling and pedestrians

There are limited provisions for cyclists or pedestrians within the proposal area. While there is an identified demand for cycling provisions for commuting and recreational purposes there is currently no identified demand for pedestrian facilities.

Informal car park area and Driver Reviver site

A cleared, paved area on Roads and Maritime land is located in the south–western corner of the intersection. This area was a former construction area for the M1 Pacific Motorway and is now used as a Driver Reviver site and informal car park.

The Driver Reviver site operates during peak holiday periods and is mostly used by northbound holiday motorists from Sydney. Vehicles predominately access the site off the M1 Pacific Motorway northbound and exit right onto John Renshaw Drive. Southbound vehicles access the site from John Renshaw Drive.

There are safety concerns associated with the entry and exit from the informal car park area. This includes the risk of rear end accidents from braking vehicles entering the site from the M1 Pacific Motorway and John Renshaw Drive. The right hand turn from the site onto John Renshaw Drive eastbound is another safety concern. This right hand turn is required for vehicles exiting and traveling northbound, eastbound or southbound of the intersection. This is particularly evident when holiday northbound traffic conflicts with peak hour traffic travelling along John Renshaw Drive such as Friday afternoons before a long weekend.

Existing over size, over mass dimension heavy vehicle stop bay

There is an existing over size, over mass dimension (OSOM) heavy vehicle stop bay on the M1 Pacific Motorway southbound. This stop bay was constructed specifically to cater for OSOM vehicles to meet curfew restrictions in place at Maitland and Sydney. Since the opening of the Hunter Expressway the site is no longer required by OSOM vehicles, however the site is used as a truck parking bay for short stops.

This stop bay is specifically for OSOM vehicles. Heavy vehicle stop bays are catered for in the Roads and Traffic Authority 2010, *RTA strategy for major heavy vehicle rest areas on key rural freight routes in NSW*. A Roads and Maritime endorsed heavy vehicle rest area is located at the BP service centre on John Renshaw Drive Beresfield. This can be accessed northbound from John Renshaw Drive and southbound from the New England Highway and Weakleys Drive approach.

This existing OSOM stop bay has identified safety concerns associated with the potential crash risk between accelerating and merging vehicles on the M1 Pacific Motorway slip lane and decelerating heavy vehicles in the truck parking bay. The stop would be closed to provide a safer road environment for light and heavy vehicles.

A survey of the current usage of the facility was carried out over two days:

- Day one was measured from 2.30pm on 27 June 2016 to 2.30pm on 28 June 2016
- Day two was measured from 2.30pm on 30 June 2016 to 2.30pm on the 1 July 2016.

The survey results showed 37 heavy vehicles observed using the facility on day one and 46 heavy vehicles and two light vehicles using the facility on day two. Generally, the facility had higher patronage at night and in the early hours compared to day time hours.

6.2.3 Potential impacts

Construction

Traffic flow

As outlined in Section 3.3, due to the critical role the proposal plays in the national, regional and local road network, the full capacity of the intersection and a speed limit of 60 km/h would be maintained leading up to and during peak time hours (4.30am to 9.30am and 2.30pm to 7pm). Lane/shoulder closures would only occur between the hours of 7.30pm to 4.30am and 9.30am and 2.30pm with a reduced speed limit of 40km/h. Lane closures on the M1 Pacific Motorway would only occur during night work. Full capacity and a speed limit of 60km/h would be maintained during peak holiday periods as detailed in Section 3.3.2.

Offline works would potentially be carried out behind safety barriers 24 hours a day, 7 days a week including holiday periods with all offline works being conducted behind safety barriers. Such construction methodology and hours would greatly mitigate the potential impact on road users during construction activities, nevertheless minor short term traffic and amenity impacts are anticipated.

Heavy and oversized vehicle access through the proposal area would be maintained throughout construction.

Generation of heavy and light vehicle movements

As noted in Section 3.3 construction of the proposal would generate heavy vehicle movements associated with the delivery of construction machinery and materials. Construction would also generate light vehicle movements to transport construction personnel.

Construction vehicles would access the site via arterial roads. Short-term manual traffic control may be required to manage heavy vehicle access to construction areas and construction laydown areas. This may result minor traffic delays for motorists, however these delays would be localised and of short duration.

The expected construction movements are minor compared to the existing heavy and light vehicle traffic volumes traveling along the M1 Pacific Motorway, John Renshaw Drive and Weakleys Drive and are not expected to result in any impacts to the traffic and transport environment of the local area.

Property access

The Beresfield industrial estate to the north of John Renshaw Drive is accessed via Yangan Drive and Enterprise Drive off Weakleys Drive, and Kinta Drive off John Renshaw Drive (east). These roads are outside of the proposal area and as such minimal impact on access to businesses located in the industrial estate is expected as a result of the proposal.

Access to the former Boral asphalt facility would be impacted by the works with the existing provision for right turn movements into and out of the property from the M1 Pacific Motorway being removed during construction. Left turn in and out access would also be impacted during road widening and installation of proposed table drainage on the M1 Pacific Motorway northbound. While this property is currently unused, as discussed in Section 6.14, the Department of Planning has approved a concept plan for the Black Hill industrial estate. If development of the Black Hill industrial estate has commenced prior to construction, access arrangements to this property would be determined by the construction contractor and detailed in the Construction Traffic and access management plan.

Existing access to the Hunter Water easement off the M1 Pacific Motorway southbound would be closed during construction. This closure would be permanent as Hunter Water has advised they have alternative safer access points to this easement.

Cyclists and pedestrians

Temporary cyclist routes would be provided during construction. During peak construction and high risk activities provision for cyclists may not be achievable. This is to reduce the risk posed to cyclists. Where possible, such activities would be programmed to occur during online works overnight.

There would be no provisions for pedestrians during construction. This is considered appropriate as there is currently no identified demand for pedestrians within the proposal area.

Public transport

There would be minimal impacts to the identified school bus service (Bus 160) which travels through the proposal area and a detour of this service would not be required. Potential impacts on this service would be mitigated through the implementation of the mitigation measures provided in Section 6.2.4.

Oversized loads and peak holiday flows

Construction of the proposal has the potential to impact on the movement of oversized loads and of peak holiday flows through the intersection. Potential impacts would be mitigated through the implementation of the mitigation measures provided in Section 6.2.4.

Impacts associated with the closure of the OMOD heavy vehicle stop and the Beresfield Drive Reviver are considered under the ‘Operation’ heading below.

Operation

Future intersection performance

The proposal aims to ease traffic congestion and improve travel times by providing additional traffic lanes and more capacity at the intersection. Traffic lights would ease congestion at peak periods and improve flows through the intersection by distributing traffic more evenly. Traffic management measures including traffic lights, dedicated turning lanes and advance road signs would improve safety and travel times.

Modelling of predicted traffic volumes for 2019 and 2029 shows the proposal would provide improvements to travel times through the intersection and surrounding network compared to the existing roundabout. The LoS in 2019 with the proposed traffic light controlled intersection rises to a LoS D compared to a LoS F if the intersection was to remain a roundabout (refer Table 6-7).

Table 6-7 Modelled intersection LoS in 2016, 2019 and 2029

	Existing roundabout layout				Traffic light proposal layout			
Year	AM peak		PM peak		AM peak		PM peak	
	Average delay (seconds)	LoS	Average delay (seconds)	LoS	Average delay (seconds)	LoS	Average delay (seconds)	LoS
2016	52	D	57	E	-	-	-	-
2019	185	F	88	F	44	D	38	C
2029	219	F	215	F	156	F	103	F

Public transport

The existing 160 bus service from Cessnock to Newcastle is a school bus service and therefore generally does not stop along John Renshaw Drive Beresfield unless prior arrangements have been made with the service operator. The proposal would not provide bus stops on John Renshaw Drive due to safety concerns associated with the proximity of the intersection. Provision of a westbound stop has been discounted due to safety issues associated with pedestrians crossing John Renshaw Drive. An eastbound stop has been discounted due to the clash between vehicles accelerating from the intersection and vehicle slowing down to access the service centre. There is a designated bus stop and shelter within the service centre which could be used in the event future bus routes service the Beresfield industrial estates.

Cyclists and pedestrians

Operation of the proposal would improve safety for cyclists through the provision of on road cycle lanes/shoulders on all approaches to the intersection, including the slip lane onto the M1 Pacific Motorway southbound. Road cycle crossings points would also be provided.

There is currently no identified demand for pedestrian crossings. The intersection design allows for the pedestrian crossings on the northern and western approaches (Weakleys Drive and John Renshaw Drive west) if required in the future. There is no provision for pedestrian crossings on the southern and eastern approaches due to safety concerns associated with the John Renshaw left slip lane to the M1 Pacific Motorway combined with no future demand on these approaches.

Closure of the informal car park area and Driver Reviver site

The removal of the existing informal car parking area and is necessary to accommodate the required road widening for the upgrade. Removal of the car park area would eliminate existing safety issues associated with site entry and the right hand turn out of the site, particularly between holiday and morning and evening peak traffic. The closure meets the proposal's objective of improving overall safety for road users. Socio-economic impacts of the closure are considered in Section 6.6.2.

Any new Driver Reviver site or rest area along the M1 Pacific Motorway would need to be assessed as a separate proposal and within the context of a M1 Pacific Motorway corridor strategy.

Safe road environments for on street commuter parking exist within the Beresfield industrial estate.

Removal of OSOM vehicle stop bay

The removal of the OSOM stop bay is required to upgrade and improve the safety of the existing slip lane from John Renshaw Drive (westbound) to the M1 Pacific Motorway (southbound). Removal of the OSOM stop bay would remove safety risks associated between accelerating and merging vehicles on the slip lane with decelerating OSOM and heavy vehicles using the stop bay.

The removal of the OSOM stop bay would not impact on OSOM vehicles. The stop bay has not been required for its intended purpose since the opening of the Hunter Expressway (HEX). The OSOM curfew restrictions that the stop was provided for are no longer applicable.

The removal of the stop bay would not impact heavy vehicles' ability to stop. Roads and Maritime designated heavy vehicle stop areas identified in the *RTA strategy for major heavy vehicle rest areas on key rural freight routes in NSW* include:

- Beresfield BP service centre accessible by northbound vehicles off John Renshaw Drive and southbound vehicle via the New England Highway and Weakleys Drive
- Twelve Mile rest area, Twelve Mile, on the Pacific Highway accessible to southbound vehicles
- Wyong Service Centre on the M1 Pacific Motorway.

The removal of the OSOM stop bay may increase the use of other areas in the immediate area, including the area on John Renshaw Drive (opposite the Beresfield Service Centre) which is used as an informal truck stop.

Mitigation measures to manage the closure of the OSOM stop bay are provided in Section 6.2.4.

6.2.4 Safeguards and management measures

The safeguards and management measures for traffic impacts are listed in Table 6-8

Table 6-8 Safeguards and management measures for traffic and access issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
TT01	Traffic and transport	A Traffic Management Plan (TMP) would be prepared and implemented as part of the CEMP. The TMP would be prepared in accordance with the Roads and Maritime *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Roads and Maritime, 2008). The TMP would include: • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain cyclist access where safe and practicable to do so • Requirements and methods to consult and inform the local community of impacts on the local road network • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms.	Contractor	Pre-construction	Core standard safeguard TT1 Section 2.3 of QA G10 Control of Traffic
TT02	Impacts of oversized loads	Roads and Maritime to liaise with industry and Roads and Maritime permits section, on determining an agreement on the management of oversize loads through the site during construction.	Roads and Maritime	Pre-construction/ Construction	Additional safeguard
TT03	Peak holiday traffic	The TMP would detail provisions to manage peak holiday traffic. This would include no online works to be carried out at this time to maintain the full capacity of the intersection.	Construction contractor	Pre-construction/ construction	Additional safeguard
TT04	Impact on	Rovers Coaches would be kept informed of construction activities	Construction	Pre-	Additional

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	existing bus route on John Renshaw Drive eastbound	affecting bus route 160.	contractor	construction/ construction	safeguard
TT05	Removal of Driver Reviver site	Roads and Maritime to provide appropriate signage and information on the Roads and Maritime and Driver Reviver websites notifying road users of the closure of the Beresfield site and provide information of alternative rest areas, service facilities and Driver Revivers at Ourimbah and Twelve Mile Creek.	Roads and Maritime	Pre-construction, construction and operation	Additional safeguard
TT06	Removal of M1 Pacific Motorway southbound OSOM vehicle stop bay	Roads and Maritime to provide appropriate signage and information on the Roads and Maritime website notifying heavy vehicle operators of the closure of the stop bay and provide signage to direct heavy vehicle operators to other appropriate facilities. Other truck parking bays which are proposed to be formalised to offset the closure of the existing truck parking bays includes the southbound truck parking bay at Heatherbrae south of Hank Street, and the westbound truck parking bay on Industrial Drive west of Steel River Boulevard in Mayfield. To minimise the risk of additional heavy vehicle operators crossing the highway from the truck parking bay on John Renshaw Drive westbound (opposite the Beresfield Service Centre), pedestrian exclusion fencing is recommended.	Roads and Maritime	Pre-construction, construction and operation	Additional safeguard

6.3 Noise and vibration

This section summarises the findings of the *Acoustic Assessment Report August 2016* prepared by Aurecon which is attached in Appendix F.

6.3.1 Methodology

The study area for the proposal has been determined in line with Roads and Maritime *Noise Criteria Guideline*, 2015 (NCG). For the purposes of the construction noise assessment, the study area extends 600 metres from the proposal area (as shown in Appendix F).

Within this proposal, provision has been made for equipment laydown, stockpile and plant parking areas that would be located in the north–western, south–western and south–eastern corners of the intersection. These equipment laydown areas may also operate as satellite construction compounds to a main compound. A construction compound outside of these areas is not included in this assessment.

Noise measurements and assessments have been undertaken in accordance with the following documents:

- Office of Environment and Heritage (OEH) (formally DECCW and EPA) documents:
  - *Interim Construction Noise Guideline*, 2009 (ICNG)
  - *NSW Road Noise Policy*, 2011 (RNP)
  - *Industrial Noise Policy*, 2000 (INP)
  - *Environmental Criteria for Road Traffic Noise*, 1999 (ECRTN)
  - *Assessing Vibration: A Technical Guideline*, 2006
- Roads and Maritime documents:
  - *Noise Criteria Guideline*, 2015 (NCG)
  - *Noise Mitigation Guidelines*, 2015 (NMG)
  - *Environmental Noise Management Manual*, 2001 (ENMM)
  - *Procedure – Preparing an operational Traffic and Construction Noise and Vibration Assessment report*, 2014
- Transport for NSW, Construction Noise Strategy, 2013 (CNS)
- WHO GCN 1999. World Health Organization, Guideline for Community Noise, 1999 (GCN)
- Australian Standards:
  - AS 1055.1-1997, *Acoustics - Description and measurement of environmental noise - General procedures*, 1997
  - AS 2436-2010, *Guide to noise and vibration control on construction, demolition and maintenance sites*, 2010
- BS6472:1992, British Standard, *Guide to evaluation of human exposure to vibration in buildings (1 Hz to 80Hz)*, 1992
- DIN4150-3 (1999-02). German Standard, *Structural Vibration Part 3 – 'Effects of vibration on structures*, 1999
- Hyder – *M1 Pacific Motorway Intersection Upgrade at Weakleys Drive & John Renshaw Drive* Traffic Modelling on Strategic Concept Design, Prepared for Roads and Maritime, May 2015.

Construction noise

The quantitative assessment method described in the ICNG has been followed to assess construction noise impact.

Construction noise criteria (Management Level) for sensitive receivers has been developed based on the ICNG stipulated criteria for non-residential receivers.

Construction noise impact has considered construction timing, operating hours of sensitive receivers, method of construction to be used, relative distances of construction work from noise sensitive receivers, construction management level (noise goal), and barrier effects due to intervening industrial buildings and terrain.

Operational noise

The proposal is classified as minor works in the NCG as the installation of traffic control devices does not increase the traffic growth within the locality. The minor works criteria applies the existing road criteria where the minor works increase noise levels by more than 2 dBA relative to the existing noise levels at the worst affected receiver.

The RNP and NCG outlines that traffic noise monitoring should be carried out at a distance of 600 metres from the centre line of the outermost traffic lane on each side of the subject roads for the proposal. The NCG states that for minor works the 600 metre noise catchment may not be required and as the nearest residential property to the proposal is about 1200 metres away. Traffic noise monitoring and an operational noise model is not required to assess operational noise for residential properties.

There are several noise sensitive receivers within the study area (see Table 6-9). Noise monitoring was carried out at their locations to determine the potential noise impact expected from the proposal compared with the criteria referenced from the NCG.

6.3.2 Existing environment

Based on the analysis of aerial imagery and confirmed by site inspection, the study area is predominantly commercial/ industrial premises to the north and north–west of the roundabout and undeveloped vegetation to the south. The closest residential property is about 1200 metres to the south–east/ east of the proposal.

Based on the definition in the RNP there are five noise sensitive receivers within the study area. These are listed in Table 6-9 and shown on Figure 6-4.

Operating hours of sensitive noise receivers is an important factor and has been taken into account in the assessment. These sensitive noise receivers are generally non-operational at night (10pm – 7am).

Noise sensitive receivers R3, R4 and R5 are a mix of commercial and light industrial properties. For this assessment a worst case has been adopted by using the commercial criteria.

Table 6-9 Noise sensitive receivers

Receiver ID	Receiver type	Address	Minimum distance between proposal and receiver (metres)
R1	Christian City Church Place of Worship	1/1 Pippita Close, Beresfield NSW 2322	215
R2	Christian Outreach Centre Place of worship	14 Enterprise Drive, Beresfield, NSW 2322	175
R3	Business Centre Hunter Commercial / Light industrial centre (Including Home construction company, tractor, truck and car repair and sales businesses.),	9/21 Babilla Close, Beresfield NSW 2322	45
R4	Commercial / Light industrial centre (Including truck, bus and material moving repair and sales companies)	Toyota Material Handling, 7 Kullara Close Beresfield, NSW 2322	40
R5	Group of Commercial / Light industrial (Including hire company, records storage and construction machine repair and manufacturer)	Coates Hire, 15 Kullara Close, Beresfield, NSW 2322 Ministor Beresfield, 30 Kullara Close Beresfield, NSW 2322	20

Noise monitoring

Noise monitoring was conducted on 21 April 2016 between 10am and 3pm to gain an understanding of the existing daytime traffic noise and background noise. The locations are shown on Figure 6-4.

Three unattended (about 2 to3 hours) noise monitoring tests were located at:

- UA-1: Inside the R1 located at 1/1 Pippita Close (worship area). Two tests were done at this location
- UA-2: Eastern end of Kullara Close
- UA-3: South–western end of 17 Babilla Close

Five attended 15 minute noise monitoring tests were located at:

- A-1: Outside R1
- A-2: South–western end of 17 Babilla Close
- A-3: South–western end of Kinta Drive
- A-4: BP Service Station - South–eastern end of Kinta Drive
- A-5: Eastern end of Kullara Close on the edge of John Renshaw Drive.

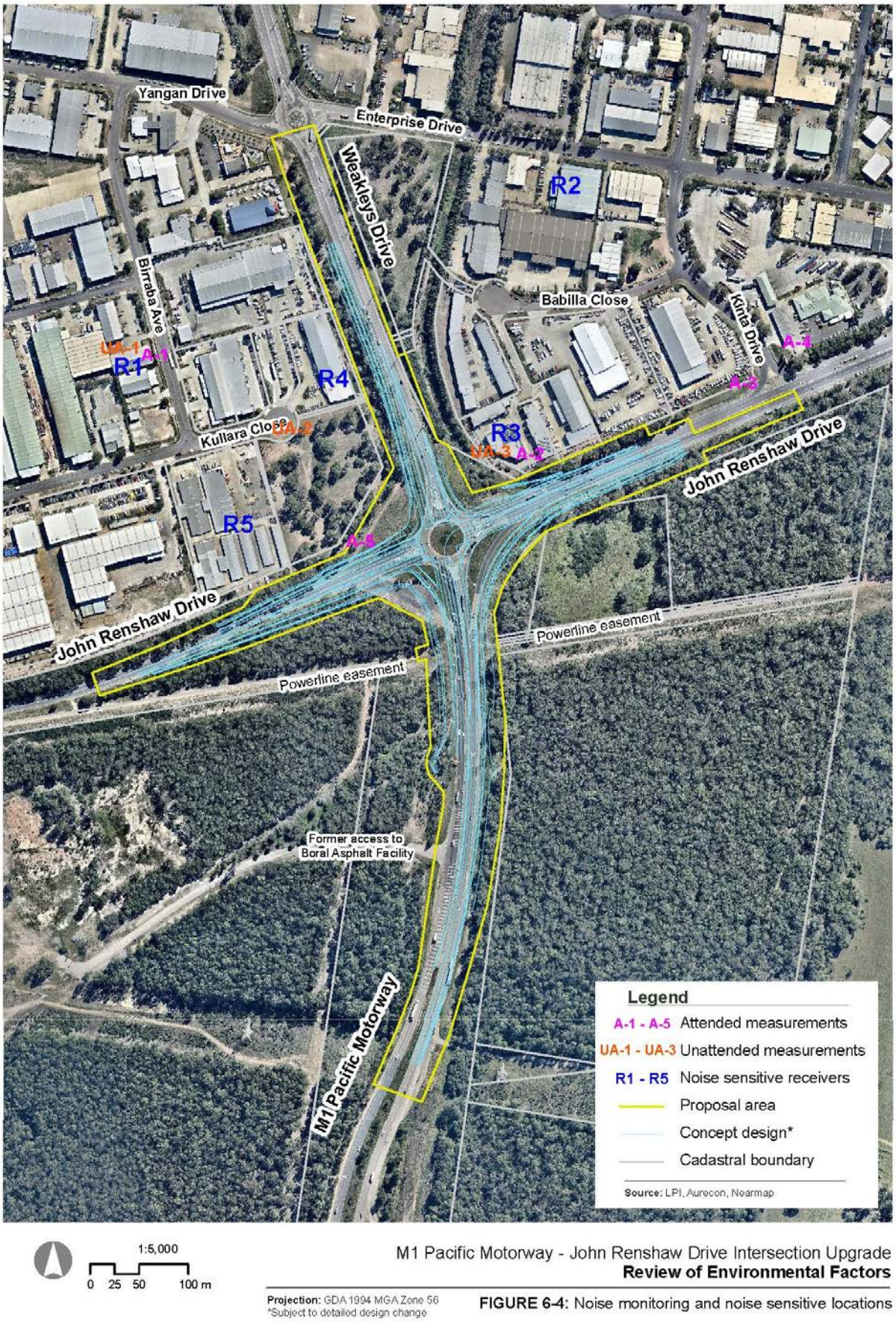
Noise measurements and assessments have been carried out in accordance with the ENMM, INP, ICNG and Australian Standard 1055.1-1997. During measurements at A-2, A-3 and A-4 simultaneous manual traffic counts were done.

The results of the noise monitoring are shown in Table 6-10. Background noise at each of the measurement locations were influenced predominantly by road traffic on Weakleys Drive and M1 Pacific Motorway comprising of heavy and light vehicles.

Table 6-10 Results of noise monitoring

Location	Time	Period	Measured sound Pressure Level, dB(A)					Traffic count
			$L_{Aeq, 15min}$	$L_{A10, 15min}$	$L_{A90, 15min}$	$L_{Amax, 15min}$	$L_{Amin, 15min}$	
UA-1 – Inside (*5 min test)	10.30am	Day	31*	33*	27*	46*	25*	n/a
UA-1 – Inside	10.25am	Day	42	35	27	73	24	n/a
UA-2	10.46am	Day	58	60	53	72	50	n/a
UA-3	11.15am	Day	71	74	64	87	54.3	336 Vehicles (55 Heavy)
A-1 - Outside	10.37am	Day	60	63	46	80	43	Traffic on Kullara Close
A-2	11.13am	Day	71	75	64	86	58	336 Vehicles (55 Heavy)
A-4 Services Station	11.33am	Day	70	72	62	81	55	348 Vehicles (54 Heavy)
A-3 Kinta Drive	11.50am	Day	75	79	66	91	56	377 Veh (57 Heavy)
A-5	This site was unsafe to access and no measurements were taken.							

Figure 6-4 Noise monitoring and noise sensitive receiver locations



6.3.3 Criteria

Construction noise criteria

This construction noise assessment has been prepared to understand the potential impacts arising from the construction of the proposal and to identify and recommend mitigation measures.

The quantitative assessment method described in ICNG has been followed to assess construction noise impact. Construction noise criteria (Noise Management Level) for sensitive receivers was developed based on the ICNG stipulated criteria for non-residential receivers.

Construction noise impact would consider construction timing, operating hours of sensitive receivers, method of construction to be used, construction vehicles, relative distances of construction work from noise sensitive receivers, construction management level (noise goal), and barrier effects due to intervening industrial buildings and terrain.

Noise management levels to be applied at the boundary of non-residential properties surrounding the site as required by the ICNG are summarised in Table 6-11.

Table 6-11 Non- residential construction noise management levels

Land use	Management level $L_{Aeq\ (15min)}$ dBA	Land use
Places of worship	45 (Internal) 55 (External)[1]	Places of worship
Industrial	75	Industrial
Commercial	70	Commercial

[1]A conservative estimate of the difference between internal and external noise levels is 10 dB as per ICNG.

Operational noise criteria

The NCG establishes criteria for three project types, with this proposal falling under minor works. The Pacific Motorway is termed as a Freeway and Weakleys Drive/ John Renshaw Drive are considered arterial roads therefore the target noise abatement levels for the existing roads near minor works (freeway/ arterial road type) are given below in Table 6-12 and apply to the proposal.

Industrial and commercial properties surrounding the site are excluded from the assessment as they are not categorised as noise sensitive receivers in the RNP.

Table 6-12 Target noise abatement levels for minor works

Existing road category	Target noise level dBA Day (7am 10pm)	Target noise level dBA Night (10pm 7am)
Freeway/ Arterial/ sub-arterial road	$L_{Aeq\ (15hour)}$ 60 (external)	$L_{Aeq\ (9hour)}$ 55 (external)

The road traffic noise criteria for non-residential land uses affected by proposed road projects and traffic generating developments is shown in Table 6-13 and also applies to the proposal.

Table 6-13 Target noise abatement levels for noise sensitive receivers

Noise sensitive receivers	Target noise level dBA Day (7am 10pm)	Target noise level dBA Night (10pm 7am)
Places of worship	$L_{Aeq\ (1\ hour)}$ 40 (internal)	$L_{Aeq\ (1\ hour)}$ 40 (internal)

Due to the high external ambient noise level and the types of industrial and commercial properties surrounding the site, they are excluded from the operational assessment as they are not considered noise sensitive receivers in the RNP.

As outlined in Section 6.3.1 due to residential properties being located more than 600 metres away from the site they have been excluded from the assessment.

Vibration criteria

Human comfort

NSW Office of Environment and Heritage (OEH) (formally DECCW and EPA) developed, *Assessing vibration: A Technical Guideline* in February 2006 to aid in protecting people from vibration levels above preferred and maximum values felt inside buildings. The guideline does not however address vibration induced damage to structures or building contents or structure-borne noise effects.

Vibration and its associated effects with regards to human comfort are usually classified as continuous, impulsive or intermittent. Construction activity typically consists of all three types of vibration, depending on the construction equipment and operations being carried out.

The maximum allowable magnitudes of building vibration provided in the technical guideline with respect to human response are shown in Table 6-14.

Table 6-14 Criteria for exposure to continuous and impulsive vibration with respect to human comfort

Location	Assessment period	Preferred Peak velocity (mm/s)	Maximum Peak velocity (mm/s)
Continuous vibration			
Residences	Day time	0.28	0.56
	Night time	0.20	0.40
Offices, schools, educational institutions and places of worship	Day time or Night time	0.56	1.1
Workshops	Day time or Night time	1.1	2.2
Impulsive vibration			
Residences	Day time	8.6	17.0
	Night time	2.8	5.6
Offices, schools, educational institutions and places of worship	Day time or Night time	18.0	36.0
Workshops	Day time or Night time	18.0	36.0

Structural damage

Vibration generated by operation and construction activities can travel though the ground and cause nearby building structures to vibrate. This may cause damage to the building structure ranging from minor hairline cracking to major structural cracking.

The German Standard DIN4150-3 *Structural Vibration Part 3 – Effects of vibration on structures* is used to assess the structural damage on residential/ commercial and heritage buildings. Table

6-15 below outlines the frequency-dependant vibrational criteria for residential and commercial properties.

At frequencies above 100Hz, the values show in column 50Hz to 100 Hz in Table 6-15 may be used as minimum values. Construction activities typically occur between 10Hz to 50Hz based on previous measurements conducted by Aurecon at construction sites.

Table 6-15 Guideline values for vibration velocity to be used when evaluating the effects of short term vibration on structures

Type of Structure	Guideline values for velocity in mm/s			
	Vibration at the foundation at a frequency of			Vibration at horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and building of similar design and/or occupancy	5	5 to 15	15 to 20	15

6.3.4 Potential impacts

Construction

Operating hours of noise sensitive receivers is an important factor and has been taken into account in the assessment. These properties are non-operational during at night (10pm – 7am).

The noise level from the various construction stages has been calculated based on the theoretical maximum cumulative noise impact. The magnitude of the noise during the construction phase of the proposal would vary and depend on the:

- Type and size of construction equipment used onsite
- Number of equipment operating
- Intensity and location of the activities onsite
- Traffic due to workforce movements and delivery of materials.

Table 6-16 indicates the expected construction equipment, time of day equipment would be used and the typical sound power levels of each.

Typical construction equipment noise levels have been primarily obtained from AS 2436 – 2010, *Guide to noise and vibration control on construction, demolition and maintenance sites*. Other equipment may be used, however this would produce similar noise emissions.

Table 6-16 Construction plant and equipment sound power levels

Construction Item	Description	Equipment used	Sound Power Level dBA[1]
Early works	Relocation of services Day	1 x 10-20 tonne excavator 2 x delivery trucks 1 x horizontal borer	107 108 108
Main works	Earthworks Day	2 x 10-20 tonne excavator 6 x delivery trucks 1 x grader 1 x compactor	107 108 110 113
	Milling and breaking up median Night	1 x milling machine 3 x delivery trucks 1 x road sweeper 2 x jackhammers 1 x 20-30 tonne excavator	116 108 75 121 110
	Small construction Day & Night	1 x 10-20 tonne excavator 2 x delivery trucks 1 x mobile crane	107 108 104
	Asphalting Night	2 x asphalt machines 8 x delivery trucks 2 x vibratory rollers 2 x road sweeper	111 108 108 75

[1] Sound Power Levels taken from *AS 2436 – 2010: Guide to Noise and vibration control on construction, demolition and maintenance sites*

It should be noted that the predicted levels in this section are considered worst case for each of the above construction items listed in Table 6-16 and include adjustments for annoying activities outlined in the ICNG. The prediction methodology takes into account individual items of equipment operating simultaneously as well as the percentage of time (100 per cent for this prediction) each item of equipment is expected to be in use during a 15 minute period.

To provide a conservative estimate, the assessment assumes that each item of equipment would be operating at maximum capacity and considers the distance between the equipment in operation and the assessment location to be the minimum distance between the proposal and the nearest noise sensitive receiver (see Table 6-9 for distance). Screening provided by buildings and topography has been taken into account for the two churches (R1 and R2).

The magnitude of the noise emissions during the construction of the proposal may vary and would depend on the number of machines operating, the intensity and exact working location of the equipment. It would be unlikely for all of the plant and equipment to be running simultaneously in the same location, and the nature of activities onsite is expected to vary during the course of the proposal.

The predicted levels in Table 6-17 provide a theoretical maximum cumulative (worst case) noise impact. Table 6-17 also presents a summary of the construction noise predictions in accordance with AS 2436-2010.

Table 6-17 Summary of predicted construction noise impacts at all sensitive receivers (without noise mitigation measures

Activity/ Stage	Mobile plant/ equipment	Predicted noise levels (worst Case) $L_{Aeq\ 15min}$ dBA				
Receiver locations* and noise management levels (when property in use)		R1 (55 dBA)	R2 (55 dBA)	R3 (70 dBA)	R4 (70 dBA)	R5 (70 dBA)
Relocation of services Day	10-20 tonne excavator	48	70	65	66	72
	Delivery truck	49	65	66	67	73
	Horizontal borer	49	51	66	67	73
	Cumulative noise level	53	55	70	71	77
Earthworks Day	10-20 tonne excavator	48	68	65	66	72
	Delivery truck	49	65	66	67	73
	Grader	51	66	68	69	75
	Compactor	54	68	71	72	78
	Cumulative noise level	57	71	74	75	81
Milling and breaking up median Night	Milling (pavement)	58	74	75	76	82
	Delivery truck	52	75	66	67	73
	Road sweeper	14	66	31	32	38
	Jackhammer	57	31	74	75	81
	20-30 tonne excavator	51	74	68	69	75
	Cumulative noise level	62	68	66	67	73
Small construction Day & Night	10-20 tonne excavator	48	66	78	79	85
	Delivery truck	49	78	65	66	72
	Mobile crane	45	65	66	67	73
	Cumulative noise level	53	66	62	63	69

Activity/ Stage	Mobile plant/ equipment	Predicted noise levels (worst Case) $L_{Aeq\ 15min}$ dBA				
Receiver locations* and noise management levels (when property in use)		R1 (55 dBA)	R2 (55 dBA)	R3 (70 dBA)	R4 (70 dBA)	R5 (70 dBA)
Asphalting Night	Asphalt rotomill	52	62	69	70	76
	Delivery truck	49	69	69	70	76
	Vibratory roller	47	69	66	67	73
	Road sweeper	14	66	64	65	71
	Cumulative noise level	55	64	31	32	38

Note: Values in red cell exceed the construction management level.

Table 6-17 shows that construction noise management levels are exceeded for some activities at all locations. Most of the works would be conducted during at night however the earthworks would be conducted mostly during the day time. All the sensitive receivers in close proximity to the works would be non-operational during at night therefore it is expected that most of the noise impacts from the proposal would not impact any sensitive receivers at night.

Earthworks may exceed the noise management levels at noise sensitive receivers during the day. If exceeded, community reaction to noise during the recommended standard construction hours is likely to occur. In order to minimise the likelihood of adverse reaction to construction noise, the standard noise mitigation measures outlined in Table 6-25 should be carried out to achieve the predicted noise levels in Table 6-18.

It should be noted that noise exceedances outside of standard working hours, as shown in the yellow highlighted squares below, are considered compliant as sensitive receivers would be non-operational during night construction works.

Table 6-18 Summary of predicted noise impacts at all the sensitive receivers with standard noise mitigation measures

Activity/ Stage	Mobile plant/ equipment	Predicted noise levels (worst case) $L_{Aeq\ 15min}$ dBA				
Receiver locations* and noise management levels (when property in use)		R1 (55 dBA)	R2 (55 dBA)	R3 (70 dBA)	R4 (70 dBA)	R5 (70 dBA)
Relocation of services Day	110-20 tonne excavator	44	46	60	61	67
	Delivery truck	45	47	61	62	68
	Horizontal borer	45	47	61	62	68
	Cumulative noise level	49	51	65	66	72

Activity/ Stage	Mobile plant/ equipment	Predicted noise levels (worst case) $L_{Aeq\ 15min}$ dBA				
Receiver locations* and noise management levels (when property in use)		**R1 (55 dBA)**	**R2 (55 dBA)**	**R3 (70 dBA)**	**R4 (70 dBA)**	**R5 (70 dBA)**
Earthworks Day	10-20 tonne excavator	44	46	60	61	67
	Delivery truck	45	47	61	62	68
	Grader	47	49	63	64	70
	Compactor	50	52	66	67	73
	Cumulative noise level	53	55	69	70	76
Milling and breaking up median Night	Milling (pavement)	54	56	70	71	77
	Delivery truck	48	50	61	62	68
	Road sweeper	10	12	26	27	33
	Jackhammer	53	55	69	70	76
	20-30 tonne excavator	47	49	61	62	68
	Cumulative noise level	58	60	73	74	80
General construction Day & Night	10-20 tonne excavator	44	46	60	61	67
	Delivery truck	45	47	61	62	68
	Mobile crane	41	43	57	58	64
	Cumulative noise level	49	50	64	65	71
Asphalting Night	Asphalt rotomill	48	50	64	65	71
	Delivery truck	45	47	61	62	68
	Vibratory roller	43	45	59	60	66
	Road sweeper	10	12	26	27	33
	Cumulative noise level	51	53	66	67	73

Note: Values in yellow exceed the construction management level during non-standard hours but the noise sensitive receivers would be non-operational during night time and therefore are compliant.

Noise impact at the sensitive receiver boundary of R5 may exceed the noise management levels during earthworks (day time operations). Refer to Section 6.3.5 for additional noise mitigation measures in accordance with Transport for NSW's (TfNSW) *Construction Noise Strategy*. However the existing background noise levels near R5 (Commercial / light industrial properties) measured between 58 dBA (UA-2) and 71 dBA (UA-3), therefore it is unlikely that temporary construction noise impacts from these day works would cause significant additional adverse effects on the people working inside the facility.

Operation

The current ambient noise at the site is dominated by road traffic and industrial sources. Data from the following sources was reviewed in order to calculate the current and future traffic noise impact of the intersection:

- Roads and Maritime 2004 Annual Average Daily Traffic (AADT) data from Roads and Maritime the traffic volumes
- Hyder 2015 M1 Pacific Motorway Intersection Upgrade at Weakleys Drive & John Renshaw Drive Traffic Modelling on Strategic Concept Design, Report No. AA006517.

The Hyder report carried out modelling for the years 2019 and 2029 based on a natural two per cent growth trend. The proposal would not generate additional traffic growth and the analysis has predicted a traffic reduction through the M1 Pacific Motorway/ Weakleys Drive intersection in the order of 20 per cent after 2029 assuming that the M1 extension to Raymond Terrace is constructed. Table 6-19 summarises the current and predicted future vehicles per hour for the proposal.

The intersection is currently used by 15 per cent heavy vehicles in the morning (7–8am) and eight per cent in the evening peaks (4–5pm).

Table 6-19 Current and future vehicles per hour (peak)

Roads	Vehicles per hour (Peak)				
	2004 Existing (RMS)	2014 Existing (Hyder)	2019 Without proposed M12RT (Hyder)	2029 Without proposed M12RT (Hyder)	2029 With proposed M12RT (Hyder)
M1 Pacific Motorway (Black Hill)	33,000/ 24 = 1375	am – 2550 pm – 2837	am – 2690 pm – 2990	am – 3060 pm – 3370	am – 2490 pm – 2720
Weakleys Drive	19,750/24 = 823	am – 3526 pm – 3853	am – 3910 pm – 4240	am – 4560 pm – 5100	am – 3570 pm – 3880
John Renshaw Drive	28,020/24 = 1168				

Note: M12RT is the M1 extension to Raymond Terrace. am – represents 7–8am peak traffic conditions. pm – represents 4–5pm peak traffic conditions.

Various scenarios for calculating the traffic noise impact (present/ future) from natural traffic growth were carried out and these assumed the year of opening as 2019 and calculated predictions for 10 years after opening (2029). The scenarios are shown in Table 6-20.

Table 6-20 Operation traffic noise prediction scenarios

Scenarios	Year	Proposal	M1 extension to Raymond Terrace
Case 1	2014	Existing scenario based on the traffic counts conducted by Hyder Consulting.	Not assumed
Case 2	2019	Predicted future scenario of year of opening the proposal.	Not assumed
Case 3	2029	Predicted future scenario 10 years after opening of proposal	Not assumed
Case 4	2029		Assumed

Calculation of traffic noise was carried out using Calculation of Road Traffic Noise (CoRTN) method. The CoRTN calculation takes into account the various parameters summarised below in Table 6-21.

Table 6-21 CoRTN operational noise parameters

Model parameters	Description
Traffic volume	Refer to Table 6-19
Traffic speed (Average)	40km/h
Percentage of heavy vehicles	15% am, 8% pm
Type of road surface	Asphalt (dense grade type)
Road gradient	None
Ground absorption	100% hard ground
Receiver location height	1.5 metres above external ground level

Model parameters	Description
Receiver distance from the road edge (R2)	175 metres
Shielding from ground topography and intervening structures	Yes (as per the current site conditions)

Results of the traffic noise impact in accordance with CoRTN are summarised in Table 6-22 below.

Table 6-22 CoRTN Traffic noise impact prediction for Christian Outreach Centre (R2)

Scenarios	$L_{A10\ (1hr}$ am	$L_{A10\ (1hr}$ pm	$L_{Aeq\ (1hr)}$ am	$L_{Aeq\ (1hr)}$ pm
Case 1 (2014)	39	37.8	36	34.8
Case 2 (2019)	39.5	38.3	36.5	35.3
Case 3 (2029)	40.2	39.1	37.2	36.1
Case 4 (2029)	39.1	37.9	36.1	34.9

It is evident from Table 6-22 that the noise impact from natural traffic growth during a worst case scenario (Peak traffic conditions) would be well below the stipulated criteria of $L_{Aeq\ 1hr}$ 55 dBA at the external façade of the Christian Outreach Centre (R2). Increase of total noise (2014 minus 2029 scenario) as per the CoRTN predictions is 1.2 dBA (AM) and 1.3 dBA (PM) which is less than 2 dBA. Therefore operational noise increase would be from natural traffic growth, not the proposal, and at the boundary of the most sensitive receiver the proposal would comply with the RNP stipulated criteria.

Features of interrupted versus free flowing traffic

Traffic noise is among the most extensively studied fields of noise pollution based on the level of influence traffic has on people irrespective of them living in urban, suburban or rural areas. Various noise prediction models have been developed to assess and predict noise propagation from road networks for free-flowing traffic conditions and road intersections. Noise predictions for intersections are not easy to assess due to the complexity of traffic dynamics when the vehicle approaches/ exit the intersection.

The closest noise sensitive receiver for this project using the RNP criteria is about 175 metres from proposal with some intervening industrial/ commercial buildings which could act as noise barriers. Therefore the noise increase at the boundary of the churches (R1/R2) may increase by less than 2 dBA due to the proposal changing the existing intersection into a signalised intersection.

Vibration impact

The Roads and Maritime *Construction and Noise and Vibration Guideline* provides estimates of vibration levels of construction equipment and safe distance for operating the equipment near a sensitive property summarised in Appendix F.

The nearest industrial property is located 20 metres from the proposal construction site, and no adverse vibration impacts are expected on the property based on the safe distances for typical equipment used for construction.

There is a very low risk of the vibration impact criteria being exceeded during the construction works and therefore no specific mitigation measures are required.

6.3.5 Safeguards and management measures

The Roads and Maritime *Construction and Noise and Vibration Guideline* outlines additional mitigation measures in circumstances where noise management levels are still exceeded after the application of standard noise mitigation measures shown in Sections above.

Table 6-23 Additional noise mitigation measures for airborne construction noise

Time period	Mitigation measures: Leq, 15 min noise level above background (RBL) Qualitative assessment of noise levels			
	0 10 dBA Noticeable	10 20 dBA Clearly audible	20 30 dBA Moderately intrusive	>30 dBA Highly intrusive
Standard: Mon – Fri (7am – 6pm) Sat (8am – 1pm)	-	-	LB, M	LB, M
OOHW Period 1: Mon – Fri (6pm – 10pm) Sat (7am – 8am, 1pm – 10pm) Sun/PH (8am – 6pm)	-	LB	LB, M	M, IB, LB, PC, SN, RO
OOHW[1] Period 2: Mon – Fri (10pm – 7am) Sat (10pm – 8am) Sun/PH (6pm – 7am)	LB	LB, M	M, IB, LB, PC, SN	AA, M, IB, LB, PC, SN

Notes: AA – Alternative accommodation, M – monitoring, IB – Individual briefings, LB – letter box drops, RO – project specific respite offer, PC – phone calls, SN – specific notification.

Implementation of the mitigation measures for all activities (about 5-10dBA reduction) resulted in reduced levels at the boundary of sensitive receivers. These are assessed against the measured background noise levels (RBL) to identify which additional mitigation measures to apply. Table 6-24 outlines the additional noise mitigation measures required in the vicinity of the worst case sensitive receivers in accordance with the TfNSW Construction Noise Strategy.

Table 6-24 Additional noise mitigation measures to be implemented

Sensitive receiver	Type	Additional mitigation measures	When	Activity	Applicable receivers/ activity
R5	Commercial/ Industrial	Letter box drops	Standard hours	Earthworks	Coates Hire, 15 Kullara Close, Beresfield, NSW 2322 Ministor Beresfield, 30 Kullara Close Beresfield, NSW 2322

[1] Out Of Hours Work

The safeguards and management measures for construction activities are listed in Table 6-25**.**

Table 6-25 Safeguards and management measures for noise and vibration issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
NV01	Noise and vibration	A Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The NVMP would generally follow the approach in the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) and identify: • All potential significant noise and vibration generating activities associated with the activity • Feasible and reasonable mitigation measures to be implemented, taking into account *Beyond the Pavement: urban design policy, process and principles* (Roads and Maritime, 2014) • A monitoring program to assess performance against relevant noise and vibration criteria • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Detailed design / pre-construction	Standard safeguard Section 4.6 of QA G36 Environment Protection
NV02	Impacts on sensitive receivers – Path controls	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding	Contractor	Construction	Standard safeguard
NV03	Site induction	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All project specific and relevant standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on high noise generating activities • Location of nearest sensitive receivers • Construction employee parking areas	Contactor	Construction	Standard safeguard

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		• Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.			
NV04	Behavioural practices	• No swearing or unnecessary shouting or loud stereos/radios on site. • No dropping of materials from height, throwing of metal items and slamming of doors.	Contactor	Construction	Standard safeguard
NV05	Equipment Selection	• Use only the necessary size and power • Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles would minimise noise and vibration impacts • Ensure vehicles are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard • Ensure plant including the silencer is well maintained.	Contactor	Pre-construction/ Construction	Standard safeguard
NV06	Plant noise levels	• The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria in Appendix H of the *RMS Construction Noise and Vibration Guideline* (2016) • Implement a noise monitoring audit program to ensure equipment remains within the more stringent of the manufacturers specifications or Appendix H.	Contactor	Construction	Standard safeguard
NV07	Rental plant and equipment.	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in Table 2 of the *RMS Construction Noise and Vibration Guideline* (2016).	Contactor	Construction	Standard safeguard
NV0	Use and siting of	• The offset distance between noisy plant and adjacent sensitive	Contactor	Construction	Standard

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
8	plant.	receivers is to be maximised • Plant used intermittently to be throttled down or shut down • Noise-emitting plant to be directed away from sensitive receivers • Only have necessary equipment on site.			safeguard
NV09	Plan worksites and activities to minimise noise and vibration.	• Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site • Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible.	Contactor	Construction	Standard safeguard
NV10	Non-tonal and ambient sensitive reversing alarms	• Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work • Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.	Contactor	Construction	Standard safeguard
NV11	Minimise disturbance arising from delivery of goods to construction sites.	• Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers • Select site access points and roads as far as possible away from sensitive receivers • Dedicated loading/unloading areas to be shielded if close to sensitive receivers • Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible • Avoid or minimise these movements during the day where possible.	Contactor	Construction	Standard safeguard
NV12	Plan worksites and activities to minimise noise and vibration.	Very noisy activities should be scheduled for night working hours. If the activities cannot be undertaken during the night, if feasible the activities should be started after 4pm.	Contactor	Construction	Additional safeguard

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
NV13	Impacts on sensitive receivers – Notification	All noise sensitive receivers likely to be affected would be notified at least five (5) days prior to commencement of any works associated with the activity that may have an adverse noise impact. The notification could be provided as a letterbox drop, phone call or individual briefing. The notification would provide details of: • The project • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information • Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.	Contactor	Construction	Additional safeguard

6.4 Air quality

6.4.1 Existing environment

Nearby receivers

The proposal is located in an area predominantly light industrial in nature near the Beresfield light industrial estate.The suburban area of Beresfield is located about 1.2 kilometres north–east of the proposal and is the closest residential area.

Meteorology

The nearest Bureau of Meteorology climate station to the proposal is at Maitland (Maitland Visitors Centre – Site 061388), about nine kilometres to the north–west. Table 6-26 shows the historical average climate data for Maitland (Bureau of Meteorology, 2015).

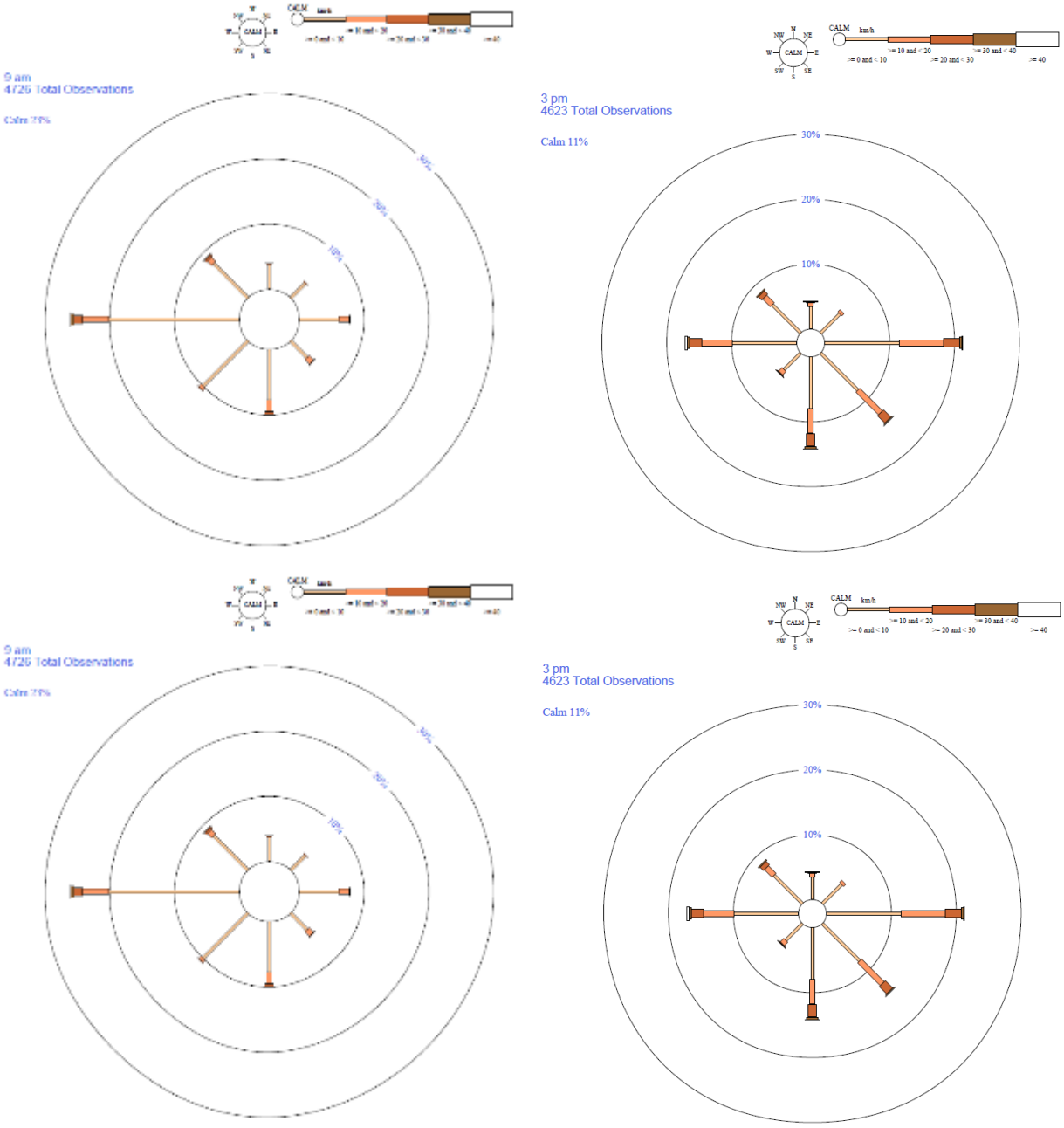
The area experiences warm summers with mean daily maximum temperatures of around 29 degrees Celsius (°C). July is generally the coolest month in the year with a mean daily minimum temperature of six degrees Celsius. February is typically the wettest month in the year, with a mean rainfall of 109 millimetres falling over nine rain days.

Table 6-26 Climate data for Maitland

Month	Mean maximum temperature (°C)	Mean minimum temperature (°C)	Mean rainfall (mm)	Mean number of rain days
January	30.3	18.1	57.6	6.1
February	29.3	18.0	108.5	8.9
March	27.6	16.0	88.7	8.3
April	24.4	12.3	97.8	8.2
May	21.2	8.3	61.9	6.1
June	18.4	6.5	83.5	8.3
July	18.0	5.5	44.4	7.2
August	20.0	5.6	35.7	5.3
September	23.2	8.4	48.2	5.8
October	25.7	11.0	56.4	6.3
November	27.0	14.4	81.0	8.0
December	28.8	16.4	63.4	6.9
Annual	24.5	11.7	827.0	85.4

The historical annual wind roses for the Maitland Visitor Centre Station for 9am and 3pm data is shown in Figure 6-5. The wind roses show that the winds in the morning predominately blow from the west, while the winds in the afternoon predominately blow from the east, with winds also from the south, south–east and west. In general, the winds speeds are less than 10 km/h. Wind speeds of more than 10 km/h are more frequent in the afternoons.

Figure 6-5 Maitland 9am and 3pm historical annual wind roses (17 June 1997 to Sept 2010) (Bureau of Meteorology)



Ambient air quality

The proposal area is located within the road corridors of the M1 Pacific Motorway, John Renshaw Drive and Weakleys Drive. The dominant source of emissions within the area is from motor vehicles travelling along the M1 Pacific Motorway and the nearby arterial road network. The main air pollutants from motor vehicles are carbon monoxide (CO), nitrogen dioxide (NO_2) and fine particles (PM_{10}, ie particulate matter with equivalent aerodynamic diameters of less than 10 microns).

Beyond the road corridor, the existing environment is dominated by industrial sources including food product manufacturing, meat product manufacturing, coal mining and fabricated metal product

manufacturing. Newcastle Memorial Park Crematorium is located in Beresfield, about 1.2 kilometres from the proposal.

The Lower Hunter Air Quality Monitoring Network utilises ambient air quality monitoring stations, operated by the NSW OEH, to provide air quality information. The closest air quality monitoring station is located at located at Francis Greenway High School on Lawson Avenue, Beresfield and is located about 2.9 kilometres north–east of the study site. Table 6-27 summarises the results collected for the period from 1 January 2015 to 9 December 2015, and the applicable criterion prescribed in *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW,* (DEC, 2005).

Table 6-27 Beresfield air quaility monitoring station data for 2014-2015 period

Pollutant	Averaging time	Measured results	EPA Criteria
Particles as PM_{10}	24 hour	37.4 µg/m^3 (2 days above EPA criteria)	50 µg/m^3
	Annual	19.3 µg/m^3	30 µg/m^3
Carbon monoxide (CO)	1 hour	Not measured (no days where values were recorded above EPA criteria)	30 mg/m^3
	8 hour		10 mg/m^3
Nitrogen dioxide (NO_2)	1 hour	0.033 ppm	0.122 ppm / 246 µg/m^3
	Annual	0.009 ppm	0.03 ppm / 62 µg/m^3

The monitoring data from Table 6-27 indicates general compliance with the EPA's air quality criteria with the exception for all measured parameters.

The OEH also has an air quality index (AQI) which is a standardised measurement used to characterise the air quality at a site or location and compare it in relative terms with other sites and locations throughout NSW. The average daily AQI for Beresfield in 2015 was 45.1 which corresponds with an AQI value of 'good'.

6.4.2 Potential impacts

Construction

Construction activities can result in the generation of dust (particulate matter), which can potentially lead to nuisance short term localised impacts on nearby commercial premises and road users. Activities likely to result in an increase dust emissions include:

- Clearing of vegetation
- Earthworks including:
  - Stripping, stockpiling and managing of topsoil
  - Excavations for road widening
  - Excavations for utility adjustments and installation of drainage structures.
- Road sub grade preparation and road pavement work
- Transport and handling of materials to and from and within the proposal area
- Use of construction vehicles
- Spray painting for line marking.

Potential air quality impacts during construction would be predominately associated with the generation of dust from excavations required for road widening and installation of drainage structures. These impacts would be mitigated by implementing the safeguards and management measures outlined in Section 6.4.3.

The operation of machinery and other construction vehicles would result in the temporary increase in exhaust fume emissions in the area. These impacts are considered minor when compared to the existing heavy and light vehicle emissions within the proposal area. Implementation of the safeguards and management measures outlined in Section 6.4.3 would minimise these impacts.

Operation

Potential air quality impacts relating to the operation of the proposal are generally associated with changes in motor vehicle traffic emissions. These emissions primarily include CO, NO_2 and particulate matter as PM_{10}.

The proposal would improve the performance of the existing intersection and would therefore relieve existing congestion and queuing times. This would therefore reduce the amount of idling vehicles within the locality and may potentially improve local air quality during peak periods.

The proposal also includes permanent on-road provision for cyclists as well as potential future provisions for pedestrians if required. This would provide a healthy non-polluting means of transport for road users.

6.4.3 Safeguards and management measures

The safeguards and management measures for air quality issues are listed in Table 6-28. Other safeguards and management measures that would address air quality impacts are identified in Section 6.8.4.

Table 6-28 Safeguards and management measures for air quality issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
AQ01	General air quality impacts	• In accordance with *G36 Environmental Protection Section 4.4* management strategies to minimise the impact of dust and other emissions on the surrounding environment would be included in the CEMP.	Construction Contractor	Pre-construction and construction	Additional standard safeguard G36 Section 4.4
AQ02	Excessive dust from stockpiles	Stockpile management would be in accordance with the Landcom *Managing Urban Stormwater, Soils and Construction Guidelines* including covering stockpiles and storage areas where possible.	Construction Contractor	Pre-construction and construction	Additional Safeguard G38 Section 3.2
AQ03	Excessive dust from non-vegetated area	• Stage work to ensure progressive vegetation clearing and revegetation can occur. Revegetate as soon as possible.	Construction Contractor	Pre-construction and construction	Additional safeguard
AQ04	Dust from haulage of materials and movement of vehicles	• Ensure that loads are always covered • Manage unsealed roads and areas to avoid the generation of dust • Impose speed limits along unsealed routes • Where possible, restrict movements along unsealed routes.	Construction Contractor	Construction	Additional safeguard
AQ05	Excessive exhaust emissions from construction plant and equipment	• Inspect plant/equipment before the start of construction on site to ensure efficient operation and compliance with manufacturers specifications • Carry out routine servicing, maintenance and visual inspections to ensure that equipment continues to operate efficiently.	Construction Contractor	Pre-construction and regularly during construction	Additional safeguard

6.5 Landscape character and visual impacts

6.5.1 Existing environment

The land around the proposal varies from highly disturbed light industrial lands to more sensitive vegetation communities. The main landscape character to the north–east and north–west of the intersection is the Beresfield light industrial park.

The areas to the south–west and south–east of the intersection are characterised by Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC, merging with Coastal Foothills Spotted Gum-Ironbark forest further to the east. A remnant area of Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC also occurs along the road corridor to the north–west of the intersection. Along the eastern corridor of Weakleys Drive, much of the corridor next to the roadway is planted with *Casuarinas*, beside a reformed drainage channel.

The landform and topography within and next to the proposal area ranges from being of low gradient, undulating terrain, to the broad ridgeline trending to the north to Weakleys Flat. To the north–east, the ridgeline is more prominent in the landscape. Drainage lines are found between each ridge spur, descending northward.

The existing intersection may be described as a visually enclosed roundabout intersection with views from the roundabout confined to the four exit roadways. Roadside vegetation defines views to some extent along all approaches to the intersection, particularly on the southern, western and eastern approaches and provides a degree of screening between the road corridor and Beresfield light industrial area. Consequently, an enclosed and semi enclosed visual character generally dominates the area.

Six Landscape Character Zones were identified during the landscape character and visual impact assessment (KI Studio, 2016).The identified Landscape Character Zones (LCZ) are as follows and are shown in Figure 6-6.

A – Beresfield light industrial west
B – Corridor buffer west
C – Corridor buffer east
D – Bersefield light Industrial east
E – Black Hill west
F – Black Hill east.

The assessment also discusses the sensitivity values for each landscape character zone. The sensitivity assessment has been based on Roads and Maritime's Environmental Impact Assessment Practice Note – Guidelines for Landscape Character and Visual Impact Assessment No. EIAN04, Version 2.0 Issue (2013).

The sensitivity value refers to the qualities of a particular landscape character zone, the number and type of receivers and how sensitive the existing character of the setting is to the proposal.. The combination of sensitivity and magnitude is used to derive an impact rating for the proposal on the various landscape character zones. Descriptions and sensitivities of each LCZ are summarised in Figure 6-6 below.

Figure 6-6 Landscape character zones

Table 6-29 Landscape character zones

Zone A Beresfield Light Industrial west		
Location	Occupying the land north–west of the intersection. Predominantly built environment, mostly light industrial facilities.	
Natural Environment	Situated on the higher grounds of an otherwise slight undulating topography, and part of the broad lower ridgeline. Highly modified environment with limited streetscape qualities and greenery. It is noted that Zone B creates a strong green backdrop to this zone.	
Built Environment	Large industrial/warehouse/office buildings with a large footprint and limited windows or visual design values.	
Spatial Character	Self-enclosed light industrial area dominated by warehouse buildings. Extensive paved areas in the form of driveways, service docks and car parks convey a utilitarian character.	
Infrastructure	A number of internal streets with minimal street lighting and underground power lines.	
Sensitivity	The sensitivity of this area is considered low due to its industrial character and commercial use.	
Zone B Corridor Buffer west		
Location	Northern road verge between John Renshaw Drive and Landscape Character Zone (LCZ) B, road verge between Weakleys Drive and LCZ B and undeveloped industrial lot immediately north–west of the intersection.	
Natural Environment	Mature stands of trees with grassed understorey provide a lush character that frames the roadway. Remnant indigenous vegetation (Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC) with large grassed areas in the vicinity of the intersection. Generally flat topography with gentle slopes rising away from the intersection. Disturbed native bushland with indigenous trees.	
Built Environment	No built environment, except for the informal track.	

Spatial Character	Skyline trees define the road's verge and strongly contribute to the road's character. Open character next to the intersection.	
Infrastructure	Dirt track providing access along the corridor, acts as fire trail and provides walking/cyclist use.	
Sensitivity	The sensitivity within this zone is considered high as it helps frame the intersection and provides a buffer between the industrial areas beyond and the road corridor.	
Zone C Corridor Buffer east		
Location	Situated to the east of Weakleys Drive and next to LCZ D, this area comprises of low lying areas with stands of planted Casuarinas. It includes a suite of undeveloped industrial lots along the northern section of Weakleys Drive and south of Enterprise Drive.	
Natural Environment	Drainage swales and formed channel with stands of Casuarinas define the southern section, whilst mature indigenous stands of trees with a grassed understorey dominate the northern end of this zone.	
Built Environment	Drainage channel, to the east of this zone, and overhead power lines immediately adjacent to Weakleys Drive.	
Spatial Character	Open, bare space exposes views to the industrial area beyond to the east. Casuarinas provide a dense screen to the mid-section of road, and frame the drainage channel works. To the north of this zone, a parkland setting of large, mature Eucalypt trees (mainly in the undeveloped industrial lots) create a buffer to the dominant warehouse buildings.	
Infrastructure	Drainage channel and overhead powerlines.	
Sensitivity	The sensitivity within this zone is considered moderate due to the land use.	

Zone D Beresfield Light Industrial east		
Location	East of Weakleys Drive and north of John Renshaw Drive.	
Natural Environment	Situated on the higher broad ridge of the site, with otherwise slight undulating topography. Highly modified environment with limited streetscape quality and greenery.	
Built Environment	Large warehouse/office buildings with a large footprint and limited visual design values.	
Spatial Character	Self-enclosed light industrial area dominated by warehouse buildings. Extensive paved areas in the form of driveways, service docks and car parks convey a somewhat utilitarian character.	
Infrastructure	A number of internal streets with minimal street lighting and underground power lines.	
Sensitivity	The sensitivity of this area is considered low due to its industrial character and commercial use.	
Zone E Black Hill west		
Location	Situated along the south–west section of the intersection	
Natural Environment	Surrounded by bushland, this zone comprises Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC.	
Built Environment	Relatively undisturbed bushland with power and water easements and access tracks. Portions of the site have been used for industrial development and underground coal mining. Note a Concept plan for a notional 23 lot subdivision has been approved by the NSW Minister for Planning and Environment (Black Hill industrial estate) (Department of Planning and Environment 2016).	
Spatial Character	Dense bushland. Visually enclosed with limited views creating a confined character.	
Infrastructure	Major overhead power line and paved access road to formal Boral asphalt facility.	
Sensitivity	The sensitivity within this zone is considered high due to the bushland setting.	

Zone F Black Hill east		
Location	Situated along the south–east section of the intersection.	
Natural Environment	Surrounded by bushland, this zone comprises areas of Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC and disturbed areas with re-growth.	
Built Environment	Partially disturbed bushland with power and water easements through it.	
Spatial Character	Dense bushland. Visually enclosed with limited views creating a confined character.	
Infrastructure	Major overhead power line.	
Sensitivity	The sensitivity within this zone is considered moderate to high due to the disturbed setting and environmental value.	

6.5.2 Potential impacts

Construction

Construction activities have the potential to cause localised changes or short-term temporary visual impacts to road users and nearby commercial operations. Visual amenity would be impacted by the presence of machinery, lighting for night works, temporary safety barriers, construction materials, stockpiles, ancillary and compound sites and visibility of exposed surfaces.

These impacts would be ongoing throughout the construction period, although staging would avoid impacting on a large area at the same time. Apart from vegetation removal (discussed in the following section) impacts would generally be temporary in nature.

Operation

Impacts on the identified Landscape Character Zones (LCZ) are summarised in Table 6-30.

Table 6-30 Potential impacts on landscape character zones

Landscape Character Zone	Landscape Character and Visual Impact
Zone A – Beresfield Light Industrial west	Low impact – Removal of vegetation in LCZ B would result in an increased view of the road corridor however the sensitivity of this area is considered low due to its industrial character and commercial use.
Zone B - Corridor Buffer west	Moderate impact – The majority of vegetation including mature trees would be removed and therefore the spatial quality would be more open and the visibility of the Beresfield light industrial estate would be increased for road users.
Zone C – Corridor Buffer east	Low - Moderate impact – Roadside plantings of Casuarinas would be removed and therefore the spatial quality would be more open and the visibility of the Beresfield light industrial area east would be increased for road users.
Zone D – Beresfield Light Industrial east	Low impact – Removal of roadside plantings in LCZ C would result in an increased view of the road corridor however the sensitivity of this area is considered low due to its industrial character and commercial use.
Zone E – Black Hill west	Low impact - Native roadside vegetation would be along be removed along John Renshaw Drive and M1 Pacific Motorway frontages however considering the expanse of vegetation within this zone, a low visual impact and impact on landscape character of this zone is anticipated.
Zone F – Black Hill east	Low – impact. Native roadside vegetation would be removed along John Renshaw Drive and M1 Pacific Motorway frontages. However the adjoining vegetation in this LCZ would mitigate any visual impact in this LCZ.

Overall the proposal when operational would result in a low to moderate change in the visual amenity for road users and industrial land uses particularly along the northern and western approaches to the intersection. This visual impact would be localised and contained within the existing topography.

The areas surrounding the proposal are not considered to be visually sensitive as they have been significantly modified in the past by the establishment of the Beresfield light industrial area and the major road corridors.

The required removal of mature native vegetation to accommodate the proposed road widening especially to the west of Weakleys Drive would contribute to a more cleared urban road landscape and would reduce the existing visual separation and screening between the road corridor and nearby industrial/commercial land use. Nevertheless this reduction in visual amenity is considered low in comparison to the scale of the existing and proposed industrial/commercial activity next to the road corridor. Mitigation measures for ameliorating the visual impacts are summarised in the following section.

6.5.3 Safeguards and management measures

Measures to manage the potential visual impacts and impacts to landscape character from the proposal are summarised in Table 6-31. Additional measures to manage landscape character and impacts are contained in Section 6.1.4.

Table 6-31 Safeguards and management measures for landscape character and visual issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
UD01	Landscape character and visual impact.	An Urban Design Plan would be prepared to support the final detailed project design and implemented as part of the CEMP. The Urban Design Plan would be prepared in accordance with relevant guidelines, including: • *Beyond the Pavement urban design policy, process and principles* (Roads and Maritime, 2014). • *Landscape Guideline* (RTA, 2008). The Plan would include design treatments for: • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements • Cyclist elements and consideration of future provision for pedestrians • Fixtures such as lighting, fencing and signs • Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas.	Construction Contactor	Pre-construction	Core standard safeguard UD1
UD02	Visual impact of altered road character from clearance of vegetation including EECs.	• Landscaping would be carried out in accordance with *Roads and Maritime Landscape Guidelines* (RTA, 2008) as detailed in the Urban Design report (KI Studios, 2016).	Construction Contractor	Construction	Additional standard safeguard

6.6 Land use and socio-economic

6.6.1 Existing environment

Land use

The proposal is located in Beresfield within the Newcastle LGA. Existing land use zones in and around the proposal area have been defined according to the zoning in the Newcastle Local Environmental Plan (LEP) and include:

- SP2 Infrastructure, associated with the road corridors of the M1 Pacific Motorway, Weakleys Drive and John Renshaw Drive
- IN2 Light Industrial zoned areas located along Weakleys Drive and the northern side of John Renshaw Drive. The Beresfield light industrial estate is located within this zoning
- Currently undeveloped vegetated IN2 Light Industrial zoned land located to the south–west of the existing intersection
- Currently undeveloped E4 Environmental Living zoned land to the south–east of the intersection
- E2 Environmental Conservation areas associated with Viney Creek and unnamed tributary.

Future Land use

A concept plan for a notional 23 lot industrial subdivision referred to as the Black Hill industrial estate was approved by the NSW Minister for Planning and Environment in 2013 for the land located to the south–west of the intersection. This development would occupy an area of 183 hectares, with extensive frontage to the M1 Pacific Motorway of over 1.5 kilometres. At time of writing the property was for sale.

Socio economic

As noted above the proposal is located within the Newcastle LGA. The Newcastle LGA covers about 187 square kilometres and has an estimated population of 160,000 people (Remplan, 2016). This LGA is considered an area with generally high levels of economic, natural, physical and human capital. Newcastle is the economic hub of the Hunter Region, accounting for about 30 per cent of the Hunter Region's developed industrial space and 80 per cent of its office space (Remplan, 2016). There are about 87,500 jobs in the Newcastle LGA and the Gross Regional Product (GRP) was $14.228 billion (about 34 per cent of the Hunter Region's GRP).

The proposal is located about one kilometre to the east of the boundary with the Cessnock LGA and about two kilometres to the south of the Maitland LGA (via Weakleys Drive). Maitland LGA, has a population of about 75,000 people and about 22,700 jobs. This LGA is one of the fastest growing areas in Australia with a growth rate consistently above two per cent (Remplan, 2016a). About 58 per cent of workers living in the Maitland LGA travel to a different LGA to work. Cessnock LGA has a population of about 55 000 people and a GRP of $2.3 billion. About 55 per cent of workers living in the Cessnock LGA work in an adjacent LGA (Remplan, 2016b). These statistics show a high level of commuting in the regional workforce across LGA boundaries.

As one of the key connections in the regional road network, the intersection plays an important role in providing for private vehicle travel to and between the major urban centres of Sydney and Newcastle and their surrounding commuter areas. The risks of allowing high levels of congestion to continue relate primarily to impacts on the economy and associated employment centres of Sydney, the Central Coast and the Lower Hunter.

Social Infrastructure

Social infrastructure refers to community facilities and services which help members of the community meet their social needs and help in enhancing community wellbeing. This includes

education facilities, child care centres, age care facilities, open space and recreation facilities. The following social infrastructure has been identified near the proposal area:

- Clifford Hallam Healthcare facility, 3 Balbu Close, Beresfield NSW 2322 (about 670 metres from the intersection)
- Christian City Church, 1/1 Pippita Close, Beresfield NSW 2322 (about 320 metres from the intersection)
- Christian Outreach Centres, 14 Enterprise Drive, Beresfield, NSW 2322 (about 340 metres from the intersection)
- Driver Reviver site (refer to following heading) within the road corridor to the southwest of the intersection.

Informal car park area and Driver Reviver site

The informal car park area, located within the road reserve in the south-western corner of the intersection, is used as a Driver Reviver in peak holiday periods. Use of the Driver Reviver site is convenient due to the high visibility of the site combined with delays caused by additional peak holiday traffic.

The Driver Reviver program operates throughout Australia during school holidays and over long weekends to reduce fatigue related crashes. Driver Reviver is a community program operated by volunteers from a wide range of service organisations and community groups. The program has operated since 1986 and there are now about 80 Driver Reviver sites operating across NSW (TfNSW 2016). Roads and Maritime support the Driver Reviver program through the provision of safety guidelines, recommendation and approval of site locations and provision of toilet facilities, water and power.

Morisset Lions Club operates the Driver Reviver site at the intersection as a free service to the community. Roads and Maritime provides portable toilets, traffic management and maintains the site. The Morisset Lions club depends on donations to operate the site and to recover cost such as fuel.

The main reasons for stopping at the Driver Reviver site given by users during the Roads and Maritime survey (refer to Section 5.2.1) were the location (35 per cent), fatigue management (32 per cent) and to use the toilets (15 per cent). Other common reasons for stopping included using the site as a meeting point or to attend to a child or pet.

The informal car park area does not meet the current criteria for a Driver Reviver.

This site is also used as an informal commuter car park.

6.6.2 Potential impacts

Construction

Land use and future land use

The construction of the proposal would not impact on the existing land use surrounding the proposal area.

Socio economic

The proposal has the potential to generate socio-economic impacts during construction. These impacts would generally be temporary and would include changes to traffic arrangements and access, as assessed in Section 6.3, and minor noise and visual amenity and air quality impacts on nearby businesses and road users, as assessed in Sections 6.5.2 and 6.4.2.

Construction activities also have the potential to result in temporary disruptions to services (power, water, gas and telecommunications) for businesses located in the Beresfield industrial estate (refer Section 3.5.). These impacts are considered to be minimal as the disruptions would be short term in nature and the businesses would be notified in accordance with Roads and Maritime utility relocation requirements.

Social infrastructure

Apart from the Driver Reviver site, considered below, there would be negligible impact on the identified social infrastructure as they are not located in the immediate vicinity of the proposal area.

Informal car park area and Driver Reviver site

The informal car park area and Driver Reviver site would be closed at the start of construction. The portion of the site not included in the proposed road widening works would be used as a construction laydown and stockpile area. The initial closure of the area would be managed by putting in place the mitigation measures outlined in Section 6.6.3.

Operation

Land use and future land use

The operation of the proposal would not change existing or future land uses surrounding the proposal area. The proposal would benefit the Beresfield industrial estate and the proposed Black Hill industrial estate by improving access to these areas by reducing traffic congestion.

Socio economic

Once operational, the proposal would provide social and economic benefits for local and regional communities and businesses by improving traffic efficiency. Benefits of improved efficiency include:

- ***Improving the performance of the NSW economy*** – Reducing delays at the proposal reduces freight operating costs and improves productivity for heavy vehicles and light commercial vehicles travelling on the Sydney-Brisbane corridor
- ***Improving urban amenity/liveability*** – Reducing delays at the intersection, reduces travel times for people accessing employment and services in the Hunter, Mid-North Coast and New England Regions. Improved traffic flow also reduces vehicle emissions such as air pollution and greenhouse gas, as well as crashes and vehicle operating costs.
- ***Improved access to the Beresfield Industrial estate*** – Reducing existing congestion would stimulate business in the estate as current congestion along Weakleys Drive deters potential investors/customers
- ***Provision of a safer road environment***
- ***Improved conditions for cyclists*** – Via widened shoulders and removal of the roundabout and future pedestrian crossings if required.

Social infrastructure

The operation of the proposal would provide improved access to the identified social infrastructure surrounding the proposal area.

Informal car park area and Driver Reviver site

Driver Revivers have historically played a role in fatigue management. Driver reviver sites have been closed on the Pacific Highway where highway upgrades have been completed and service centre strategies implemented.

Closing the Driver Reviver site would not impact on the ability of motorists to stop when tired. There is an existing 24 hour service centre about 300 metres from the intersection on John Renshaw Drive which caters for northbound holiday traffic. There are opportunities for motorists to stop when tired at Heatherbrae (11 kilometres to the north) and Raymond Terrace (18 kilometres to the north). The Twelve Mile Creek rest area is also located about 30 kilometres to the north of

the existing site. This rest area has a Driver Reviver during peak holiday periods. There are regular opportunities for motorists to stop between Sydney and Coffs Harbour. The greatest difference between stops on the Sydney to Coffs Harbour route is between the M1 Morisset 24 hour service centre and the Beresfield service centre (49 kilometres). This difference would not increase with the closure of the site due to the presence of the Beresfield 24 hour service centre.

Roads and Maritime is investigating alternative options for a Driver Reviver in consultation with the Morisset Lions Club. Any new rest areas along the M1 Pacific Motorway would be assessed within the context of an M1 Pacific Motorway corridor strategy as a separate proposal.

The removal of the site would not impact on the ability of road users to park and commute or meet with other road users in the area. There are a range of locations in the local area which would provide safer meeting spots and/or opportunities for parking.

The broader road safety benefits of the proposal are discussed in Section 6.2.3.

6.6.3 Safeguards and management measures

Safeguards and measures to manage the potential socio-economic impacts are summarised in Table 6-32. Specific measures to manage impacts associated with traffic, noise, air quality and visual amenity are outlined in the following sections:

- Traffic and transport – Section 6.2.4
- Noise and vibration – Section 6.3.5
- Air Quality – Section 6.4.3
- Visual amenity and Landscape – Section 6.5.3.

Table 6-32 Safeguards and management measures for socio-economic land use issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
SE01	Socio-economic	A Community and Stakeholder Consultation Sub Plan (CSCP) would be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CSCP would include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected businesses and social infrastructure, including changed traffic and access conditions • Contact name and number for complaints. The CSCP would be prepared in accordance with the *Roads and Maritime's Community Engagement and Communications: A resource manual for staff* (2012).	Contactor	Detailed design / pre-construction	Core standard safeguard SE1
SE02	Impacts on businesses and the community during construction	At least two weeks prior to the start of work, businesses and social infrastructure in the Weakleys Drive industrial precinct would be notified of the nature and likely duration of the proposal and provided with a 24 hour phone hotline that would be established for the construction duration.	Construction contractor	Pre-construction/ construction	Additional standard safeguard
SE03	Impacts on businesses and the community during construction	Ongoing community consultation would be carried out in accordance with the *Roads and Maritime's Community Engagement and Communications: A resource manual for staff* (2012) and the proposal's consultation strategy.	Roads and Maritime Construction Contractor	Construction	Additional standard safeguard
SE04	Impacts on businesses and the community during construction	A complaint handling procedure and register would be included in the CEMP.	Construction Contractor	Construction	Additional standard safeguard

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
SE05	Interruptions to utility services	Businesses and social infrastructure in the Beresfield industrial estate would be informed before any interruptions to utility services that may be experienced as a result of utilities relocation.	Construction Contractor	Construction	Additional standard safeguard
SE06	Closure of Driver Reviver	Roads and Maritime would provide appropriate signage and information on the Roads and Maritime and Driver Reviver websites notifying road users of the closure of the Beresfield site and provide information of alternative rest areas, service facilities and Driver Revivers at Ourimbah and Twelve Mile Creek.	Roads and Maritime	Construction	Additional standard safeguard
SE07	Closure of Driver Reviver	Roads and Maritime is investigating alternative sites for a Driver Reviver. Any new site would be considered under a separate proposal and environmental assessment.	Roads and Maritime	Operation.	Additional standard safeguard

6.7 Hydrology, flooding and water quality

6.7.1 Methodology

The information in this section was obtained primarily from the Preliminary Environmental Assessment (Advitech, 2014), the Newcastle City Council's *Development of Newcastle City-wide Floodplain Risk Management Study and Plan* (2012) and in particular the *Hydrology and Hydraulics Assessment* (Aurecon, 2016) compiled as part of the development of the concept design.

As there are no documented flood studies within the study catchment area a TUFLOW model was used to model the existing drainage as well as the effects of the proposal on flood impacts. Construction water quality impacts were assessed to determine the need for management measures. Operational water quality impacts were also assessed using the *Model for Urban Stormwater Improvement Conceptualisation* (MUSIC) model.

6.7.2 Existing environment

Hydrology and drainage

The proposal is located within the Viney Creek catchment. Viney Creek extends under John Renshaw Drive about 650 metres west of the intersection before flowing in a north, north–easterly direction crossing Weakleys Drive about one kilometre north of the intersection before continuing to the north–east and draining into Woodberry Swamp about 2.5 kilometres from the proposal area.

Woodbury Swamp is an extensive floodplain wetland system that is partially subject to water level management via drains and floodgates. It is listed as a SEPP 14 wetland and is connected via Greenways Creek to the Hunter River located about six kilometres to the north–east. The Hunter River flows into the Hunter Estuary about 16 kilometres downstream (ten kilometres to the east as the crow flies) from the proposal area. The Hunter Estuary Wetlands is a RAMSAR listed wetland and is therefore a matter of national significance under the EPBC Act.

The catchments contributing flow to the proposal area fall into two distinct land uses:

- Undeveloped rural –these densely vegetated land areas are located south of the intersection and comprise the majority of the catchment drained through the existing major culverts under the M1 Pacific Motorway. The total area of the undeveloped catchments draining under the M1 Pacific Motorway and then under John Renshaw Drive is about 72 hectares
- Industrial –The industrial land use is located north of the intersection and drains through the drainage culverts under Weakleys Drive. The total area of industrial land use catchment is about 4.2 hectares.

The site has a general slope towards the north–east with the exception of John Renshaw Drive east which has a steep hill sloping towards the west. Rainfall captured on the road surface generally drains towards existing pits located on the roads or stormwater drains located on the shoulder of the roads. A constructed drainage line (concrete lined in places) extends along the western side of the M1 Pacific Motorway.

There are several existing pipes and two 1200 millimetre pipes under the M1 Pacific Motorway to carry stormwater west of the M1 Pacific Motorway to the major constructed drainage channel located in the road corridor to the east. This channel then crosses under John Renshaw Drive just

east of the existing roundabout through three 1200 millimetre diameter pipes into the constructed drainage channel between Weakleys Drive and the industrial development to the north–east of the intersection. This drainage channel forms a topographic low area just east of the intersection, with drainage across most of the site flowing into this highly modified watercourse.

A deep open drain in the north–western corner of the intersection flows under Weakleys Drive in twin pipe culverts just to the north of the intersection and discharges into the constructed drainage channel. This drainage channel flows in a northerly direction from the site, via a detention pond in the Beresfield industrial area before entering Viney Creek about 1.35 kilometres from the proposal area.

Flooding

The Newcastle City Council's *Development of Newcastle City-wide Floodplain Risk Management Study and Plan* (2012) indicates that the proposal area is not located within flood prone land. Flood prone land is land potentially affected by the one in 100 year average return interval (ARI) flood.

The closest flood fringe land is located about 400 metres north–east of the proposal area, within the stream system on the northern side of Enterprise Drive, Beresfield. The closest 'Flood Storage area is located about 850 metres south–east of the site, and the closest 'floodway' is located about 2.5 kilometres to the east of the proposal area.

There are no documented flood studies within the study catchment area. In the absence of existing information an analysis has been carried out to define the peak flows at the various major culverts within the proposal area. The TUFLOW model showed that the existing major culverts under the M1 Pacific Motorway can convey between a one in 20 year and one in 50 year ARI. The culverts under John Renshaw Drive just east of the intersection can carry about the one in 5 year ARI. The proposal does not include any capacity upgrades for these culverts.

Water quality

Water quality parameters have not been established for the drainage channel to the east of Weakleys Drive, or for the downstream Viney Creek. The drainage channel receives runoff predominately from the relatively natural catchments south of the intersection and therefore the water quality in the stormwater channel is expected to be mostly characteristic of runoff from undeveloped catchments. However existing sources of degraded water quality inputs include the existing road system and Beresfield industrial area.

6.7.3 Potential impacts

Construction

Hydrology and Flooding

Construction activities have the potential to result in temporary changes in onsite overland flows and obstruction of existing drainage inlets particularly during installation of drainage structures. This could result in localised flooding. The detailed design would consider phasing and construction methodologies of the drainage works to mitigate the risk of localised flooding.

Water Quality

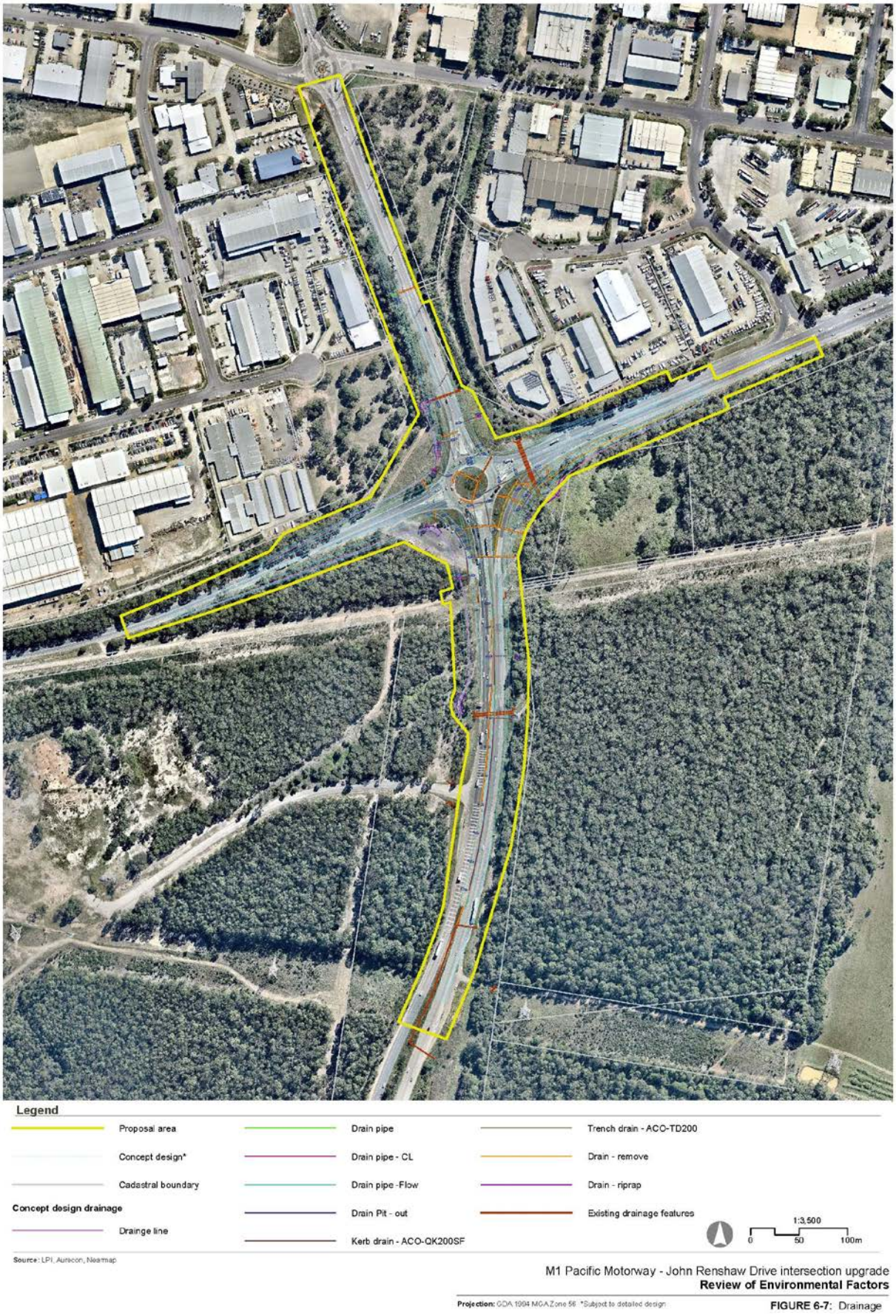
The construction phase of the proposal has the potential to result in impacts on local water quality through:

- Construction activities with a risk of erosion including bulk earthworks, vegetation removal, stockpiling, trenching for utilities and drainage works
- Erosion of soil and sedimentation through stormwater runoff from exposed surfaces and transport of eroded sediments to local receiving drainage channels

- Accidental spills of fuels, oils or other chemicals from construction vehicles or equipment. Contaminants could enter the local stormwater system and be transported to sensitive downstream receiving environments.

While there are sensitive environments downstream of the proposal area including Ramsar and SEPP 14 wetlands, the risk of any detrimental effect is considered low (refer to discussion of operational water quality impacts under the following subheading).

Figure 6-7 Drainage



Operation

Hydrology and flooding

The proposal would use the existing and additional drainage structures as described in Section 3.2.3. The pavement drainage system would carry rainfall from the road through a system of pits and pipes to the discharge points. Flows greater than the one in 10 year Average Recurrence Interval (ARI) would flow into the open channels on the M1 Pacific Motorway, John Renshaw Drive and Weakleys Drive via sides of the road.

Open channels are proposed on both sides of John Renshaw Drive west and along the southern side of John Renshaw Drive east. The location of the open channels, and other drainage infrastructure is shown in Figure 6-7.

The TUFLOW modelling showed that the proposal would increase 1 in 100 year ARI flood levels upstream of the existing culverts located under the M1 Pacific Motorway by about 0.08 metres. In addition, the modelling showed that the 1 in 100 year ARI immediately upstream of John Renshaw Drive east would be increased by about 0.11 metres as a result of raising the road level. This increase in flood level extends upstream of the culverts within the M1 Pacific Motorway road reserve.

Downstream of the proposal area, flood levels are predicted to be lower than existing levels as a result of the raising of John Renshaw Drive. This reduction in flood level is observed in all flood events aside from the 1 in 5 year ARI design event, where flood levels are predicted to increase by approximately 0.03 metres compared to existing levels. This small increase would not have any impacts on the major drainage system downstream of the proposal area which can carry much larger flows.

The proposal would not alter the topography of the locality or result in any changes to surface drainage pathways. The pavement drainage is designed to accommodate stormwater flows generated from the upgraded road sections. As a result, the operation of the proposal would have no adverse impacts on drainage or hydrology.

Water Quality

The MUSIC model developed for the project demonstrated that the impact of the proposal on the downstream water quality is minimal (between 1.3 and 2.3 per cent increase in annual pollutant loads). The proposal is therefore unlikely to result in any significant water quality impact during operation.

The intersection would be converted from a roundabout to traffic lights which is designed to reduce the occurrence of accidents. The reduced risk of associated spills has resulted in no formal spill containment structures being incorporated into the detailed design. In the event of spill incident elements of the drainage system can be portioned off from the downstream drainage system to limit the spread of spills.

6.7.4 Safeguards and management measures

Safeguards and management measures to manage hydrology, flooding and water quality impacts are summarised in Table 6-33.

Table 6-33 Safeguards and management measures for hydrology, flooding and water quality issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
SW01	Soil and water	A site specific Erosion and Sediment Control Plan (ESCP) would be prepared and implemented as part of the CEMP that would demonstrate how the requirements of the REF and legislation would be implemented. The Plan would include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor	Pre-construction	Core standard safeguard SW2 Section 2.2 of QA G38 Soil and Water Management
SW02	Erosion and sedimentation	The ESCP would specify measures to be implemented and maintained in accordance with the Landcom *Managing Urban Stormwater, Soils and Construction Guidelines* and G38, R178 and the RTA Biodiverstiy Guidelines. The controls should: • Prevent onsite erosion and sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets • Minimise the area of exposed soils with work areas to be stabilised progressively durin g works • Plan and deliver drainage works to avoid impacts to receiving water quality.	Construction contractor	Construction	Additional Standard Safeguard Section 2.2 of QA G38 Soil and Water Management
SW03	Erosion and sedimentation from stockpiles	The maintenance of established stockpile sites during construction is to be in accordance with the RTA *Stockpile Site Management Guideline (2011)*.	Construction contractor	Construction	Additional Standard Safeguard Section 2.2 of QA G38 Soil and Water Management
SW04	Contamination of surface	All fuels, chemicals, and liquids would be stored at least 50 metres away from the existing stormwater drainage system and would be	Construction contractor	Construction	Additional Standard

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	water	stored in an impervious bunded area within the compound site. The refuelling of plant and maintenance of machinery would be undertaken in designated areas.			Safeguard Section 2.2 of QA G38 Soil and Water Management

6.8 Landform, geology and soils

6.8.1 Methodology

The following reports have been used to describe the existing landform, geology and soils and to inform the impacts on the proposal and of the proposal on the environment:

- *Geotechnical Investigation M1 Pacific Motorway/John Renshaw Drive/Weakleys Drive Intersection Upgrade, Black Hill/Beresfield* (RCA, 2015a)
- *M1 Pacific Motorway intersection upgrade at Weakleys Drive and John Renshaw Drive: Geotechnical Design Report* (Aurecon, 2016)
- *Newcastle Soil Landscape Map (Soil Landscape Series Sheet 9232) Newcastle Local Environmental Plan (2012) Beresfield ASS Risk Map (Department of Land and Water Conservation)*
- *Acid Sulfate Soil Management Advisory Committee (1998) Acid Sulfate Manual, NSW Agriculture*
- *Contamination Assessment M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive Intersection Upgrade, BlackHill/Beresfield (RCA, 2015b)*
- Preliminary Erosion and Sedimentation Assessment (Roads and Maritime, 2016) – See Appendix H.

These reports provide geotechnical data for input into the design of the proposal and include descriptions of site surface and sub surface conditions and details of the field and laboratory investigations undertaken. Key findings of the above investigations are summarised in the following section.

6.8.2 Existing environment

The main landscape units are low hills generally sloping towards the north, associated with flat alluvial terraces along Viney Creek in the west and Hexham Swamp towards east. The natural landscape of the area has been significantly altered by vegetation clearing, road infrastructure, power line easements and an underground water pipe line. The surrounding landscape areas covered by dense vegetation still have the potential to retain relatively undisturbed soil profiles.

Landform

Topographically the site is situated within an area of undulating low hills and rises. The natural surface in the vicinity of the intersection has been modified mainly by filling associated with road construction with some sections/areas of the roads within and in the vicinity of the intersection constructed on fill embankments, notably along the eastern side of the M1 Pacific Motorway to the south of the intersection and in the vicinity of creek/watercourse crossings.

The road surface levels are relatively flat along the M1 Pacific Motorway and Weakleys Drive, however John Renshaw Drive west slopes down towards the intersection with a crest in the vicinity of the western extent of the proposed work. John Renshaw Drive east slopes to the west towards the creek / watercourse which passes beneath John Renshaw Drive just to the east of the intersection. Surface slopes to the north of the intersection generally slope towards the drainage channel to the east of Weakleys Drive.

Geology

The study area is situated on folded Permian rocks that consist of shales, tuffs, sandstone, mudstones, and coal, with some lava beds in the basal portion, and contain the extensive coal measures that are mined throughout the region. Generally, the Permian rocks are only moderately resistant, consequently forming the lowlands.

RCA (2015a) state that the site is situated within the Tomago Coal Measures, which are noted to generally comprise siltstone, sandstone, coal, tuff and claystone rock types.

Soils
The 1:100,000 Newcastle Soil Landscape Map (Soil Landscape Series Sheet 9232) indicates that the site is situated generally within the Beresfield (Be) soil landscape, with some smaller areas described as Cockle Creek soil landscape. A description of the two soil landscapes is provided below.

Beresfield (Be) soil landscape
The Beresfield soil landscape comprises silt and sandy loam topsoil materials, and silty clay subsoils. The landscape is described as undulating low hills and rises on Permian sediment in the east Maitland Hills region. The soils may have foundation and water erosion hazards, with seasonal waterlogging. They are highly acid soils of low fertility.

Cockle Creek soil landscape
The Cockle Creek soil landscape is characterised by narrow floodplain alluvial fan deposits. The soils may have foundation and water erosion hazards, with permanently high water tables in localised areas. They are acidic, infertile, sodic, dispersible soils of low wet strength. The Cockle Creek soil landscape is located in the vicinity of the northern side of the intersection and the eastern side of Weakleys Drive to the north of the intersection.

Existing fill material
Fill was encountered in all test pits during the geotechnical investigations to depths varying between 0.1 metres to 1.9 metres. The fill was highly variable but generally could be divided into road base fill (slag fill), cohesive fill (clay fill) and granular fill (including sandy fill and gravel fill).

Acid sulfate soils
Acid sulfate soils (ASS) refer to soils and sediments containing metal sulphides. In an undisturbed state, these soils and sediments pose no or low risk to the environment. When disturbed and exposed to oxygen, these soils and sediments can generate sulfuric acid and toxic quantities of iron, aluminium and other metals, which can be readily released into the environment (ASSMAC, 1998). Most ASS are formed by natural processes under specific environmental conditions, which generally limits ASS occurrence to low lying sections of coastal floodplains, rivers and creeks at surface elevations less than about five metres AHD.

The Newcastle Local Environmental Plan (2012) Acid Sulfate Soils Map shows that the site is generally classified as ‘Class 5’ (lowest risk), with the areas at the northern and north–eastern extent of the study site classified as ‘Class 3’ (medium risk). The Beresfield ASS Risk Map (Department of Land and Water Conservation) indicates that there is a low probability of the occurrence of ASS materials at depths between one metre and three metres below the ground surface in the vicinity of the northern side of the intersection.

Acid sulfate screening tests were undertaken on three borehole and one test pit sample (RCA, 2015a). The ASSMAC (1998) guidelines indicate that potential ASS conditions are present where the pH of soil in peroxide is less than 3.5 and/or the pH change during tests (pHF – pHFOX) is greater than one. None of the samples tested had a pH in peroxide less than 3.5, however one of the samples tested had a pH change of greater than one (RCA, 2015a) and is therefore potentially ASS. This sample was from a depth of 0.6–0.8 metres.

Contaminated land
The proposal area is located next to the Beresfield industrial precinct, located north of John Renshaw Drive. The former Boral asphalt facility is also located about 300 metres west of the M1

Pacific Motorway. Searches of official databases for Beresfield were carried out on 10 December 2015, and included:

- NSW EPA Contaminated Land Record – Indicated that there are no contaminated sites within the suburb of Beresfield. The closest source of potential contamination to the study site is the Green Acres Farm at Woodland Close, Tarro, about 3.2 kilometres east of the proposal
- A review of the Protection of the Environment Operations Act 1997 public register showed that there were five licenced operators for properties or operations carried out in Beresfield. Of these only two are still current and only one is next to the study area. One site Fairfax Regional Printers Pty Limited is located about 120 metre north–east of the proposal on Enterprise Drive and is licenced for printing, packaging and visual communications waste generation. There are no recent notices on record (since 2009) for the properties near the proposal.

The Contamination Assessment report (RCA, 2015b) indicated that several surface soils in the proposal area are impacted by elevated concentrations of zinc, benzo (a pyrene and TRH>C16 – C34 which is likely due to spills/leaks from cars/truck, car/truck accidents and other sources of a similar nature. There was some potential for elevated concentrations of benzo(a)pyrene to be due to trace asphalt fragments generally found within surface soils at the site (refer to the next section).

Coal Tar

Coal tar is a by-product of the coal distillation process. Between about 1973 and 1977 coal tar was commonly used as a binder instead of bitumen in asphalt mixes, particularly in the Sydney and Newcastle areas. Coal tar continued to be used in roads in very small quantities up until about 1989 in some asphalt mixes and some pre-coated aggregate for sealing. It has also on occasions been inadvertently used in recycled asphalt mixes (Roads and Maritime, 2015d).

RCA (2015b) identified the presence of coal tar along John Renshaw Drive. This was indicated from visual and olfactory evidence (slight coal tar odour) in three pavement cores during geotechnical field investigations. The presence of coal tar is likely to be associated with the historical development of the road pavements below the site.

Aurecon (2016) tested a sample of potentially coal tar contaminated asphalt from John Renshaw Drive using the RMS T542 test procedure. The test resulted in coal tar not being detected however it should be recognised the test procedure used is not always reliable. It is therefore considered based on the RCA (2015b) findings that there is the potential for coal tar asphalt to be present beneath the existing pavement surface along John Renshaw Drive.

6.8.3 Potential impacts

Construction

Landform, geology and soils

There would be no significant change to landform within the proposal area as the vertical and horizontal alignments of the proposal have been designed to utilise the existing pavement and drainage structures. As outlined in Section 3.3 this would minimise the requirements for earthworks through the proposed overlaying of the existing pavement rather than excavation and replacement. Similarly, there would be no impact to the underlying geology of the area.

The majority of earthworks would be associated with road widening activities outside of the existing road pavement and would include stripping and stockpiling of topsoil, removal offsite of unsuitable material and importation of suitable fill material. Earthworks would also be required for the installation of drainage structures as identified in Section 3.2.3 and minor proposed utility works as outlined in Section 3.5.

Water and wind erosion could result from earthworks, excavation, vegetation clearing, stockpiles and other construction activities. Further detail on potential air and water quality impacts of erosion are contained in Sections 6.4 and 6.7 respectively.

Roads and Maritime carried out a Preliminary Erosion and Sedimentation Assessment for the proposal (contained in Appendix H). This assessment determined that the proposal was not deemed high risk in terms of erosion due to the existing level topography and the works being predominantly within the existing road formation. The site was also deemed low risk in terms of there being no site constraints which would limit the implementation of effective sedimentation controls. Potential erosion impacts would be managed by the mitigation measures outlined in Sections 6.8.4.

There is a low probability of ASS/PASS soils being present within the soils on the northern side of the intersection and no ASS/PASS soils are likely to be present the other areas of the proposal. It is considered unlikely that the work would disturb ASS/PASS soils (if indeed present) due to there being minimal excavation work proposed in this location.

Contamination
Construction works within the proposal area have the potential to intercept surface soils impacted by elevated concentrations of zinc, benzo (a) pyrene and TRH>C16 – C34 as identified in RCA (2015b) which is likely due to spills/leaks from cars/truck, car/truck accidents and other sources of a similar nature. RCA considered that based on the existing and proposed site use, it was not likely that the elevated concentrations represented a significant risk of harm to human health or the environment. Disturbance of potentially contaminated materials may also expose construction workers and/or the general public and the environment to these contaminants if appropriate controls are not put in place.

Coal tar asphalt has been identified below the existing pavement layer in at least three locations along John Renshaw Drive. Due to the construction methodology of overlaying of the existing pavement, potential disturbance of this material would be limited to minor utility relocations and installation of drainage structures.

There is also potential for construction activities to result in contamination of soil and/or water due to leaks and spills of potentially contaminating materials or incorrect storage of hazardous materials and chemicals.

Measures to manage the potential contamination impacts arising from the proposal are outlined in Sections 6.8.4.

Operation
Operation of the proposal is not likely to result in any significant impacts on landform, geology or soils. The risk of soil erosion during operation would be minimal as all areas impacted during construction would be sealed or rehabilitated and landscaped to reduce soil erosion.

6.8.4 Safeguards and management measures

Safeguards and management measures to manage landform, geology and soils impacts are summarised in Table 6-34. Other safeguards and management measures that would address potential erosion and sedimentation impacts are identified in Sections 6.8.4, while safeguards to manage the reuse or disposal of excess spoil including potential coal tar asphalt are outlined in Section 6.11.3.

Table 6-34 Safeguards and management measures for landform, geology and soils issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
C01	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area would cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.	Contractor	Detailed design / Pre-construction	Core standard safeguard C2 Section 4.2 of QA G36 Environment Protection
C02	Accidental spill	A site specific emergency spill plan would be developed, and include spill management measures in accordance with the Roads and Maritime *Code of Practice for Water Management* (RTA, 1999) and relevant EPA guidelines. The plan would address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Contractor	Detailed design / Pre-construction	Core standard safeguard C3 Section 4.3 of QA G36 Environment Protection
C03	Environment incident	All incidents would be classified in terms of Roads and Maritime Services Incident Classification Procedure (February 2016).	Contractor	Construction	Additional Safeguard
C04	Potential or actual acid sulphate soils	Potential or actual acid sulphate soils are to be managed in accordance with the RTA's *Guidance for the Management of Acid Sulphate Materials 2005.*	Construction contractor	Construction	Additional safeguard
C05	Coal Tar	Coal tar encountered is to be managed in accordance with Roads and Maritime's Technical Direction Environment ETD 2015/021 Coal tar asphalt handing and disposal. Including the disposal of all excavated coal tar at a licenced landfill.	Construction contractor	Construction	Additional safeguard

6.9 Aboriginal heritage

6.9.1 Methodology

A Stage 1 Archaeological Heritage Assessment was carried out by Roads and Maritime, in accordance with the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) (RMS, 2011). The Stage 1 assessment revealed that the study area required further investigation of Aboriginal heritage and objects that may exist in the areas to be impacted by the proposed upgrade.

A Stage 2 assessment in accordance with the PACHCI guidelines was prepared (Advitech, 2015a). This included adhering to the requirements of the NSW Office of Environment and Heritage (OEH) and the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DDCoP) (DECCW, 2010). This Stage 2 assessment was supplemented by an additional letter advice in response to minor changes in the study area (Advitech, 2016a).

The next section summarises the Stage 2 Aboriginal heritage assessment and additional letter report completed by Advitech as part of the preparation of this REF. The full assessment and additional letter report are contained in Appendix G.

6.9.2 Existing environment

Historical background

The geomorphological evolution of the Newcastle region is complex and there are two major periods that significantly changed the landscape for past Aboriginal occupation of the area. The relevant period of environmental history for Aboriginal occupation is within the last 50,000 years with the critical time being the last 20,000 years.

At the last glacial maximum, 20,000 years ago, the sea level was about 120 metres lower than present and the shoreline was about 30 kilometres seaward of its present position. Sea levels then rose rapidly from about 17,000 years ago until 10,000 years ago, with sea level rates tapering until the present level that was reached at 6,000 years ago. It is likely that the study area was part of, or adjoined by an open bay (now known as Hexham Swamp) and was most likely favourable for occupation due to its elevation and the nearby Hexham Swamp and its resources.

The Pambalong People (also known as Bambalong Tribe) occupied the Hexham Swamp area. It is unclear whether the Pambalong People were a subgroup of the Awabakal Tribe or a group in their own right. It is also not certain whether the Pambalong People occupied the actual study area. Gunson (1974:30 in Advitech, 2015a) states that the Awabakal were originally the largest clan of a tribe in the Lake Macquarie region.

Following European settlement of the area in the 1820s, the landscape was subjected to a range of disturbances including extensive clearing, agricultural cultivation, pastoral grazing, residential developments and mining. The more recent construction of the M1 Pacific Motorway and associated drainage and utilities, upgrades of the road network and development of the surrounding industrial estates has impacted on the natural soil profiles and vegetation.

Database searches

A search of the OEH Aboriginal Heritage Information Management system (AHIMS) register on 5 December 2014, showed that 71 known Aboriginal sites are currently recorded within one kilometre of the study area. This included 36 open camp sites, 30 isolated finds, four Potential Archaeological Deposits (PAD) and one scarred tree. Seventeen of the sites were noted as being either partially or completely destroyed. A detailed AHIMS search was also conducted in May 2015

at the request of Roads and Maritime. This search indicated 35 known Aboriginal sites within 300 metres of the proposal area (see Figure 6-8).

Registered sites AHIMS #38-4-0551 (an isolated artefact) and AHIMS #38-4-1213 (open site) are the only sites recorded within the immediate vicinity of the proposed works. Site #38-4-1213, which is outside of the proposal area, has been destroyed. The isolated artefact (site #38-4-0551) is located on the north–western boundary of the proposal area and may potentially be impacted by the proposal.

Site inspection

A preliminary investigation was carried out by Advitech in January 2014 to identify the Aboriginal cultural heritage features that may coincide with the proposal. It was concluded that a number of Aboriginal archaeological sites are located within and in close proximity to the preliminary investigation area and more detailed investigation is needed to assess the cultural heritage resources of the area and the nature and level of the proposed impact on the identified sites.

A detailed survey for Stage 2 PACHCI was therefore carried out on 17 March 2015 in accordance with. The survey team comprised of an Archaeologist, a representative of the Mindaribba Local Aboriginal Land Council (MLALC) and the Roads and Maritime Aboriginal Cultural Heritage Officer and Project Manager.

The survey included a single transect varying from one to three metres apart depending on accessibility and focused on those areas of exposure at the extents of the existing roadways that would be impacted by the proposed works in order to identify any artefactual evidence. All areas of the preliminary investigation area were surveyed, excluding the in-use road surfaces.
Four survey units were identified. Survey Unit one (SU1) encompasses the M1 Pacific Motorway from the roundabout, SU2 encompassed the western extent of John Renshaw Drive, SU3 includes Weakleys Drive and SU4 encompassed the eastern extent of John Renshaw Drive.

The survey noted the original soil profiles of the investigation area had largely been destroyed. No undisturbed areas were noted and no objects or sites were identified. This was determined to be most likely due to the highly disturbed land use including the establishment of the existing roadways, utility easements and the Beresfield industrial subdivision. This land use had resulted in impacts including loss of natural soil profiles through the substantial earthworks involved in establishing the current land use. Such impacts had destroyed any evidence of past Aboriginal occupation.

Figure 6-8 AHIMS heritage sites

Map omitted

Archaeological potential

While the site survey of the investigation area did not reveal any resources or artefacts, the assessment overall found that a number of Aboriginal sites were identified as existing or known to have previously existed in proximity to the proposal area. However previous land use, including large scale road levelling and construction, drainage works and diversions, associated infrastructure and signage indicate that the proposal area is highly disturbed and any artefacts originally present in the area would have most likely been destroyed.

6.9.3 Potential impacts

Construction

The proposed construction activities would impact on the soil profiles surrounding the road corridors.

While the proposal has a small potential to impact on the AHIMS registered isolated artefact (#38-4-0551) located just to the north of the proposal area boundary on John Renshaw Drive (refer Figure 6-8), it is considered appropriate safeguards as outlined in Section 6.9.4 including provision of a five metre wide fenced buffer zone around the site would ensure there is no impact on this registered site. Therefore no Aboriginal Heritage Impact Permit (AHIP) would be required for the proposal.

Due to the highly disturbed nature of the site and the low archaeological potential of the proposal area, it is considered unlikely that any objects of Aboriginal heritage would be impacted by the proposed works.

Operation

Operation of the proposal is not anticipated to impact on the AHIMS registered isolated artefact (#38-4-0551) as it is located outside of the proposal area in a stand of trees which would remain as part of the proposal.

6.9.4 Safeguards and management measures

Measures to manage the potential impacts on Aboriginal Heritage from the proposal are summarised in Table 6-35.

Table 6-35 Safeguards and management measures for Aboriginal heritage issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
AH01	Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) would be prepared in accordance with the Procedure for Aboriginal cultural heritage consultation and investigation (Roads and Maritime, 2012) and implemented as part of the CEMP. It would effectively control the risk to known and unknown artefacts on site and in the adjacent areas.	Contactor	Pre-construction	Core standard safeguard AH1 Section 4.9 of QA G36 Environment Protection
AH02	Impacts on identified isolated artefact	Protect the AHIMS registered isolated artefact (#38-4-0551) located just to the north of the proposal area boundary on John Renshaw Drive by: • Installation of a five metre fenced buffer zone around the artefact • Site induction for all staff, contractors and others should include identification of exclusion zones and statutory requirements.	Construction contractor Roads and Maritime	Pre-construction/ Construction	Standard safeguard Section 4.9 of QA G36 Environment Protection
AH03	Aboriginal heritage	• The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) would be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction.	Contactor	Construction	Core standard safeguard AH2 Section 4.9 of QA G36 Environment Protection

6.10 Non-Aboriginal heritage

6.10.1 Methodology

The historical heritage assessment included a review of heritage database searches including the Department of the Environment Australian Heritage database, the NSW State Heritage Register, the NSW State Heritage Inventory, the Newcastle Local Environmental Plan 2012 and Roads and Maritime's Section 170 register.

6.10.2 Existing environment

The area was settled by European's from the 1820s and used for timber harvesting, agricultural cultivation, pastoral grazing, residential and industrial developments and mining. The area affected by the proposal has previously been disturbed by construction of the road system and associated drainage works, and utilities. A search of the statutory and non-statutory lists did not identify any non-Aboriginal heritage items within or in the vicinity of the proposal area.

6.10.3 Potential impacts

Construction and Operation

The heritage assessment found that neither construction nor operation of the proposal would impact on any listed non-Aboriginal heritage items. No areas of potential archaeological or heritage significance have been identified within or in the vicinity of the proposal area. It is considered unlikely that unidentified non-Aboriginal heritage items would be located in the proposal area.

6.10.4 Safeguards and management measures

Safeguards and management measures to manage potential impacts to non-Aboriginal heritage are summarised in Table 6-36.

Table 6-36 Safeguards and mitigation measures to manage Non-Aboriginal heritage

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
NAH01	Non-Aboriginal heritage	• The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) would be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered.	Contactor	Construction	Core standard safeguard H2 Section 4.10 of QA G36 Environment Protection

6.11 Waste

6.11.1 Policy Setting

Waste Avoidance and Resource Recovery Act 2001

Waste management would be undertaken in accordance with *the Waste Avoidance and Resource Recovery Act 2001* (WARR Act). The objectives of this Act include:

- To encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development
- To ensure that resources management options are considered against the following hierarchy:
  - Avoidance of unnecessary resource consumption
  - Resource recovery (including reuse, reprocessing, recycling and energy recover)
  - Disposal
- To provide for the continual reduction in waste generation
- To minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste
- To ensure that industry shares with the community the responsibility for reducing and dealing with waste
- To achieve integrated waste and resource management planning, programs and service delivery on a State-wide basis
- To assist in the achievement of the objectives of the Protection of the Environment Operations Act 1997.

Roads and Maritime encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development (refer to Section 8.2).

Waste Classification Guidelines 2014

The *NSW EPA Waste Classification Guidelines 2014* (the Guidelines) details how waste should be divided into groups with similar risks to the environment and human health. The groups of waste defined in clause 49 of Schedule 1 of the Protection of the Environment Operations Act 1997 (POEO Act) are:

- Special waste
- Liquid waste
- Hazardous waste
- Restricted solid waste
- General solid waste (putrescible)
- General solid waste (non-putrescible).

Waste classification should be undertaken in accordance the guidelines for any materials which are excavated and removed from the work area. The waste classification then determines how the waste must be managed and disposed of.

6.11.2 Potential impacts

Construction

During construction, the proposal would generate the following potential waste streams:

- General solid waste including:
  - Scrap metal from reconstruction and/or replacement of existing road infrastructure
  - Unsuitable soils for construction purposes such as those with high clay or organic content
  - Excess construction materials such as asphalt or concrete

    - Redundant pavement material from replacement and/or reconstruction of sections of the existing road including waste generated through proposed widening works, roundabout removal and median works
    - Paper, food and general rubbish generated by the construction work force
    - Packaging materials from items delivered to site, such as pallets, crates, cartons, plastics and wrapping materials
- Green waste from vegetation clearing and trimming required for the proposal
- Liquid waste including sewage generated from work force, stormwater run-off from construction areas, small volumes of excess fuel, oils as required for vehicle, road plant maintenance
- Potential coal tar contaminated excavated road materials (refer Section 6.8.2)
- Potential ASS.

The inappropriate disposal of the above waste streams can result in impacts to the environment and human health. Mitigation measures to avoid waste impacts are contained in 6.11.3.

In the event that coal tar contaminated materials are encountered during utility or drainage works, these would be disposed of at an appropriately licensed facility. It should be noted that under the *Waste Guidelines 2014* all asphalt waste including coal tar asphalt is pre-classified as General Solid Waste.

Operation

Waste impacts associated with the operation of the proposal are similar to the existing intersection and would be related to littering by road users, some green wastes through maintenance works and potential spills of materials, including hazardous materials resulting from vehicle collisions. This latter potential waste impact would be mitigated by the improved safety at the intersection which would reduce the likelihood of vehicle collisions.

6.11.3 Safeguards and management measures

Measures to manage the potential waste from the proposal are summarised in Table 6-37.

Table 6-37 Safeguards and management measures for waste issues

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
W01	Generation of construction waste	The construction contractor would prepare a waste management plan and a waste management register in accordance with the requirements of Roads and Maritime's *QA Specification G36 – Environmental Protection (Management System).* The plan would include the process for managing excess material.	Construction contractor	Generation of construction waste	Standard safeguard G36 Section 4.11
W02	Generation of construction waste	The generation and management of construction waste is to be managed in accordance with the WARR Act.	Construction contractor	Generation of construction waste	Additional standard safeguard G36 Section 4.11
W03	Re-use of Construction materials	The potential to reuse materials in accordance with *Roads and Maritime Waste Fact Sheet 9: Re-use of waste off site* would be investigated during detailed design and construction.	Roads and Maritime/ Construction Contractor	Detailed design/ Construction	Additional standard safeguard
W04	Management of construction waste	All waste would be classified in accordance with the NSW EPA Waste Classification Guidelines 2014 and disposed of accordingly with supporting documentation.	Construction contractor	Construction	Additional standard safeguard
W05	Management of construction waste	Working areas are to be kept free of rubbish and cleaned up at the end of each working day/night.	Construction contractor	Construction	Additional standard safeguard
W06	Generation of green waste during operation	The generation of green waste would be managed in accordance with the Roads and Maritime *Technical Procedure: Mulch management, Controlling the risk of weeds, pest, and disease*	Roads and Maritime	Operation	Additional standard safeguard

6.12 Climate change and greenhouse gases

6.12.1 Policy setting

Climate Change

Roads and Maritime has prepared *The RMS Climate Change Action Plan* which identifies how Roads and Maritime would:

- Reduce Roads and Maritime's carbon footprint
- Help reduce the carbon footprint of road transport
- Adapt the Roads and Maritime's road transport system to the impacts of climate change
- Manage Roads and Maritime's transition to a low carbon economy.

Greenhouse gas emissions

The Commonwealth Department for the Environment estimates annual greenhouse gas emissions for Australia to fulfil the reporting requirements of the United Nationals Framework Convention on Climate Change and Kyoto Protocol.

Roads and Maritime reports its greenhouse gas emissions and direct energy consumption annually to the Office of Environment and Heritage in accordance with the NSW Government Sustainability Policy. The annual report includes information on greenhouse gas emissions from energy usage associated with the operation of Roads and Maritime Services' properties, street lighting, traffic signals and vehicles.

6.12.2 Potential impacts

Construction impacts

Potential greenhouse gas emission sources associated with the construction of the proposal would include the following:

- Vegetation clearing - the breakdown of organic matter as waste material releases stored CO_2 to the atmosphere
- Carbon dioxide, methane and nitrous oxide generated from liquid fuel (eg diesel and petrol) used in construction plant, vehicles and asphalt production
- Embedded emissions associated with the manufacture and delivery of construction materials
- Electricity usage for construction compound and lighting for night works.

Operational impacts

It is expected that the operation of the proposal would result in a reduction in greenhouse gas due to improved efficiency of the road network and reduced queuing.

Climate change risks during the operation of the proposal would be primarily associated with increased frequency and severity of weather events, which may result in increased peak load on drainage infrastructure and associated inundation of the proposal area.

6.12.3 Safeguards and management measures

Table 6-38 identifies safeguards and management measures which would be implemented to address potential impacts to greenhouse gas and to mitigate potential climate change risks as a result of the proposal.

Table 6-38 Greenhouse gas and climate change safeguards and mitigation measures

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
CC01	Greenhouse gas emissions	• Effective staging of works and site planning to minimise the resources used • Minimise vegetation clearing and maximise on site reuse of green waste in accordance with RTA Biodiversity Guidelines Guide 5 – Re-use of woody debris and bushrock • Use low emodied energy productes where possible • Energy (fuel/electrical) efficiency would be considered when selecting equipment • Equipment would be regularly maintained to retain fuel efficiency • Where feasible, biofuels would be used (biodiesel, ethanol, or blends such as E10 and B80), to reduce greenhouse gas emissions from construction plant and equipment • Plant and office-based equipment (including lights and computers) would be operated in an efficient manner • Locally-sourced materials and staff would be used wherever possible, to reduce transport related emissions.	Construction contractor	Construction	Additional safeguard

6.13 Demand on resources

6.13.1 Resources used

Construction of the proposal would require the use of a number of resources, including:

- Resources associated with the operation of construction machinery, and motor vehicles (including diesel and petrol)
- Material required for road surfaces and infrastructure (road base, paints, solvents, asphalt, spray seal, sand, concrete, aggregate, steel, etc)
- Fill required to meet design levels
- Construction water (for earthworks, dust suppression and concrete)
- Materials required for road signage, street lighting and traffic lights.

The initial estimated quantities of these materials that would be required for the proposal are provided in Section 3.3.5. The materials required for construction of the proposal are not currently limited in availability. However, materials such as metal and fuel are non-renewable and would be used conservatively.

6.13.2 Potential impacts

The above resources are readily available and/or can be sourced locally. At present, the source or requirements for construction water is unknown. The requirement is anticipated to be minimal (for dust suppression, wash down and revegetation etc).
Due to the proposal's limited size and scope of work, it is not expected to impact on the availability of resources for other uses.

6.13.3 Safeguards and management measures

Mitigation measures provided in Table 6-39 would be implemented to minimise resource use

Table 6-39 Resource use safeguards and mitigation measures

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
D01	Demand on resources	• Procurement would endeavour to use materials and products with a recycled content where that material or product is cost	Contactor	Construction	Additional safeguard
D02	Demand on resources	• Any additional fill material required would be sourced from appropriate sources and/or other Roads and Maritime projects.	Contractor	Construction	Additional safeguard

6.14 Cumulative impacts

6.14.1 Study area

This section discusses the potential cumulative impacts that may arise as a result of construction and operation of the proposal interacting with other major developments in the local area.

Cumulative impacts are those that may not be considered significant on their own, but may be more significant when considered in association with other impacts. Cumulative impacts may occur as a result of the interaction of a single project with the proposal or due to the combined effects of a number of projects occurring simultaneously in a given area.

6.14.2 Other projects and developments

The projects summarised in Table 6-40 have been identified as having the potential to contribute towards cumulative impacts, if constructed at the same time as the proposal.

Table 6-40 Past, present and future projects

Project	Construction impacts	Operational impacts
M1 Upgrade Tuggerah to Doyalson The M1 Upgrade Tuggerah to Doyalson project is part of the M1 Pacific Motorway Productivity Package. The upgrade proposes to replace the existing pavement and widen around 12.3 kilometres of the M1 Pacific Motorway from two lanes in each direction to three lanes in each direction between Wyong Road Tuggerah and Doyalson Link Road, Kiar. Work is expected to start in 2017 and will continue for about three and a half years.	• Changes in traffic arrangements • Reduced speed limits through the work zone may also cause delays and disruptions to traffic flow • Night works would be required at times and may cause noise and lighting impacts for nearby residents • Noise, air and visual amenity impacts on road users and nearby sensitive receivers • Construction traffic movements • Clearing of up to 18 hectares of native vegetation, including about 5.5 hectares in total of three EECs.	• Increased traffic capacity along the motorway • More reliable travel times • Improved road safety • Potential operational noise impacts.
M1 Upgrade Kariong to Somersby The M1 Upgrade Kariong to Somersby project is part of the M1 Pacific Motorway Productivity Package. Work will include repairing sections of the concrete motorway between Kariong and Somersby. Widening the motorway between the Kariong	• Changes to the traffic lane arrangements but two lanes in each direction would be maintained during peak travel periods. Lane closures outside peak travel periods may cause delays and disruptions to traffic flow • Reduced speed limits through the work zone may also cause delays and	• Improved road safety by providing an additional travel lane for the northbound and southbound carriageways of the motorway • Overall improvement in the LoS of this section of the M1 Pacific Motorway through reduced traffic congestion and improved road network efficiency

Project	Construction impacts	Operational impacts
and Somerby interchanges to provide three lanes in each direction. Construction of the upgrade is expected to start 2017 and continue for about 12 to 18 months.	disruptions to traffic flow • Night works would be required at times and may cause noise and lighting impacts for nearby residents • Construction traffic movements • Removal of about 12.5 hectares of native vegetation mostly from within the central median.	• Improved travel times for interstate and intrastate freight • Improve existing public transport capability due to reduced travel times.
M1 extension to Raymond Terrace The proposed upgrade includes 15 kilometres of dual carriageway motorway with two lanes in each direction, bypassing Hexham and Heatherbrae and interchanges at Black Hill, Tarro, Tomago and Raymond Terrace The NSW Government has committed $200 million under Rebuilding NSW to get the project ready for construction. Timing for construction is not confirmed and would be dependent on planning approval, future traffic needs and funding availability.	• Changes to the traffic lane arrangements. Lane closures outside peak travel periods may cause delays and disruptions to traffic flow • Reduced speed limits through the work zone may also cause delays and disruptions to traffic flow • Night works would be required at times and may cause noise and lighting impacts for nearby residents • Construction traffic movements • This proposal would require clearing of native vegetation and disturbance of some waterways and wetlands. • Potential impacts on Aboriginal Heritage.	• Improved connection between the M1 Pacific Motorway and the Pacific Highway • Improved traffic flow for motorists and freight for more reliable travel times • Improved accessibility to the surrounding road network • Improved safety for all road users.
Black Hill Employment Land (Northern Estates) NSW Planning and Environment has approved a concept plan for a 167 hectares notional 23 lot subdivision (Black Hill industrial estate) zoned light industrial located to the south–west of the proposal. The property is currently on the market and there have been no further applications to Newcastle City Council to proceed with Black Hill industrial estate.	• Clearing of large areas of Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC. • Potential water quality impacts on Viney Creek • Noise, air and visual amenity impacts on road users and nearby commercial premises arising from the development of the subdivision and subsequent construction of commercial premises.	• An increase in traffic using the proposal intersection and surrounding road network to access the development • Visual and landscape character impacts of removed vegetation and new commercial buildings.

6.14.3 Potential impacts

Environmental factor	Construction	Operation
Traffic	The construction period for both M1 Upgrade Kariong to Somersby and M1 Upgrade Tuggerah to Doyalson would overlap with the construction period of the proposal. Cumulative impacts arising from the concurrent construction of these proposals include traffic impacts such as increased travel times for users of the motorway. It is not expected that construction period of the proposal would overlap with that of the M1 extension to Raymond Terrace. Therefore no cumulative construction impacts are expected. Although, considered unlikely, the potential construction of the Black Hill industrial estate concurrently with the proposal would result in increased traffic impacts on road users.	The concurrent operation of the identified Roads and Maritime proposals along the M1 Pacific Motorway would result in beneficial cumulative traffic impacts including greater freight efficiency, improved travel times for commuters and safety improvements compared to the respective proposal's individual benefits. The Black Hill industrial estate and the M1 extension to Raymond Terrace have been carefully considered in the predicted future traffic volumes and the subsequent modelling undertaken for the proposal (refer Section 6.2). Operation of the proposal would remove a potential access to and from the M1 Pacific Motorway southbound and the Black Hill industrial estate. This is considered appropriate to ensure the safety of all road users and the potential for future access to the Black Hill industrial estate would be provided from John Renshaw Drive.
Amenity	Overlapping construction of the M1 Pacific Motorway Productivity Projects may result in temporary increased amenity impacts on motorway users. These amenity impacts may include cumulative construction noise, visual and air quality impacts.	Operation of the proposal concurrently with the proposals identified above is not anticipated to result in cumulative amenity impacts on road users.
Biodiversity	Construction of the M1 Pacific Motorway Productivity Projects, M1 extension to Raymond Terrace and Black Hill industrial estate would result in cumulative biodiversity impacts through the clearance of native vegetation including EECs. It should be noted that the proposal accounts for only 1.1 hectares of vegetation clearance to this cumulative impact.	As per construction impacts.

6.14.4 Safeguards and management measures

ID#	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
CI02	Cumulative construction impacts	The Consultation Plan would include consultation with the Project Managers of the M1 Pacific Motorway Productivity Package Projects and the M1 extension to Raymond Terrace Project. The Consultation Plan would also include consultation with Newcastle City Council and the land owner of the proposed Black Hill industrial estate.	Roads and Maritime/ Construction contractor	Pre-construction construction	Additional safeguard

7 Environmental management

This chapter describes how the proposal would be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) would be prepared to describe the safeguards and management measures identified. The CEMP would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The CEMP would be prepared prior to construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, Hunter Region, before the start of any on-site works. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan), QA Specification G40 – Clearing and Grubbing, and QA Specification G10 - Traffic Management.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF would be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures would minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1 Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
GEN1	General - minimise environmental impacts during construction	A Construction Environmental Management Plan (CEMP) would be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager before the start of the activity. As a minimum, the CEMP would address: • Any requirements associated with statutory approvals • Details of how the project would implement the identified safeguards outlined in the REF • Issue-specific environmental management plans • Roles and responsibilities • Communication requirements • Induction and training requirements • Procedures for monitoring and evaluating environmental performance, and for corrective action • Reporting requirements and record-keeping • Procedures for emergency and incident management • Procedures for audit and review. The endorsed CEMP would be implemented during the undertaking of the activity.	Contractor / Roads and Maritime project manager	Pre-construction / detailed design	Core standard safeguard GEN1
GEN2	General - notification	All businesses and other key stakeholders (eg local councils) affected by the activity would be notified at least five days before the start of the activity.	Contractor / Roads and Maritime project	Pre-construction	Core standard safeguard GEN2

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
			manager		
GEN3	General – environmental awareness	All personnel working on site would receive training to ensure awareness of environment protection requirements to be implemented during the project. This would include up-front site induction and regular "toolbox" style briefings. Site-specific training would be provided to personnel engaged in activities or areas of higher risk. These include: • Areas of Aboriginal heritage sensitivity • Threatened species habitat.	Contractor / Roads and Maritime project manager	Pre-construction	Core standard safeguard GEN3
B01	General	A Flora and Fauna Management Plan would be prepared in accordance with Roads and Maritime's *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RTA, 2011) and implemented as part of the CEMP. It would include, but not be limited to: • Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • Requirements set out in the *Landscape Guideline* (RTA, 2008) • Pre-clearing survey requirements • Procedures for unexpected threatened species finds and fauna handling; • Procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013) • Protocols to manage weeds and pathogens.	Contractor	Pre-construction	Standard safeguard Section 4.8 of QA G36 Environment Protection
B02	Reduce Vegetated Clearing Limits	• Measures to further avoid and minimise the construction footprint and Vegetated Clearing Limits or hollow-bearing tree removal would be investigated during detailed design and implemented where practicable and feasible. The clearing of native vegetation must be minimised with the objective of reducing impacts to any threatened species, populations and ecological communities to the greatest extent	Contractor	Detailed design / pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		practicable.			
B03	Pre-clearing process	This would be carried out in accordance with the requirements of the Roads and Maritime's Biodiversity Guidelines (RTA, 2011) - *Guide 1: Pre-clearing process*. Including: • Consult with an ecologist to determine the location of suitable nearby habitat for the release of fauna that may be encountered during the pre-clearing process or habitat removal. Mark the pre-determined habitat identified for fauna release on a map • Prior to clearing: a. Confirm the locations of biodiversity features including: ▪ Hollow-bearing trees ▪ Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC ▪ Callistemon linearifolius (Netted Bottle Brush) b. Identify fauna that have the potential to be disturbed as a result of clearing activities c. Ensure an ecologist checks for the presence of threatened flora and fauna species that were identified in the environmental assessment as likely to occur, including: ▪ *Rutidosis heterogama* (Heath Wrinklewort) ▪ *Tetratheca juncea* (Black-eyed Susan) ▪ *Melaleuca biconvexa* (Biconvex Paperbark) Undertake these checks during optimal conditions for the target species where possible d. Record the details for all hollow-bearing trees, trees containing threatened fauna and threatened flora e. Mark habitat features to be protected during construction f. Confirm the location of pre-determined habitat identified for the release of any fauna encountered on site g. Submit and updated maps/plans, habitat features and recommended clearing procedures to the project manager and/or	Contractor	Pre-construction / construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		environment manager (or equivalent) • Twenty-four hours before clearing: a. Licensed wildlife carers and/or ecologists should capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities a. Relocate fauna into pre-determined habitat identified for fauna release. b. All fauna handling should be carried out by licensed wildlife carers and/or ecologists and in accordance with Guide 9: fauna handling c. Inform clearing contractors of any changes to the sequence of clearing if required d. Carry out staged habitat removal as outlined in *Guide 4: Clearing of vegetation and removal of bushrock* where fauna habitat features have been identified and marked.			
B04	Exclusion Zones	Locations of the Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC, *Callistemon linearifolius* (Netted Bottle Brush) and hollow-bearing trees that are outside of the Vegetation Clearing Limit would be clearly marked and/or fenced to exclude access during construction. This would be carried out in accordance with the requirements of the Roads and Maritime's Biodiversity Guidelines (RTA, 2011) - *Guide 2: Exclusion Zones*; Including as a minimum: • Mark exclusion zones on a suitable plan • Select a suitable exclusion fence type • Allow enough lead time to establish exclusion zones before clearing • Mark out exclusion zones with temporary markings such as pegs or paint and where possible use a qualified surveyor • Place exclusion zone fencing outside tree protection zones • Erect signs to inform personnel of the purpose of exclusion zone fencing • Ensure all exclusion zones are regularly inspected and repairs to fencing are made where required	Contractor	Pre-construction / construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		• Communicate the importance of exclusion zones, and any changes to the zones, to all site staff and visitors (eg in toolbox talks and inductions) • Ensure that any breaches of the exclusion zone are reported through the Roads and Maritime environmental incident reporting procedure.			
B05	Vegetation Clearing	Trees and vegetation would be removed in accordance with the Roads and Maritime's Biodiversity Guidelines - *Guide 4 – Clearing of Vegetation and Removal of Bushrock*. Vegetation clearing would include as a minimum: • Develop a clearing and grubbing plan with reference to the Vegetation Clearing Limit (Figure 6-1) and Biodiversity Guidelines and communicate the requirements of the plan to site staff regularly • Document the selection of suitable work methods in a clearing and grubbing plan • Ensure clearing of vegetation and/or removal of bushrock does not go beyond the approved Vegetated Clearing Limits for the project • A staged habitat removal process is to be used when identified hollow-bearing trees, or bushrock is to be removed • Carefully clear vegetation so as not to mix topsoil with debris and to avoid impacts to surrounding native vegetation • Keep stockpiles of cleared vegetation under two metres high in accordance with the RTA's Stockpile Site Management Guideline • Non-woody vegetation (typically grasses and groundcover species) should be incorporated into the stripping of topsoil to retain any organic materials and nutrients within the topsoil layer.	Contractor	Pre-construction / construction	Standard safeguard
B06	Weed and Pathogen Management	Weed and Pathogen management would be done in accordance with the Roads and Maritime's Biodiversity Guidelines – Guide 6 and Guide 7. Including as a minimum: • Develop and implemented a weed management plan for the site • Separate weeds from native vegetation where native vegetation is to	Contractor	Pre-construction / construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		be used for mulch. Do not use weeds for mulch • All weed plant material and topsoil containing weed plant material should be disposed of to an appropriate waste management facility • Check the Department of Primary Industries (DPI) website (www.industry.nsw.gov.au) for the most up-to-date hygiene protocols for each pathogen and for the most recent locations of contamination.			
B07	Nest boxes	Installation of nest boxes is to be undertaken in accordance with Roads and Maritime *Biodiversity Guidelines - Guide 8: Nest boxes.* Including as a minimum: • Nest boxes are to replace the loss of hollows at a ratio of at least 1:1 (one nest boxes installed for each hollow removed) • Where nest boxes are required, an ecologist should be engaged to develop a nest box strategy • Consult with an ecologist to assist in the implementation of the nest box strategy including installation and monitoring of nest boxes • Nest boxes should be supplied for the following species, in line with Table 8.1 and Table 8.2 of Guide 8: a. Microbats a. Squirrel Gliders b. Yellow-bellied Gliders • The nest box lid should overhang the front and sides of the nest box by at least 25 millimetres to prevent water damage. For monitoring and maintenance purposes, consider using a hinged lid. Do not use metal lids or plates on the roof of the nest box lid • Paint the outside of the nest box with non-toxic, dark-coloured, outdoor, water-based acrylic paint. Avoid toxic substances • To assist with drainage, drill three small holes in the base of the nest box • Non-toxic woodchips, wood shavings or sawdust could be placed into possum, glider and bird nest boxes to provide extra insulation in cold climates.	Contractor	Pre-construction / construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		• An ecologist should be on site during the installation of nest boxes • The preferred method of attaching nest boxes to trees is the Habisure© system. Bolting nest boxes to trees is not recommended. • The density and quantity of each nest box type should reflect the proportion of tree hollow types being removed, the proportion of tree hollow types to be retained in adjacent habitat, the availability of adjacent food resources and the assemblage of hollow-dependant fauna known or likely to occur in the project locality • The location of nest boxes should be as close as possible to the original hollow-bearing tree, consider the type of bark preferred by the target species, be in close proximity to food or other resources, not be installed on trees with existing hollows or where there is a high density of Common Mynas (*Acridotheres tristis*) • Orientate nest boxes between north–west and east and so they are not facing lights from adjacent development • Install approximately 70 per cent of nest boxes up to one month before the start of any clearing. The remainder of nest boxes would be installed before completion of the project • Record the nest box identification number, nest box type, GPS location, species and diameter at breast height of the host tree, nest box height and orientation • Undertake ongoing monitoring and maintenance of nest boxes in accordance with the nest box management strategy for the project.			
B08	Fauna Protection	Any fauna handling would be undertaken by an appropriately licenced ecologist in accordance with the Roads and Maritime's Biodiversity Guidelines - *Guide 9 – Fauna handling*. Including as a minimum: • If unexpected threatened fauna or flora species are discovered, stop works immediately and follow the Roads and Maritime *Unexpected Threatened Species Find Procedure* in the RTA Biodiversity Guidelines 2011 – Guide 1 (Pre-clearing process) • Allow fauna to leave an area without intervention as much as possible	Contractor	Pre-construction / construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		• Contact an animal rescue agency/wildlife care group or vet before works start to ensure they are willing and available to be involved in fauna rescue and assist with injured animals • Never deliberately kill a snake as all snakes are protected under the National Parks and Wildlife Act 1974 (NSW). If a snake must be handled to remove the risk of harm to the snake or people then handling should only be done by a licensed fauna ecologist or wildlife carer with skills and experience in snake handling. • Follow the Hygiene Protocol for the control of disease in frogs (Wellington and Haering 2008) for all frog handling • If handling bats, the handler must be vaccinated against the Australian Bat Lyssavirus (ABL) which is a form of rabies • Release fauna into pre-determined habitat identified for fauna release • Keep records of fauna captured and relocated.			
B09	Revegetation works	Revegetation of areas disturbed by the proposed works would be undertaken in accordance with Roads and Maritime Landscape Plantings QA Specification R179 and the Roads and Maritime Biodiversity Guidelines - *Guide 3: Re-establishment of native vegetation*. Including as a minimum: • Locally indigenous species would be included as part of landscaping and rehabilitation works to promote native fauna habitat. Species identified on site that are suitable for revegetation works are detailed in Appendix F. • Collect local native topsoils and leaf litter and store for use in revegetation works • Soils in areas to be revegetated should match surrounding soil conditions as closely as possible unless adjacent areas are weedy or contaminated • Consider appropriate shade and drainage conditions when planting. Provide mulching around plants for dry or potentially weedy sites to help retain moisture and suppress weeds.	Contractor	Pre-construction / construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
TT01	Traffic and transport	A Traffic Management Plan (TMP) would be prepared and implemented as part of the CEMP. The TMP would be prepared in accordance with the Roads and Maritime *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Roads and Maritime, 2008). The TMP would include: • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain cyclist access where safe and practicable to do so • Requirements and methods to consult and inform the local community of impacts on the local road network • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms.	Contractor	Pre-construction	Core standard safeguard TT1 Section 2.3 of QA G10 Control of Traffic
TT02	Impacts of oversized loads	Roads and Maritime to liaise with industry and Roads and Maritime permits section, on determining an agreement on the management of oversize loads through the site during construction.	Roads and Maritime	Pre-construction / Construction	Additional safeguard
TT03	Peak holiday traffic	The TMP would detail provisions to manage peak holiday traffic. This would include no online works to be carried out at this time to maintain the full capacity of the intersection.	Construction contractor	Pre-construction / construction	Additional safeguard
TT04	Impact on	Rovers Coaches would be kept informed of construction activities affecting	Construction	Pre-	Additional

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	existing bus route on John Renshaw Drive eastbound	bus route 160.	contractor	construction / construction	safeguard
TT05	Removal of Driver Reviver site	Roads and Maritime to provide appropriate signage and information on the Roads and Maritime and Driver Reviver websites notifying road users of the closure of the Beresfield site and provide information of alternative rest areas, service facilities and Driver Reviver sites at Ourimbah and Twelve Mile Creek.	Roads and Maritime	Pre-construction, construction and operation	Additional safeguard
TT06	Removal of M1 Pacific Motorway southbound OSOM vehicle stop bay	Roads and Maritime to provide appropriate signage and information on the Roads and Maritime website notifying heavy vehicle operators of the closure of the stop bay and provide signage to direct heavy vehicle operators to other appropriate facilities. Other truck parking bays which are proposed to be formalised to offset the closure of the existing truck parking bays includes the southbound truck parking bay at Heatherbrae south of Hank Street, and the westbound truck parking bay on Industrial Drive west of Steel River Boulevard in Mayfield. To minimise the risk of additional heavy vehicle operators crossing the highway from the truck parking bay on John Renshaw Drive westbound (opposite the Beresfield Service Centre), pedestrian exclusion fencing is recommended.	Roads and Maritime	Pre-construction, construction and operation	Additional safeguard
NV01	Noise and vibration	A Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The NVMP would generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify: • All potential significant noise and vibration generating activities associated with the activity • Feasible and reasonable mitigation measures to be implemented, taking into account Beyond the Pavement: urban design policy, process and principles (Roads and Maritime, 2014)	Contractor	Detailed design / pre-construction	Standard safeguard Section 4.6 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		• A monitoring program to assess performance against relevant noise and vibration criteria. • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.			
NV02	Impacts on sensitive receivers – Path controls	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding	Contractor	Construction	Standard safeguard
NV03	Site induction	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All project specific and relevant standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on high noise generating activities • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.	Contactor	Construction	Standard safeguard
NV04	Behavioural practices	• No swearing or unnecessary shouting or loud stereos/radios on site • No dropping of materials from height, throwing of metal items and slamming of doors.	Contactor	Construction	Standard safeguard
NV05	Equipment Selection	• Use only the necessary size and power • Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles would minimise noise and vibration	Contactor	Pre-construction / Constructio	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		impacts • Ensure vehicles are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard • Ensure plant including the silencer is well maintained.		n	
NV06	Plant noise levels	• The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria in Appendix H of the *RMS Construction Noise and Vibration Guideline* (2016) • Implement a noise monitoring audit program to ensure equipment remains within the more stringent of the manufacturers specifications or Appendix H.	Contactor	Construction	Standard safeguard
NV07	Rental plant and equipment.	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in Table 2 of the *RMS Construction Noise and Vibration Guideline* (2016).	Contactor	Construction	Standard safeguard
NV08	Use and siting of plant.	• The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. • Plant used intermittently to be throttled down or shut down • Noise-emitting plant to be directed away from sensitive receivers • Only have necessary equipment on site.	Contactor	Construction	Standard safeguard
NV09	Plan worksites and activities to minimise noise and vibration.	• Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site • Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible.	Contactor	Construction	Standard safeguard
NV10	Non-tonal and	• Non-tonal reversing beepers (or an equivalent mechanism) must be	Contactor	Constructio	Standard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	ambient sensitive reversing alarms	fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work • Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.		n	safeguard
NV11	Minimise disturbance arising from delivery of goods to construction sites.	• Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers • Select site access points and roads as far as possible away from sensitive receivers • Dedicated loading/unloading areas to be shielded if close to sensitive receivers • Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible • Avoid or minimise these movements during the day where possible.	Contactor	Construction	Standard safeguard
NV12	Plan worksites and activities to minimise noise and vibration.	Very noisy activities should be scheduled for night working hours. If the activities cannot be undertaken during the night, if feasible the activities should be started after 4pm.	Contactor	Construction	Additional safeguard
NV13	Impacts on sensitive receivers – Notification	All noise sensitive receivers likely to be affected would be notified at least five (5) days prior to commencement of any works associated with the activity that may have an adverse noise impact. The notification could be provided as a letterbox drop, phone call or individual briefing. The notification would provide details of: • The project • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.	Contactor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
AQ01	General air quality impacts	In accordance with *G36 Environmental Protection Section 4.4* management strategies to minimise the impact of dust and other emissions on the surrounding environment would be included in the CEMP.	Construction Contractor	Pre-construction and construction	Additional standard safeguard G36 Section 4.4
AQ02	Excessive dust from stockpiles	Stockpile management would be in accordance with the Landcom *Managing Urban Stormwater, Soils and Construction Guidelines* including covering stockpiles and storage areas where possible.	Construction Contractor	Pre-construction and construction	Additional Safeguard G38 Section 3.2
AQ03	Excessive dust from non-vegetated area	Stage work to ensure progressive vegetation clearing and revegetation can occur. Revegetate as soon as possible.	Construction Contractor	Pre-construction and construction	Additional safeguard
AQ04	Dust from haulage of materials and movement of vehicles	• Ensure that loads are always covered • Manage unsealed roads and areas to avoid the generation of dust • Impose speed limits along unsealed routes Where possible, restrict movements along unsealed routes.	Construction Contractor	Construction	Additional safeguard
AQ05	Excessive exhaust emissions from construction plant and equipment	• Inspect plant/equipment before the start of construction on site to ensure efficient operation and compliance with manufacturers specifications • Carry out routine servicing, maintenance and visual inspections to ensure that equipment continues to operate efficiently.	Construction Contractor	Pre-construction and regularly during construction	Additional safeguard
UD01	Landscape character and visual impact.	An Urban Design Plan would be prepared to support the final detailed project design and implemented as part of the CEMP. The Urban Design Plan would be prepared in accordance with relevant guidelines, including: • Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014) • Landscape Guideline (RTA, 2008).	Construction Contactor	Pre-construction	Core standard safeguard UD1

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		The Plan would include design treatments for: • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining walls, bridges and noise walls • Cyclist elements and consideration of future provision for pedestrians • Fixtures such as lighting, fencing and signs • Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas.			
UD02	Visual impact of altered road character from clearance of vegetation including EECs.	Landscaping would be carried out in accordance with *Roads and Maritime Landscape Guidelines* (RTA, 2008) as detailed in the Urban Design report (KI Studios, 2016).	Construction Contractor	Construction	Additional standard safeguard
SE01	Socio-economic	A Community and Stakeholder Consultation Sub Plan (CSCP) would be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CSCP would include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected businesses and social infrastructure, including changed traffic and access conditions • Contact name and number for complaints. The CSCP would be prepared in accordance with the *Roads and Maritime's Community Engagement and Communications: A resource manual for staff* (2012).	Contactor	Detailed design / pre-construction	Core standard safeguard SE1

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
SE02	Impacts on businesses and the community during construction	At least two weeks prior to the start of work, businesses and social infrastructure in the Weakleys Drive industrial precinct would be notified of the nature and likely duration of the proposal and provided with a 24 hour phone hotline that would be established for the construction duration.	Construction contractor	Pre-construction / construction	Additional standard safeguard
SE03	Impacts on businesses and the community during construction	Ongoing community consultation would be carried out in accordance with the *Roads and Maritime's Community Engagement and Communications: A resource manual for staff* (2012) and the proposal's consultation strategy.	Roads and Maritime Construction Contractor	Construction	Additional standard safeguard
SE04	Impacts on businesses and the community during construction	A complaint handling procedure and register would be included in the CEMP.	Construction Contractor	Construction	Additional standard safeguard
SE05	Interruptions to utility services	Businesses and social infrastructure in the Beresfield industrial estate would be informed before any interruptions to utility services that may be experienced as a result of utilities relocation.	Construction Contractor	Construction	Additional standard safeguard
SE06	Closure of Driver Reviver	Roads and Maritime to would provide appropriate signage and information on the Roads and Maritime and Driver Reviver websites notifying road users of the closure of the Beresfield site and provide information of alternative rest areas, service facilities and Driver Revivers at Ourimbah and Twelve Mile Creek.	Roads and Maritime	Construction	Additional standard safeguard
SE07	Closure of Driver Reviver	Roads and Maritime is investigating alternative sites for a Driver Reviver. Any new site would be considered under a separate proposal and environmental assessment.	Roads and Maritime	Operation.	Additional standard safeguard
SW01	Soil and water	A site specific Erosion and Sediment Control Plan (ESCP) would be prepared and implemented as part of the CEMP that would demonstrate	Contractor	Pre-construction	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		how the requirements of the REF and legislation would be implemented. • The Plan would include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.			SW2 Section 2.2 of QA G38 Soil and Water Management
SW02	Erosion and sedimentation	The ESCP would specify measures to be implemented and maintained in accordance with the Landcom *Managing Urban Stormwater, Soils and Construction Guidelines* and G38, R178 and the RTA Biodiverstiy Guidelines. The controls should: • Prevent onsite erosion and sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets • Minimise the area of exposed soils with work areas to be stabilised progressively durin g works • Plan and deliver drainage works to avoid impacts to receiving water quality.	Construction contractor	Construction	Additional Standard Safeguard Section 2.2 of QA G38 Soil and Water Management
SW03	Erosion and sedimentation from stockpiles	The maintenance of established stockpile sites during construction is to be in accordance with the RTA *Stockpile Site Management Guideline (2011)*.	Construction contractor	Construction	Additional Standard Safeguard Section 2.2 of QA G38 Soil and Water Management
SW04	Contamination of surface water	All fuels, chemicals, and liquids would be stored at least 50 metres away from the existing stormwater drainage system and would be stored in an impervious bunded area within the compound site. • The refuelling of plant and maintenance of machinery would be undertaken in designated areas.	Construction contractor	Construction	Additional Standard Safeguard Section 2.2 of QA G38 Soil and Water Management

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
C01	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area would cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.	Contractor	Detailed design / Pre-construction	Standard safeguard C2 Section 4.2 of QA G36 Environment Protection
C02	Accidental spill	A site specific emergency spill plan would be developed, and include spill management measures in accordance with the Roads and Maritime *Code of Practice for Water Management* (RTA, 1999) and relevant EPA guidelines. The plan would address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Contractor	Detailed design / Pre-construction	Core standard safeguard C3 Section 4.3 of QA G36 Environment Protection
C03	Environment incident	All incidents would be classified in terms of Roads and Maritime Services Incident Classification Procedure (February 2016).	Contractor	Construction	Additional Safeguard
C04	Potential or actual acid sulphate soils	Potential or actual acid sulphate soils are to be managed in accordance with the RTA's *Guidance for the Management of Acid Sulphate Materials 2005.*	Construction contractor	Construction	Additional safeguard
C05	Coal Tar	Coal tar encountered is to be managed in accordance with Roads and Maritime's Technical Direction Environment ETD 2015/021 Coal tar asphalt handing and disposal. Including the disposal of all excavated coal tar at a licenced landfill.	Construction contractor	Construction	Additional safeguard
AH01	Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) would be prepared in accordance with the Procedure for Aboriginal cultural heritage consultation and investigation (Roads and Maritime, 2012) and implemented as part of the CEMP. It would effectively control the risk to known and unknown artefacts on site and in the adjacent areas.	Contactor	Pre-construction	Core standard safeguard AH1 Section 4.9 of QA G36 Environment

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
					Protection
AH02	Impacts on identified isolated artefact	Protect the AHIMS registered isolated artefact (#38-4-0551) located just to the north of the proposal area boundary on John Renshaw Drive by: • Installation of a five metre fenced buffer zone around the artefact • Site induction for all staff, contractors and others should include identification of exclusion zones and statutory requirements.	Construction contractor Roads and Maritime	Pre-construction / Construction	Standard safeguard Section 4.9 of QA G36 Environment Protection
AH03	Aboriginal heritage	The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) would be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction.	Contactor	Construction	Core standard safeguard AH2 Section 4.9 of QA G36 Environment Protection
NAH01	Non-Aboriginal heritage	The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) would be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered.	Contactor	Construction	Core standard safeguard H2 Section 4.10 of QA G36 Environment Protection
W01	Generation of construction waste	The construction contractor would prepare a waste management plan and a waste management register in accordance with the requirements of Roads and Maritime's *QA Specification G36 –Environmental Protection (Management System).* The plan would include the process for managing excess material.	Construction contractor	Generation of construction waste	Standard safeguard G36 Section 4.11
W02	Generation of construction	The generation and management of construction waste is to be managed in accordance with the WARR Act.	Construction contractor	Generation of	Additional standard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	waste			construction waste	safeguard G36 Section 4.11
W03	Re-use of Construction materials	The potential to reuse materials in accordance with *Roads and Maritime Waste Fact Sheet 9: Re-use of waste off site* would be investigated during detailed design and construction.	Roads and Maritime/ Construction Contractor	Detailed design/ Construction	Additional standard safeguard
W04	Management of construction waste	All waste would be classified in accordance with the NSW EPA Waste Classification Guidelines 2014 and disposed of accordingly with supporting documentation.	Construction contractor	Construction	Additional standard safeguard
W05	Management of construction waste	Working areas are to be kept free of rubbish and cleaned up at the end of each working day/night.	Construction contractor	Construction	Additional standard safeguard
W06	Generation of green waste during operation	The generation of green waste would be managed in accordance with the Roads and Maritime *Technical Procedure: Mulch management, Controlling the risk of weeds, pest, and disease*	Roads and Maritime	Operation	Additional standard safeguard
CC01	Greenhouse gas emissions	• Effective staging of works and site planning to minimise the resources used. • Minimise vegetation clearing and maximise on site reuse of green waste in accordance with RTA Biodiversity Guidelines Guide 5 – Re-use of woody debris and bushrock • Use low emodied energy productes where possible • Energy (fuel/electrical) efficiency would be considered when selecting equipment • Equipment would be regularly maintained to retain fuel efficiency • Where feasible, biofuels would be used (biodiesel, ethanol, or blends such as E10 and B80), to reduce greenhouse gas emissions from construction plant and equipment • Plant and office-based equipment (including lights and computers)	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		would be operated in an efficient manner • Locally-sourced materials and staff would be used wherever possible, to reduce transport related emissions.			
D01	Demand on resources	Procurement would endeavour to use materials and products with a recycled content where that material or product is cost and performance effective.	Contactor	Construction	Additional safeguard
D02	Demand on resources	Any additional fill material required would be sourced from appropriate sources and/or other Roads and Maritime projects.	Contractor	Construction	Additional safeguard
CI02	Cumulative construction impacts	The Consultation Plan would include consultation with the Project Managers of the M1 Pacific Motorway Productivity Package Projects and the M1 extension to Raymond Terrace Project. • The Consultation Plan would also include consultation with Newcastle City Council and the land owner of the proposed Black Hill industrial estate.	Roads and Maritime/ Construction contractor	Pre-construction construction	Additional safeguard

7.3 Licensing and approvals

Determination of this REF under the provision of Part 5 of the EP&A Act is the only approval required for this proposal. With the exception of an ROL, no further approvals or licences are required.

8 Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impact, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

8.1 Justification

The M1 Pacific Motorway is an important link in the National Land Transport Network and is part of the Sydney to Brisbane corridor, one of the busiest transport corridors in Australia. Located at the northern end of the Motorway, the proposal is the sole and therefore critical arterial connection linking the M1 Pacific Motorway to the A1 Pacific Highway. The proposal also provides critical connections between the M1 Pacific Motorway, New England Highway and local industrial and commercial precincts.

The proposal is recommended as the existing intersection does not have capacity to service the nearly 4,000 vehicles per hour currently travelling through during peak periods. This lack of capacity together with conflicts between a mix of commercial, tourist, inter-regional and local traffic, results in delays, queuing and increased travel times.

If the intersection is left in its current state, average delays in excess of two minutes and queue lengths up to one kilometre in length are anticipated. This increased congestion would reduce network reliability of a key intersection within the state and national transport network.

The M1 extension to Raymond Terrace, which would bypass the proposal, is currently being developed. Therefore an upgrade of the proposal is temporarily required to improve the capacity of the intersection and avoid the negative economic, social and safety impact of high traffic congestion.

By reducing delays at the intersection the proposal would:

- Improve the performance of the NSW economy, through the reduction of freight operating costs and improved productivity for heavy vehicles and light commercial vehicles travelling on the Sydney-Brisbane corridor
- Improve urban amenity/liveability through improved travel times for motor vehicles accessing people, employment and services in the Hunter, Mid–North Coast and New England Regions
- Improve traffic flows thereby reducing vehicle emissions such as air pollution and greenhouse gas and vehicle operating costs
- Provide a safer road environment for all road users including cyclists.

8.2 Objects of the EP&A Act

Object	Comment
5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The proposal would promote the social and economic welfare of the community through the proper management and development of this key transport corridor. Where possible throughout the design, management and conservation of natural resources has been incorporated, in particular through minimising the extent of the works and associated impacts to the identified EEC within the study area.
5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.	The proposal would help in the coordination and the orderly economic development of land for the region and along the Sydney Brisbane freight corridor by reducing traffic congestion thereby alleviating the negative economic, social and safety impacts of high traffic congestion
5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.	The proposal has been designed to minimise impacts on communication and utility services as addressed in Section 3.5.
5(a)(iv) To encourage the provision of land for public purposes.	The proposal would fulfil this through improving road safety of a public road
5(a)(v) To encourage the provision and co-ordination of community services and facilities.	The proposal would Improve urban amenity/liveability through improved travel times for motor vehicles accessing people, employment and services in the Hunter, Mid–North Coast and New England Regions.
5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	The proposal would occur within a modified and disturbed environment and impacts to the environment have been minimised as far as practicable. Assessments of significance undertaken for the identified EEC and listed species within the study area found that the impacts from the proposal would not be considered significant. Mitigation measures would be implemented to mitigate potential impacts. Impacts to native animals and plants including threatened species, populations and ecological communities and their habitats were considered in Section 6.1.
5(a)(vii) To encourage ecologically sustainable development.	Ecologically sustainable development is considered in Sections 8.2.2 below.
5(a)(viii) To encourage the provision and maintenance of affordable housing.	Not relevant to the proposal.

Object	Comment
5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.	The proposal is one of three Roads and Maritime's projects which form the M1 Pacific Motorway Productivity Package and will be jointly funded by the State and Federal Governments.
5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.	The proposal development process has involved community, statutory and non-statutory consultation with relevant stakeholders. Consultation undertaken and proposed is outlined in Section 5. This REF is on public display for community and stakeholder comment. Roads and Maritime will consider submissions made prior to making a decision about whether to proceed with the proposal.

8.2.1 The precautionary principle

The precautionary principle upholds that lack of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation if there is a threat of serious or irreversible environmental damage. In the application of the precautionary principle Roads and Maritime should be guided by:

- Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
- An assessment of the risk weighted consequences of various options.

This REF has demonstrated that the proposal does not present risks of serious or irreversible environmental damage. This has been supported by the Roads and Maritime risk assessment process which forms an integral component of the development of the proposal. This risk assessment process includes an evaluation of the environmental risks and methods to manage these identified risks.

The assessment of the potential impacts of the proposal is considered consistent with the precautionary principle and have been undertaken in line with accepted scientific and assessment methodologies.

8.2.2 Intergenerational equity

This principle of ESD upholds that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

The proposal would cater for future generations of road users by addresses existing and projected future traffic congestion at this critical intersection in the Sydney to Brisbane transport corridor and therefore provide for the continued economic development of the region.

The proposal would also cater for future generations by improving the urban amenity/liveability through improved travel times for vehicles accessing employment, services and recreational opportunities. Improved traffic flows would also benefit the environment for future generations through a reduction in vehicle emissions and associated air pollution and greenhouse gases.

8.2.3 Conservation of biological diversity and ecological integrity

The conservation of biological diversity and ecological integrity principle has been a fundamental consideration throughout the development of the proposal.

Conservation of biological diversity and ecological integrity has been considered during all stages of the proposal's development. The biodiversity assessment (refer to Section 6.1 and Appendix E) concluded that while vegetation removal would be required for the proposal, including the removal of about 0.97 hectares of Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion (EEC) and up to 16 specimens of the listed flora specie *C. Linearifolius* the proposal would not have a significant effect on these or other existing flora or fauna species, biodiversity communities or the overall biological integrity of the proposal site and nearby areas. The findings of the biodiversity assessment indicate that the potential impacts would be acceptable and minimised through the proposed safeguards

8.2.4 Improved valuation, pricing and incentive mechanisms

Improved valuation, pricing and incentive mechanisms provide that cost to the environment should be factored into the economic costs of a proposal. The concept design for the proposal has been developed with an objective of minimising potential impacts on the surrounding environment.

This REF has considered the environmental consequences of the proposal and identified mitigation measures for areas which have the potential to experience adverse impacts. The value placed on environmental resources is evident in the extent of the planning, environmental investigations and design of proposal safeguards. The implementation of the safeguards identified is included in both the capital and operating cost of the proposal and would result in an economic cost to Roads and Maritime. This signifies that environmental resources have been given

8.3 Conclusion

The proposal to upgrade the M1 Pacific Motorway, Weakleys Drive and John Renshaw Drive intersection at Beresfield is subject to assessment under Part 5 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration critical habitat, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. While the proposal as described in the REF best meets the proposal objectives, it would still result in minor vegetation clearance, including a listed EEC and flora specie. It would also have temporary construction impacts on amenity in the form of noise, visual and air quality impact and minor traffic disruptions. Mitigation measures as detailed in this REF would mitigate or minimise these expected impacts. The proposal would improve traffic and freight efficiency by providing additional capacity to reduce existing and future congestion. On balance the proposal is considered justified.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Part 5 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of the Environment is not required.

9 Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Mike Luger
Technical Director
Aurecon
Date: 21 September 2016

I have examined this review of environmental factors and accept it on behalf of Roads and Maritime Services.

Damien Grace
Project Development Manager
Roads and Maritime Services
Hunter Region
Date: 8/11/2016

10 References

Acid Sulfate Soil Management Advisory Committee (ASSMAC) 1998, Acid Sulfate Soil Manual, August 1998.

Advitech Environmental 2016a, *Archaeological Assessment: Aboriginal Heritage. M1 Intersection with John Renshaw Drive, Beresfield – Proposed Compound site and land widening,* assessment letter

Advitech Environmental 2015a, *RMS Aboriginal Heritage Assessment Upgrade of M1 Intersection with John Renshaw Drive and Weakleys Drive, Beresfield (Rev 1)*.

Advitech Environmental 2014, *Upgrade of M1 Pacific Highway intersection with John Renshaw Drive and Weakleys Drive Beresfield: Preliminary Environmental Investigation*

AS (2010), Guide to noise and vibration control on construction, demolition and maintenance sites, Australian Standards AS 2436

AS/NZS (2000), Acoustics—Recommended design sound levels and reverberation times for building interiors, Australian/New Zealand Standards, AS/NZS 2107:2000

Australian Government (2014) *National Land and Transport Network Determination 2014*

Australian Transport Council, 2011 *National Road Safety Strategy 2011–2020*
DECCW 2010 *Aboriginal Cultural Heritage Consultation Requirements for Proponents*

Commonwealth DoE (2014), Directory of Important Wetlands in Australia, Commonwealth Department of the Environment, *www.npi.gov.au*

Commonwealth DoE (2014), National Pollution Inventory database, Commonwealth Department of the Environment, *www.npi.gov.au*

Commonwealth DoE (2015), Protected Matters Search Tool for Maters of National Environmental Significance, Commonwealth Department of the Environment website accessed 2 April 2015

Commonwealth legislation (1999), Commonwealth Environment Protection and Biodiversity Conservation Act 1999, *www.legislation.nsw.gov.au*

DECCW 2010, *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*

Department of Land and Water Conservation 1995, *Soil Landscapes of the 1:100,000 Newcastle Map* (Soil Landscape Series Sheet 9232)

DUAP 1999, *Is an EIS required?*

DUAP 1996 *Roads and Related Facilities*

Jacobs 2016 *John Renshaw Drive / Weakleys Drive Intersection Modelling*

KI Studio 2016 *M1 Pacific Motorway Intersection Upgrade at Weakleys Drive and John Renshaw Drive – Urban Design and Landscape Character and Visual Assessment*

MI Engineers 2016 *M1 Pacific Motorway intersection upgrade at Weakleys Drive and John Renshaw Drive Constructability Workshop Report*

NSW DECC (2009), Interim Construction Noise Guideline, Department of Environment and Climate Change, NSW Government, Sydney

NSW DECC (2011), Road Noise Policy, Department of Environment and Climate Change NSW Government, Sydney

NSW Department of Planning (2016) Black Hill approval documents

NSW Department of Premier and Cabinet, 2015 *Rebuilding NSW State Infrastructure Strategy 2014 – Update*

NSW Department of Premier and Cabinet 2012, *The NSW Government State Infrastructure Strategy 2012-2032: First Things First*

NSW Department of Premier and Cabinet, 2011, *NSW 2021: A Plan to Make NSW Number One*

NSW EPA (2006) Assessing Vibration: A Technical Guideline, NSW Office of Environment and Heritage, NSW Government, Sydney

NSW legislation (1979), Environmental Planning and Assessment Act 1979 (EP&A Act), *www.legislation.nsw.gov.au*

NSW legislation (1977), Heritage Act 1977, *www.legislation.nsw.gov.au*

NSW legislation (1974), National Parks and Wildlife Act 1974, *www.legislation.nsw.gov.au*

NSW legislation (2014), NSW Government Gazette, Noxious Weeds (Weed Control) Order, *www.legislation.nsw.gov.au*

NSW legislation (1993), Noxious Weeds Act 1993, *www.legislation.nsw.gov.au*

NSW legislation (1993), Protection of the Environment Operations Act 1997, *www.legislation.nsw.gov.au*

NSW legislation (2004) State Environmental Planning Policy 71 2014 – Coastal Protection (SEPP71), *www.legislation.nsw.gov.au*

NSW legislation (2011), State Environmental Planning Policy (State and Regional Development) 2011, *www.legislation.nsw.gov.au*

NSW legislation (1995), Threatened Species Conservation Act 1995, *www.legislation.nsw.gov.au*

NSW Streets Opening Conference Guide to Codes and Practices for Streets Opening

Office of Environment and Heritage website *http://www.environment.nsw.gov.au/acidsulfatesoil/*.

Office of Environment and Heritage (OEH*) Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*

RCA Australia 2015, *Geotechnical Investigation M1 Pacific Motorway/John Renshaw Drive/Weakleys Drive Intersection Upgrade, Black Hill/Beresfield, June 2015.*

Roads and Maritime 2015, *MPRC presentation document: M1 Pacific motorway / Weakleys Drive / John Renshaw Drive / Intersection Upgrade, Beresfield*

Roads and Maritime 2015a, *M1 Pacific Highway Productivity Package: Preliminary Business Case Application for Federal Funding Development Phase PPR*

Roads and Maritime 2015b, *M1 Pacific Motorway intersection Upgrade at Weakleys Drive and John Renshaw Drive Strategic Design Report*

Roads and Maritime 2015c, *M1 Pacific Motorway, Weakleys Drive and John Renshaw Drive intersection upgrade community consultation report*

Roads and Maritime, 2014The *Roads and Maritime Strategy 2014–2018*

Roads and Maritime 2014a, *M1 Weakleys Drive Intersection Treatment Options: Value Management Review of Options Report*

Roads and Maritime (2014), Noise Criteria Guideline, Roads and Maritime Services, NSW Government, Sydney, RMS 14.583

Roads and Maritime (2014), Noise Mitigation Guideline, Roads and Maritime Services, NSW Government, Sydney, RMS 14.584

Roads and Maritime 2011 *Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI)

Roads and Maritime (2002), Biodiversity Guidelines; Protecting and managing biodiversity on RTA projects, Roads and Maritime Services, NSW Government, Sydney, ISBN 0 7305 9080 1

Roads and Maritime (2001), Environmental Noise Management Manual, Roads and Maritime Services, NSW Government, Sydney, ISBN 1 877070 72 6

Roads and Traffic Authority 2010, *RTA strategy for major heavy vehicle rest areas on key rural freight routes in NSW*

Websites

EPA Search the Contaminated Land website, accessed 3 December 2015
https://www.epa.nsw.gov.au/prclmapp/searchregister.aspx

Roads and Maritime Interactive rest area map
http://www.rms.nsw.gov.au/roads/using-roads/trip-information/rest-areas/restareasmap/index.html

Transport for NSW (2016) Centre for Road Safety Driver Reviver sites
http://roadsafety.transport.nsw.gov.au/stayingsafe/fatigue/driverreviver/index.html

Remplan (2016) Cessnock City Council Economic Profile (visited 3 February 2016)
http://www.economicprofile.com.au/cessnock

Remplan (2016) Maitland City Council Economic Profile (visited 3 February 2016)
http://www.economicprofile.com.au/maitland

Remplan (2016) Newcastle Economic Profile
http://www.economicprofile.com.au/newcastle

Terms and acronyms used in this REF

Term / Acronym	Description
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ARI	Average recurrence interval
ASS	Acid Sulfate Soils
CEMP	Construction environmental management plan
CSCP	Community and stakeholder consultation sub plan
EEC	Endangered Ecological Community
EIA	Environmental impact assessment
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FM Act	Fisheries Management Act 1994 (NSW)
GDP	Gross Domestic Product
Heritage Act	Heritage Act 1977 (NSW)
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
ITS	Intelligent transport systems
LAeq	Equivalent continuous level. A term utilised to define the period of measurement of continuous noise or energy average noise level.

LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local Government Area
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
MNES	Matters of national environmental significance under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
NCC	Newcastle City Council
Noxious Weeds Act	Noxious Weeds Act 1993 (NSW)
NPW Act	National Parks and Wildlife Act 1974 (NSW)
OEH	Office of Environment and Heritage
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PASS	Potential Acid Sulfate Soils
PoEO Act	Protection of the Environment Operations Act 1997
RBL	Rated Background Level
REF	Review of environmental factors
RNP	Road noise policy
Roads and Maritime	NSW Roads and Maritime Services
RTA	NSW Roads and Traffic Authority
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SEPP 14	State Environmental Planning Policy No.14 – Coastal Wetlands
SEPP 44	State Environmental Planning Policy 44 Koala Habitat Protection
TfNSW	Transport for NSW
TMP	Traffic Management Plan
TSC Act	Threatened Species Conservation Act 1995 (NSW)
QA Specifications	Specifications developed by Roads and Maritime Services for use with road work and bridge work contracts let by Roads and Maritime Services.
VMS	Variable message sign
WARR Act	Waste Avoidance and Recovery Act 2007

Appendix A

Consideration of clause 228(2) factors and matters of national environmental significance

Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the *Environmental Planning and Assessment Regulation 2000*, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
a. Any environmental impact on a community? Construction of the proposal would result in short term negative traffic and amenity impacts on road users and commercial premises to the north of the intersection as discussed in Chapter 6. Impacts would be minimised through the implementation of the safeguards and management measures outlined in Chapter 7. Operation of the proposal would result in a long term positive impact on the local and regional communities through an increase in the road capacity, improved safety and congestion for all road users.	 Short term minor negative Long term moderate positive
b. Any transformation of a locality? The required removal of mature native vegetation to accommodate the proposed road widening would contribute to a more cleared urban road landscape and would partially remove the existing visual separation and screening between the road corridor and nearby industrial/commercial land use. Nevertheless this small reduction in visual amenity is considered low in comparison to the scale of the existing and proposed industrial/commercial activity next to the road corridor. Mitigation measures for ameliorating any impact are outlined in Chapter 7.	 Long term minor negative
c. Any environmental impact on the ecosystems of the locality? The proposal would remove about 0.97 hectares of Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion (EEC) and up to 16 specimens of the listed flora specie *C. Linearifolius.* The proposal would not have a significant effect on these or other existing flora or fauna species, biodiversity communities or the overall biological integrity of the proposal site and nearby areas. The findings of the biodiversity assessment indicate that the potential impacts would be acceptable and minimised through the proposed safeguards outlined in Chapter 7.	 Long term minor negative
d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? During construction, the proposal would result in a reduction in the aesthetic quality of the locality as a result of dust generation, noise, visual and traffic movements. These impacts would be minimised through implementation of the management measures and safeguards summarised in Chapter 7.	 Short term minor negative

Factor	Impact
e. Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? An AHIMS registered isolated artefact (#38-4-0551) is located just to the north of the proposal area boundary on John Renshaw Drive. It is considered appropriate safeguards as outlined in Chapter 7, including provision of a five metre fenced buffer zone around the site would ensure there is no impact on this registered site.	Neutral
f. Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act* 1974)? The proposal would remove about 1.1 hectares of native vegetation including about 0.97 hectares of EEC. Due to the modified and urban environment of much of the proposal area, the potential for protected species to use this area is reduced. The proposal would not result in a significant impact on protected fauna habitat. Impacts on protected fauna habitat would further be minimised through the implementation of the safeguards and management measures in Section 6.1.	Long term minor negative
g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? Up to 16 specimens of the listed flora specie *C. Linearifolius* would be removed as part of the proposal. The proposal would not have a significant effect on this or other existing flora or fauna species, biodiversity communities or the overall biological integrity of the proposal site and nearby areas. The findings of the biodiversity assessment indicate that the potential impacts would be acceptable and minimised through the proposed safeguards outlined in Chapter 7.	Neutral
h. Any long-term effects on the environment? There would be long term minor negative impacts on biodiversity and visual impact within the proposal area. Mitigation measures for ameliorating identified impacts are outlined in Chapter 7. Operation of the proposal would result in a long term positive socio economic and traffic impacts through an increase in the road capacity, improved safety and congestion for all road users.	Long term minor negative Long term moderate positive
i. Any degradation of the quality of the environment? Construction would also result in potential traffic, noise, water and air quality impacts. These impacts would be minimised through the implementation of safeguards outlined in Chapter 7. There would be no long term degradation of the quality of the environment during the operation of the proposal.	Short term minor negative Long term nil

Factor	Impact
j. Any risk to the safety of the environment? There is potential for road safety to be decreased during construction due to altered traffic conditions. Traffic management safeguards including the preparation of a TMP, would address safety risks. The proposal would improve safety for road users during operation by controlling traffic movements through the intersection, reducing congestion and queuing and through the provision of cyclist facilities.	 Short term minor negative Long term major positive
k. Any reduction in the range of beneficial uses of the environment? The proposal would not result in the reduction in the range of beneficial uses of the environment either during construction or operation.	 Neutral
l. Any pollution of the environment? During construction the proposal could potentially result in minor short term water or air pollution arising from construction activities. Management of potential impacts would be accordance with the management measures outlined in Chapter 7. Operation of the proposal has the potential to reduce the probability of crashes due to controlled traffic movements through the intersection. This would reduce the potential for spills and pollution of the environment.	 Short term Long term minor positive
m. Any environmental problems associated with the disposal of waste? Coal tar contaminated materials may potentially be encountered during utility or drainage works. This would be disposed of at a licensed facility. It should be noted that under the *Waste Guidelines 2014* all asphalt waste including coal tar asphalt is pre-classified as General Solid Waste.	 Neutral
n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? All resources required for the proposal are readily available and are not in short supply.	 Neutral
o. Any cumulative environmental effect with other existing or likely future activities? Temporary potential cumulative impacts may occur in the unlikely event that construction activities occur simultaneously with the development of the Black Hill industrial estate and the construction of the M1 extension to Raymond Terrace. The long-term effect of the proposal would have a positive cumulative impact on travel times, road safety and efficiency, facilitating the anticipated increase in traffic volumes as a result of future traffic predictions, population growth and the development of the Black Hill industrial estate.	 Potential short term minor negative Long term moderate positive
p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal is not located within a coastal area and therefore would not result in any impact on coastal processes and coastal hazards.	N/A

Matters of National Environmental Significance

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
a. Any impact on a World Heritage property? The proposal would not impact on a World Heritage property.	No impact
b. Any impact on a National Heritage place? The proposal would not impact on a National heritage place.	No impact
c. Any impact on a wetland of international importance? While there are identified sensitive environments downstream of the proposal area including Ramsar and SEPP 14 wetlands, the distance between the proposal area and these sensitive environments, combined with the highly modified downstream environment, results in an extremely low probability that potentially degraded water quality resulting from the proposal would impact on these sensitive receiving environments. Mitigation measures outlined in Chapter 7 would mitigate any potential water quality impacts arising from construction of the proposal. The proposal constitutes widening of sections of existing roads catchments and incorporates appropriate road drainage. As such, it would not have a substantial influence on either the quality or quantity of inflows to waterways.	No impact
d. Any impact on a listed threatened species or communities? The proposal is not likely to significantly impact threatened species, populations or ecological communities within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*.	No significant impact
e. Any impacts on listed migratory species? The proposal is not likely to significantly impact migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*	No significant impact
f. Any impact on a Commonwealth marine area? The proposal would not impact on a Commonwealth marine area.	No impact
g. Does the proposal involve a nuclear action (including uranium mining)? The proposal does not involve a nuclear action.	No impact

Factor	Impact
Additionally, any impact (direct or indirect) on Commonwealth land? The proposal would not impact Commonwealth land.	No impact

rms.nsw.gov.au

contactus@rms.nsw.gov.au

Customer feedback
Roads and Maritime
Locked Bag 928
North Sydney NSW 2059

November 2016
RMS 16.538
ISBN: 978-1-925582-19-2

Transport
Roads & Maritime
Services