PACIFIC HIGHWAY AND WYONG ROAD, TUGGERAH

Review of Environmental Factors Submission Report

MAY 2013
Executive summary

This submissions report relates to the Review of Environmental Factors (REF) prepared for the upgrade of the Pacific Highway and Wyong Road intersection at Tuggerah on the New South Wales (NSW) Central Coast. The proposal involves the upgrade of the Pacific Highway and Wyong Road intersection at Tuggerah by replacing the existing roundabout with a signalised intersection. The intersection currently experiences substantial delays during the morning and afternoon peak periods, which leads to risk taking and numerous crashes. The proposal is required to improve safety at the intersection, ease current traffic congestion at peak times and to cater for future traffic growth.

The REF was placed on public display for comment between 18 February 2013 and 18 March 2013 and submissions relating to the proposal and the REF were received by Roads and Maritime Services (RMS). This submissions report summarises the issues raised and provides responses to each issue, details additional investigations carried out since finalisation of the REF, describes and assesses the environmental impact of changes to the proposal and identifies new or revised environmental management measures.

A total of 10 submissions were received in response to the exhibition of the REF comprising two government agencies (the Office of Environment and Heritage [OEH] and Wyong Shire Council [WSC]), one business and seven submissions from the community. Each submission has been examined individually to understand the issues being raised. The issues raised in each submission have been extracted and collated and corresponding responses to the issues have been provided. Where similar issues have been raised in different submissions, only one response has been provided.

Of the submissions received, two objected to specific aspects of the proposal, but did not object to the proposed upgrade. Two submissions supported the proposal and the remaining six submissions did not offer a position on the proposal.

The OEH submission focussed on the need for and nature of the proposed flooding mitigation measures. The need for consultation with owners of the commercial properties that may be affected by flooding was also emphasised.

The WSC submission raised various queries regarding the traffic modelling assumptions, the design of specific elements of the intersection and the provision for pedestrian and cyclist passage. The need for ongoing consultation between RMS and WSC was also reiterated.

The most prominent issues raised in the individual and business submissions related to:
- Land use and property.
- Landscape character, visual impact and urban design.
- Pedestrian and cyclist facilities.
- Consultation
- Noise and vibration.

Other considerations included traffic and transport, the strategic need for the proposal, the selection of the preferred option, flooding, ecology and air quality.
Following public display of the REF, and in response to submissions received, RMS undertook a *Feasibility and Overshadowing Assessment* (RMS, 2013) to consider removal of one left turning lane from Wyong Road westbound to the Pacific Highway southbound (the alternate design) to reduce impacts to properties 1-7 Yaldeeme Close, Tuggerah. An additional traffic assessment was undertaken as part of the feasibility assessment (RMS, 2013) for the alternate design, which found that queuing at the Pacific Highway and Wyong Road intersection remains consistent for the concept design and the alternate design. As such the alternate design with a single left turning lane is sufficient for maintaining intersection performance.

Five different scenarios were assessed as part of the overshadowing component of the *Feasibility and Overshadowing Assessment* (SKM, 2013), which investigated impacts to residential properties located immediately adjacent to the intersection.

According to the results of the feasibility and overshadowing assessment and in consideration of the recommendations of the *Noise and Vibration Assessment* completed for the proposal (SKM, 2013a), RMS has selected option 4 - alternate design with noise wall as the best outcome in terms of overshadowing and noise impacts to adjacent properties. Further investigation into operational noise reduction treatments such as architectural treatments, and the material for the noise wall would need to be undertaken during the detailed design phase.

In accordance with the safeguards and management recommendations outlined in the REF, RMS appointed Parsons Brinckerhof (PB) to undertake additional *Ecological Survey Assessment* in April 2013. The additional survey included targeted surveys for the threatened plant *Melaleuca biconvexa*, to confirm the number of *Melaleuca biconvexa* impacted by the proposal. The survey of *Melaleuca biconvexa* would be undertaken using the visual abundance method as defined in Duncan (2011). Additionally, an assessment of the potential occurrence and habitat for the threatened frog species (Wallum Froglet and Green and Golden Bell Frog) and microchiropteran bat species was undertaken. The additional ecology survey assessment concluded that the proposal is unlikely to cause a significant impact on local populations of threatened species or their habitats as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Threatened Species Conservation Act 1995* (TSC Act). As such there would be no requirement for a Species Impact Statement under the EP&A Act or a referral under the EPBC Act.

After consideration of the issues raised in the public submissions and changes to the proposal, the management and mitigation measures have been revised for traffic and transport; noise and vibration; general (consultation); biodiversity; landscape; visual impact and urban design; hydrology and hydraulics.
1 Introduction

1.1 Purpose
This submissions report relates to the Review of Environmental Factors (REF) prepared for the upgrade of the Pacific Highway and Wyong Road intersection at Tuggerah on the New South Wales (NSW) Central Coast and should be read in conjunction with that document.

The REF was placed on public display and submissions relating to the proposal and the REF were received by Roads and Maritime Services (RMS). Chapter 2 of this submissions report summarises the issues raised and provides responses to each issue. Chapter 3 details investigations carried out since finalisation of the REF and Chapter 4 describes and assesses the environmental impact of changes to the proposal. Chapter 5 identifies new or revised environmental management measures.

1.2 The proposal
The proposal involves the upgrade of the Pacific Highway and Wyong Road intersection at Tuggerah by replacing the existing roundabout with a signalised intersection. The intersection currently experiences substantial delays during the morning and afternoon peak periods, which leads to risk taking and numerous crashes. The proposal is required to improve safety at the intersection, ease current traffic congestion at peak times and to cater for future traffic growth. The proposal would also address objectives outlined in NSW 2021: A Plan to Make NSW Number One, Central Coast Regional Strategy, Central Coast Regional Action Plan and the North Wyong Structure Plan.

An overview of the proposal is provided in Figure 1-1. Further detail on each of the components of the proposal is provided in Chapter 3 of the REF. The main features of the proposal include:

- Replacement of the existing roundabout with a signalised intersection.
- Widening of the intersection approaches to accommodate extra lanes (approach and/or turning lanes) in all four directions, comprising:
  - Upgrade of around 500 metres of the Pacific Highway - from Anzac Road (about 235 metres north-east of the intersection) to about 265 metres south-west of the intersection.
  - Upgrade of around 900 metres of Wyong Road - from Gavenlock Road (about 350 metres north-west of the intersection) to Bryant Drive (about 550 metres south-east of the intersection).
- Construction of a new rail overbridge over the Main Northern Rail Line to accommodate eastbound movements along Wyong Road. The existing Tuggerah Rail Overbridge would accommodate all westbound movements, including turning lanes to the Pacific Highway (north).
- Upgrade of the intersection of Wyong Road and Gavenlock Road to incorporate an additional left turn slip lane into Gavenlock Road (southbound).
- Construction of a slip lane on Wyong Road eastbound from the intersection of the Pacific Highway and tying into the existing turn lane into Bryant Road.
• Tie in works at Tambelin Street, at the Anzac Parade intersection (i.e. to the completed Tuggerah Straight upgrade) and at the existing roundabouts with Bryant Drive and Gavenlock Road.

• Construction of about one kilometre of retaining walls. These would be located on the northern side of Wyong Road (east and west of the intersection), the southern side of Wyong Road (east of the intersection) and the western side of the Pacific Highway (north of the intersection).

• Installation of at-grade pedestrian crossings on all four legs of the intersection.

• Extension of the existing pedestrian underpass including improvement of the general amenity of the underpass facility.

• Extension of the pedestrian/cyclist shared path network to improve pedestrian/cyclist connections to adjacent areas including Tuggerah railway station, Supa Centa Tuggerah, Tuggerah Business Park and Tuggerah Westfield Shopping Centre.

• Installation of swales and a constructed wetland for operational water quality control.

• Installation of shut-off valves on three drainage lines to be used for containing emergency spills.

• Installation of temporary sediment control basins at four locations during the construction period, construction of onsite and offsite diversion drains and provision of sediment fences and erosion controls at the source.

• Use of ancillary construction facilities, including a site compound and stockpile sites.

• Temporary access tracks, access areas for retaining wall construction, crane pads and bridge over Tuggerah Creek during construction.

• Relocation of underground and overhead utilities to accommodate the proposal.

The proposal is in a modified urban environment which includes a mix of residential, commercial/business, industrial and transport related land uses. The main features of the area include the Tuggerah Westfield Shopping Centre to the west of the proposal, the Anzac Road industrial area to the north, Supa Centa Tuggerah to the east and Tuggerah Business Park to the south-east of the proposal. A small residential area is located directly to the south of the intersection. The Main Northern Rail Line is located to the east of the proposal and passes under Wyong Road.

Remnant vegetation, roadside plantings, disturbed areas dominated by exotic vegetation and maintained grassland surround the intersection. Four Threatened Ecological Communities (TECs) were recorded within the remnant vegetation located near the proposal. Many areas surrounding the existing intersection are at a lower elevation, and can become flooded during periods of high rainfall.

Mardi Creek is located north of the intersection and Tuggerah Creek is located east of the intersection. The creeks drain to the east towards Tuggerah Lakes and Budgewoi Lake. SEPP 14 wetlands occur within the Tuggerah Lakes Nature Reserve (former Pioneer Dairy site), located about one kilometre to the north-east of the proposal.
Figure 1-1 | Overview of the proposal
The proposal is anticipated to be constructed in five stages to minimise traffic impacts, while ensuring efficient construction and minimising overall impacts on adjacent residents and businesses. Construction of the proposal is anticipated to start in early 2015 and have a duration of between 18 and 24 months. The proposal would be funded by the State Government.

1.3 REF display

Roads and Maritime Services prepared an REF to assess the environmental impacts of the proposed works. The review of environmental factors was exhibited between 18 February 2013 and 18 March 2013 at four locations, as detailed in Table 1-1.

**Table 1-1 Display locations**

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gosford Motor Registry</td>
<td>Shops 11 and 12, Park Plaza Corner William Street and Henry Parry Drive, Gosford</td>
</tr>
<tr>
<td>Erina Motor Registry</td>
<td>Karalta Lane, Erina</td>
</tr>
<tr>
<td>Woy Woy Motor Registry</td>
<td>39 Victoria Road, Woy Woy</td>
</tr>
<tr>
<td>RMS Central Coast Office</td>
<td>Upper level, The Pavilion 29 George Street, Woy Woy</td>
</tr>
</tbody>
</table>

The REF was placed on the RMS internet website and made available for download. The exhibition locations and website link were advertised in the Central Coast Express Advocate on 22 February, 1 March and 6 March 2013.

A community update newsletter was distributed to 1500 homes and businesses in the proposal area on 18 February 2013 and made available for download on the project website. The newsletter was the main communication tool outlining the proposal and providing instructions on how to provide feedback to RMS.

Letters of notification, which included a copy of the community update newsletter, were sent to the residents of numbers 1-7 Yaldeeme Close.

In addition to the above public exhibition, an invitation to comment on the REF was sent directly to the following identified stakeholders:

- Wyong Shire Council.
- RailCorp.
- The Office of Environment and Heritage.
- Westfield, Tuggerah.
- Tuggerah Supa Centre.

1.4 Changes to the proposal

Following public display of the REF, and in response to submissions received, RMS undertook a Feasibility and Overshadowing Assessment (SKM, 2013) to consider removal of one left turning lane from Wyong Road westbound to the Pacific Highway southbound (alternate design) to reduce impacts to properties 1-7 Yaldeeme Close, Tuggerah (refer to Chapter 3). The removal of the lane in this location would result in about a 3.5 metre reduction in width of the road corridor leading to a shorter...
pedestrian underpass extension and increased clearance between the existing boundary fences of residential properties and the retaining wall proposed on the southern side of the eastern leg of Wyong Road.

An additional traffic assessment was undertaken as part of the feasibility assessment (RMS, 2013) for the alternate design (refer to Figure 1-2 and Section 3.1.2). The alternate design was compared against the concept design and impacts to intersection operation and queuing for the different designs was modelled. The assessment was completed for the morning and afternoon peak demand periods for 2025 and 2035, and included low and high growth scenarios.

The traffic modelling found that queuing at the Pacific Highway and Wyong Road intersection remains consistent for the concept design and the alternate design. As such a second left turning lane is not required to reduce the queuing at the intersection and the additional queuing that would result from the removal of this lane would not impede adjacent through lanes and cause delays or congestion for northbound traffic.

There would be minor increase in intersection delay; however the level of service (LoS) for the alternate design compared to the concept design are the same for both the 2025 and 2035 low growth scenarios. While, for the high growth scenarios for 2025 and 2035 the alternate design would operate with a LoS D compared to LoS C for the concept design for both morning and afternoon, with the exception of the afternoon 2035 scenario when both the designs operated at LoS D. Despite the LoS being lower the intersection delay is only three seconds slower, therefore the alternate design with a single left turning lane is sufficient for maintaining intersection performance for future traffic demands for both peak periods.

Five different scenarios were assessed as part of the overshadowing component (refer to Section 3.2) of the Feasibility and Overshadowing Assessment (SKM, 2013), and include the following:

- Option 1 – Existing intersection configuration without trees.
- Option 2 – Existing intersection configuration with trees.
- Option 3 – Concept design with a noise wall.
- Option 4 – Alternate design with a noise wall.
- Option 5 – Alternate design with a noise wall and landscaping features.

These five options investigated impacts to residential properties 1-7 Yaldeeme Close that are located immediately adjacent to the intersection. According to the results of the overshadowing assessment and in consideration of the recommendations of the Noise and Vibration Assessment completed for the proposal (SKM, 2013a). RMS has selected option 4 - alternate design with noise wall as the best outcome in terms of overshadowing and noise impacts to adjacent properties. Further investigation into operational noise reduction treatments such as architectural treatments and the material for the noise wall would need to be undertaken during the detailed design phase.
Figure 1-2 | Alternate design
## 2 Response to issues

The REF was placed on public display for comment between 18 February 2013 and 18 March 2013 and a total of 10 submissions relating to the proposal and the REF were received by RMS. Of the 10 submissions received two were from government agencies (OEH and WSC), one was from a business and seven submissions were from the community. Table 2-1 lists the respondents and each respondent’s allocated submission number. The table also indicates where the issues from each submission have been addressed in this report.

### Table 2-1: List of respondents and where there issues are addressed in the submissions report

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Submission No.</th>
<th>Section number where issues are addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency submission</td>
<td>1</td>
<td>2.11</td>
</tr>
<tr>
<td>Office of Environment and Heritage (OEH)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual submission</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Individual submission</td>
<td>3</td>
<td>2.5, 2.7.3</td>
</tr>
<tr>
<td>Individual submission</td>
<td>4</td>
<td>2.3, 2.9, 2.11, 2.14</td>
</tr>
<tr>
<td>Individual submission</td>
<td>5</td>
<td>2.15</td>
</tr>
<tr>
<td>Individual submission</td>
<td>6</td>
<td>2.2</td>
</tr>
<tr>
<td>Individual submission</td>
<td>7</td>
<td>2.5, 2.7.3</td>
</tr>
<tr>
<td>Individual submission</td>
<td>8</td>
<td>2.7.3, 2.8, 2.10, 2.12, 2.13.1, 2.13.2</td>
</tr>
<tr>
<td>Business submission</td>
<td>9</td>
<td>2.13.3</td>
</tr>
<tr>
<td>Agency submission</td>
<td>10</td>
<td>2.4, 2.7.1, 2.7.2, 2.7.3</td>
</tr>
<tr>
<td>Wyong Shire Council (WSC)</td>
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<td></td>
</tr>
</tbody>
</table>

### 2.1 Overview of issues raised

Each of the 10 submissions received has been examined individually to understand the issues being raised. The separate issues raised in each submission have been extracted and collated and corresponding responses to the issues have been provided. Where similar issues have been raised in different submissions, only one response has been provided. The issues raised and RMS response to these issues forms the basis of this chapter.

Of the submissions received, two objected to specific aspects of the proposal but did not object to the proposed upgrade. Two submissions supported the proposal and the remaining six submissions did not offer a position on the proposal.

The OEH submission focussed on the need for and nature of the proposed flooding mitigation measures. The need for consultation with owners of the commercial properties that may be affected by flooding was also emphasised.
The WSC submission raised various queries regarding the traffic modelling assumptions, the design of specific elements of the intersection and the provision for pedestrian and cyclist passage. The need for ongoing consultation between RMS and WSC was also reiterated.

The most prominent issues raised in the individual and business submissions related to:

- Land use and property.
- Landscape character, visual impact and urban design.
- Pedestrian and cyclist facilities.
- Consultation
- Noise and vibration.

Other considerations included traffic and transport, the strategic need for the proposal, the selection of the preferred option, flooding, ecology and air quality.

### 2.2 Strategic need

**Submission numbers**

2 – Individual
6 – Individual

**Issue description**

Two submissions from individuals expressed concern regarding the proposal being prioritised over other projects in the area. Both submissions considered the Enterprise Drive/Wyong Road roundabout upgrade to be of higher importance than the proposal. One submission also suggested that the Wyong Road dual carriageway and bridge over river project should be of higher priority than the proposal.

**Response**

Section 2.1 of the REF outlines the strategic need for proposal. As noted, the proposal has been prioritised over other road projects in the area due to:

- The current poor level of service provided by the intersection, i.e. Level of Service F (over capacity) during morning peaks and Level of Service D (operating near capacity) during afternoon peaks.
- The poor crash history at this intersection, which is exacerbated by the poor sight distance over the existing railway bridge and the high incidence of risk taking due to congestion and small gaps at the roundabout.

In addition, as identified in Section 2.1.3 of the REF, the proposal assists in fulfilling government strategies for improving transport and infrastructure in NSW and the Central Coast region. This includes the following:

- The proposal 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.
  - Improving road safety.
- The proposal meets one of the main strategies included in the NSW
government *Central Coast Regional Strategy* (NSW Government 2008) which includes improving links to the Gosford Regional City, Tuggerah–Wyong Major Centre and the wider network of centres on the Central Coast.

- The proposal is specifically mentioned as a priority action in the *NSW 2021: Central Coast Regional Action Plan* (NSW Government 2012) to address traffic hotspots and increase linkages within the region.

RMS intends to upgrade the intersection of Wyong Road and Enterprise Drive in the short term, and a concept design is currently being developed.

### 2.3 Options assessment

#### Submission numbers

4 – Individual

#### Issue description

One submission from an individual indicated a preference for option D as the preferred option over option E. The submission considered option D to be the best longer term solution due to its beneficial effects on traffic flow and road user safety and due to its reduced environmental impacts. The submission identified Options B and C as good interim solutions if funding was not available for option D.

#### Response

RMS undertook the assessment of options during the development of the concept design options and a copy of the report is still available online on the project website. A high level review of environmental impacts for each option was considered in this assessment. Based on the construction footprint, option D would have the greatest environmental impact from a social, noise and vibration, urban design, property acquisition and ecological (including impacts to threatened species) perspective. Environmental impacts for all other options were considered to be similar. None of the options were expected to trigger any environmental or cultural requirement for approvals, consequently environmental impacts was not used as a defining criterion for identifying the preferred option.

Section 2.4 of the REF outlines the various alternatives and options that were considered for the upgrade of the Wyong Road and Pacific Highway intersection. The community were provided with the opportunity to comment on these options when the options report was put on display in June 2011.

Following a detailed review of the options, which included consideration of the community submissions, option E was selected as the preferred option. This option was found to best fulfil the project objectives in terms of meeting the strategic need for improved traffic flows and safety at the intersection while catering for additional future traffic capacity. It also provides the best balance between technical, environmental, social and economic criteria.
A brief overview of each option is as follows:

- **Option B** (replacement of roundabout with traffic lights without bridge widening) would improve the capacity of the intersection while reducing the conflict between different movements. The intersection performance for this option would be very poor for the 2031 scenario, excluding the traffic expected to be generated by the Tuggerah Town Centre development. This option was rejected as it does not meet longer term target capacity objectives for the intersection and therefore does not fulfil the proposal objectives.

- **Option C** (replacement of roundabout with traffic lights as well as widen the bridge over the rail line) would improve the capacity of the intersection with the construction of traffic lights. In addition, the widening of the bridge to accommodate additional length for turning lanes would assist to improve intersection capacity. Short-term capacity improvements and resultant improvements to queue length and crash risks would be experienced at this intersection for up to 10 years. However, delays and queues would reach unacceptable levels 15 years after the upgrade (excluding the traffic expected to be generated by the proposed Tuggerah Town Centre development). This option was rejected as it does not meet longer term target capacity objectives for the intersection and therefore does not fulfil the proposal objectives or the options criteria.

- **Option D** (grade separation) would reduce the conflicts between different traffic movements and would also provide adequate capacity for the intersection into the future, including traffic generated by the proposed Tuggerah Town Centre development. However, this option involves the construction of a large structure. This would have major impacts, requiring full replacement of the existing bridge over the rail line. It is not compatible with current planning by the Department of Planning and Infrastructure (DP&I) for the proposed Tuggerah Town Centre development. Construction of this option would require immediate upgrades of the adjacent road network and infrastructure, which would add substantially to the cost of construction. Whilst this option meets capacity and safety requirements, it was rejected as it presents a high cost larger scale development in excess of that required in order to achieve the proposal goals. In addition, it is not compatible with DP&I’s plans for the Tuggerah Town Centre.

- **Option E** (current proposal) would improve capacity for traffic flows at the Pacific Highway and Wyong Road intersection through the provision of additional approach and turning lanes. The option would provide capacity for projected increases in traffic volumes until 2031, with and without the proposed Tuggerah Town Centre development. Option E would also allow for better control of traffic flow. This would also help to address safety issues associated with risk taking during the current long waiting times at the roundabout. The option would also improve safety along the westbound lane of Wyong Road through an adjustment of its vertical alignment, therefore providing close to the minimum sight distance for motorists. Overall, this option was found to best meet the strategic need for improved traffic flows and safety at the intersection while catering for the need for additional future traffic capacity. The intersection upgrade option has been found to fulfil proposal objectives, contribute towards achieving regional traffic and safety objectives. It was therefore identified as the preferred option.
2.4 Description of the proposal
Submission numbers
10 – WSC

Issue description
The submission from WSC suggested that the proposal did not include the recently approved adjustments to the Wyong Road and Bryant Drive roundabout.

Response
RMS has confirmed with WSC that this comment refers to the recently approved adjustments associated with the proposed development to the Central Coast Mariners (CCM) Football Club.

RMS is aware of this development and relevant information was provided to RMS on 23 April 2012. No subsequent inputs were provided by WSC.

The design of the interface at Bryant/Reliance Drive has taken into account the CCM development. The proposal provides for the Wyong Road Eastbound lanes to tie into the existing lanes at the same point that the CCM development does.

During detailed design, RMS would consult with WSC and CCM to ensure the two designs remain aligned and that the proposed cyclist/pedestrian strategy is retained. The RMS environmental officer will also be consulted and will advise of any further environmental impact assessment requirements associated with any design changes.

2.5 Support for the proposal
Submission numbers
3 – Individual
7 – Individual

Issue description
Two submissions from individuals expressed support for the proposal. One submission emphasised the improved safety for motorists that would result from the proposal.

Response
These submissions are noted.

2.6 Consultation
Submission number(s)
8 – Individual
10 – WSC
Issue description

One submission from an individual noted the following:

- Whilst consultation has been undertaken in a professional manner, the requirement to make a written submission, despite several meetings with RMS, was an imposition.
- The submission indicated that information provided during the display of the REF did not adequately show how the design would impact on the individual’s property.
- A request for additional information and further consultation with RMS was made.
- The submission emphasised that the final design should incorporate feedback from residents so that the best possible outcome for the residents is achieved.

The submission from WSC noted that ongoing discussions between RMS and WSC would be required with regards water, sewage and hydrology.

Response

The various meetings between RMS and the property owner have provided an opportunity for the property owner to understand the potential implications of the design for their property and for RMS to understand the property owners concerns. While RMS recognises that the requirement to make a written submission is another imposition, RMS prefers issues and concerns to be submitted in writing to ensure that they are accurately captured, understood and responded to.

Appendix A of the REF includes plans of the concept design, which outline the extent of the proposal, as well as the cadastral boundaries of adjacent properties. Lot and DP details of the properties adjacent to the proposal are shown in Figure 3-16 of the REF. The property in question is not directly impacted by the proposal from an acquisition perspective, however, indirect impacts as a result of the proposal would result. This would include temporary air quality, noise and vibration impacts and longer term social, visual amenity and operational noise impacts. These impacts have been identified and assessed within the relevant sections of Chapter 6 of the REF.

RMS has undertaken ongoing consultation with the affected property owner during the preparation of this submissions report including to provide more information about property impacts and to consider issues raised. Additional feasibility investigations into potential design changes have been undertaken based on the submissions received. Based on the results of these feasibility investigations (refer to Chapter 3) RMS has decided to modify the concept design and adopt an alternate design that would reduce the impact of the proposal on these property owners.

RMS will continue to liaise with the property owner, and other adjacent property owners, regarding the alternate design to ensure that they have a clear understanding of the potential impacts on their property/properties and to ensure that an acceptable outcome and design is achieved.

RMS will undertake ongoing consultation with WSC in regards to impacts to water, sewage and hydrology through the detailed design phase.
2.7 Traffic and transport

2.7.1 Construction traffic

Submission number(s)

10 – WSC

Issue description

The submission from WSC expressed concern over the use of the Pacific Highway south of Wyong Road as a haulage route. These concerns were associated with the safety of motorists and pedestrians, especially near Tuggerah Public School, and the potential degradation of the road pavement.

Response

As outlined Section 3.3.7 of the REF, the majority of additional construction truck movements will occur during the construction of the Wyong Road (eastbound) widening, including the retaining walls and the rail overbridge duplication. These movements would not occur on the Pacific Highway south of Wyong Road.

During construction of retaining wall RW-C, the southern underpass extension and the upgrade of the Pacific Highway south of Wyong Road, some trucks will be required to drive south along the Pacific Highway and turn right at Tonkiss Street in front of the Tuggerah Public School. This is to mitigate against unsafe vehicle movements close to the Pacific Highway and Wyong Road Intersection. As this route is not an approved RMS restricted access vehicle route or 19 metre B-Double Route (over 50 tonnes), trucks used on this route would be restricted to rigid trucks or truck and trailers (five to eight tonnes).

As outlined in Section 6.1 of the REF, construction traffic would be carefully managed through the development and implementation of a Construction Traffic Management Plan and specific Traffic Control Plans. This would include consideration of impacts to local traffic and safety risks to road users and pedestrians, including around Tuggerah School. Provision would be made in the Construction Traffic Management Plan to ensure that truck movements are kept outside school zone times, which would reduce the risk to students.

RMS would be responsible for maintaining the condition of any local roads used during construction. Prior to construction, RMS would undertake a condition survey of local roads. The condition of any local roads used during construction would be managed and monitored and any damage to these roads caused by construction traffic would be repaired during and at the completion of all construction works.

2.7.2 Traffic modelling

Submission number(s)

10 – WSC

Issue description

The submission from WSC raised various queries associated with the assumptions and results of the traffic modelling, including:

- Whether the traffic volumes for 2025 and 2035 were based on Paramics
modelling and whether this, in turn, included all future development in the area.

- Whether the 1.7 per cent annual linear growth rate used to determine the 2025 and 2035 traffic volumes was based on the Paramics modelling and whether this growth rate was used uniformly on all approach legs and lanes.
- Why the 2035 afternoon peak numbers ‘blocked’ are lower with the Tuggerah development than without it.
- Why there is such a small difference in the ‘blocked’ and ‘% blocked’ values when comparing the do-nothing scenario with the concept design scenario.
- Whether pedestrian movements across the highway at Anzac Parade have been taken into account in the traffic analysis. The submissions noted that the existing heavy pedestrian movement is currently causing problems and delays to this intersection and whole road network.
- What impact the at-grade pedestrian movement will have on the operation of the proposed Wyong Road signalised intersection.

Response

A Traffic and Transport Assessment (SKM, 2012) was prepared as part of the REF. The methodology, including this information, is summarised in Section 6.1 of the REF. In terms of the issues raised by WSC:

- All traffic turning flows were extracted from Paramics modelling under different demand scenarios. These scenarios included with and without the proposed Tuggerah Town Centre Development.
- The projection of the traffic demand in the Wyong Town centre was derived from WSC’s estimate of future land use in the Town Centre. These land use assumptions were incorporated in the RMS’s strategic Emme/2 model and used as the basis for the development of the 2021 and 2031 model demand.
- Traffic prediction assumed an annual linear growth rate of 1.7 per cent and this was applied uniformly in the study area, including all approaches of the intersection, from “2021 to 2025” and “2031 to 2035”. The growth rate of 1.7 per cent is based on Section 3.1 of the Wyong Road Intersection Upgrade Options Report (RTA, 2011).
- The “Models Traffic Released/Blocked” is an indication of the network operation. "Released vehicles" refers to the vehicles that were able to complete the assigned journey within the model simulation period, whilst "unreleased / blocked vehicles" refers to the vehicles that were prevented from completing the journey and were "blocked" in the zone during the simulation period. Blocking occurs when there are capacity constraints on the road network. Although it could be expect the “Tuggerah development” would have a higher number of blocked vehicles than “no Tuggerah development”, the number of blocked vehicles as a whole is very small and hence the difference between the two scenarios is minimal (i.e. only 0.2 per cent in the two hour simulation period) and is regarded as insignificant.
- The future demand models have assumed the same existing signal phasing as Sydney Coordinated Adaptive Traffic System (SCATS), including the pedestrian movement, at the Pacific Highway and Anzac Road intersection. SCATS is an intelligent transportation system developed by RMS to control and coordinate traffic signals for arterial roads or networks. The system uses sensors at each traffic signal to detect vehicle presence and pedestrians waiting to cross and uses this information to calculate and adapt the timing of traffic signals in the network. The pedestrian movements were assumed to be 50 full pedestrian crossings per hour. The morning and afternoon peak queues...
modelled using the SCATS phasing for the Pacific Highway and Anzac Road intersection closely reflect the observed queues at the study intersections. Based on a fixed signal time assessment, the current assessment result is sufficient enough to reflect the delay caused by pedestrian crossings.

2.7.3 Traffic movement

Submission number(s)
3 – Individual
7 – Individual
8 – Individual
10 – WSC

Issue description

Three submissions from individuals and the submission from WSC raised issues associated with the traffic movement within the proposal area. In summary, the individual submissions raised the following issues:

- A car clearance space should be provided for on the Pacific Highway at the intersection of Tambelin Street with the Pacific Highway to enable cars to safely exit Tambelin Street and turn right towards Pacific Highway.
- A give way sign should be installed for motorists turning left from Wyong Road (eastbound) onto Pacific Highway (northbound) to allow motorists to turn left onto Anzac Road safely.
- The dedicated left turn only lane from Wyong Road (westbound) into Gavenlock Road would exacerbate traffic congestion at the intersection due to the short distance between the intersection and the Westfield Parade roundabout. The left turn only lane from Wyong Road (westbound) to Gavenlock Road should also be diverted so that it intersects with the Gavenlock Road and Westfield Parade roundabout to ease congestion associated with the Westfield exit.

The WSC submission expressed concern regarding the following issues:

- Whether the Wyong Road (westbound) slip lane into Gavenlock Road provides adequate separation to enable drivers to pick gaps on the roundabout and enter Westfield.
- Whether the kerbside lane turning left into the Pacific Highway (southbound) from Wyong Road (westbound) would push traffic in the outside turning lane into the median.
- The potential for fast vehicles in the left turn slip lanes to lose control and crash into vehicles on the other side of the median, especially for the Pacific Highway (southbound) left turn onto Wyong Road (eastbound).

Response

In accordance with the guidelines articulated in RMS delineation manual, the provision for a marked car clearance space is not required to enable cars to safely exit Tambelin Street. The current design provides the best solution in terms of road user safety considering the turning movements and proximity to the intersection.

The use of a give way sign for motorists turning left from Wyong Road (eastbound) onto Pacific Highway (north bound) to allow motorists to turn left onto Anzac Road is
a safety issue for the current intersection (roundabout) layout. The proposal would not require this as signalised slip lanes would be provided to control eastbound traffic along Wyong Road turning left onto the Pacific Highway north. Furthermore, when vehicles are turning right from Wyong Road westbound to Pacific Highway northbound or when northbound vehicles travel straight through the intersection along the Pacific Highway, vehicles from Wyong Road eastbound turning left onto Pacific Highway northbound would be stopped at the red traffic light, therefore eliminating the issue.

The design addresses the problems caused by the short distance between the two roundabouts at Gavenlock Road as well as the existing weaving manoeuvres between traffic turning right from Wyong Road wishing to continue south through the Westfield Parade roundabout and the traffic turning left from Wyong Road wishing to turn right at the Westfield Parade roundabout. The proposal would have only one lane exiting the Wyong Road and Gavenlock Road roundabout. Left turning traffic from Wyong Road would also then enter this lane, with priority given to Wyong Road roundabout traffic. Traffic on Gavenlock Road then divides into right turn or straight through traffic at the Westfield Parade roundabout after this intersection point. The gap is comparable to the existing situation and it may even be improved as through traffic on the roundabout would create opportunities. The design should help to ease congestion associated with the Westfield exit and would eliminate the current weaving manoeuvres.

Intersection options for Wyong Road (westbound), Gavenlock Road and Westfield Parade were identified and considered during design development. Diverting the left turn only lane from Wyong Road (westbound) to Gavenlock Road so that it intersects with Gavenlock Road and the Westfield Parade roundabout was considered. This solution, however, was rejected on the basis of the property impact it would have, especially since this option would require the solution to be built on land identified for the possible future development of the Westfield site (to the east of Gavenlock Road). It would constrain future alternatives for accessing the Westfield site (east of Gavenlock Road) from being identified closer to the actual development of the site.

An alternate design has been proposed which includes the removal of one of the two left turning lanes from Wyong Road (westbound) into the Pacific Highway southbound; refer to Figure 3-1. The alternative design would accommodate a 19 metre semi-trailer vehicle and would be a low speed corner (i.e. 25 kilometres per hour) as highlighted by the additional signage (refer signage design drawing in Appendix A). This would assist in managing the potential for traffic to be pushed into the median when using the left turning lane.

As outlined in Section 5.8.1 of the Upgrade of the Pacific Highway and Wyong Road intersection Concept Design Report (RMS, 2013), the proposal has incorporated advisory speed signage to mitigate against the potential for fast vehicles in left turn slip lanes to lose control. This includes signage marked with ‘EXIT SPEED’ ‘25km/h’ that would be located adjacent to left turn lanes with a hazard marker on the median. This would advise motorists of the low speed environment ahead.

2.8 Noise and vibration

Submission number(s)
8 – Individual
Issue description

One respondent raised concerns regarding with the potential noise impacts associated with the construction and operation of the proposal. The submission emphasised that the individual’s property had been subject to noise and vibration impacts due to the large volume of continuous traffic, including heavy vehicles currently using the intersection, and the absence of a noise barrier. The submission requested that double glazing be provided on all windows of the individual’s dwelling as soon as possible to limit noise impacts, and the erection of signage along Wyong Road to limit compression braking.

Response

A Noise and Vibration Assessment (SKM, 2013a) was prepared as part of the REF and is summarised in Section 6.2 of the REF. The assessment has identified that the individual’s property would be highly noise affected by the proposal during construction. Section 6.2.3 of the REF outlines the proposed safeguards and management measures, which would include:

- The preparation of a construction noise and vibration management plan as part of the Construction Environmental Management Plan, which would include:
  - The identification of potentially affected properties and residences.
  - A risk assessment to identify potential risk for discrete work elements.
  - The identification of feasible and reasonable noise controls.
  - Performance monitoring.
  - A description of the approved hours of work and work to be undertaken.
  - A complaints handling protocol.
  - Site specific controls.
- Construction timetabling, which would include consideration of time and duration restrictions and respite periods, as well as measures to avoid cumulative noise impacts.
- The selection and orientation of plan to reduce noise emissions to sensitive receivers.
- The restriction of activities to standard working hours as much as practical. For any work performed outside standard working hours, noise impacts would be minimised in accordance with the RMS Environmental Noise Management Manual (ENMM) (RTA, 2011).
- The use of quieter construction methods, plant and equipment, where practical, feasible and reasonable.
- The establishment of a community liaison telephone number and site contact so that noise related complaints can be addressed.
- Routine noise monitoring in accordance with the ENMM, and implementation of appropriate corrective action as required.

The Noise and Vibration Assessment (SKM, 2013a) also found that the individual's property would experience acute noise impacts during operation and that operational noise mitigation would be required. The REF identifies that following consultation with the affected landholder all feasible and reasonable measures that could mitigate potential operational noise impacts would be considered. The investigation would take into consideration the noise mitigation hierarchy as outlined in the ENMM which applies mitigation measures in the following order of preference:
• Road design and features, including pavements, alignment, speed limits and gradient.
• Construction of noise walls.
• Receiver treatments, which may include acoustic treatments to individual dwellings.
• Property acquisition.

Signage would be finalised in detailed design. This would include consideration of signage to reduce compression breaking on the approaches to the intersection. This could be accommodated without changing the design of the current proposal.

Following public display of the REF, RMS engaged SKM to investigate the feasibility of the removal of one left turn lane from Wyong Road Westbound to the Pacific Highway southbound (the alternate design (refer to Chapters 3.4) in order to reduce impacts to residential properties 1-7 Yaldeeme Close from the proposal.

The results of the feasibility assessment (refer to Chapter 3) have shown that the alternate design is acceptable from a traffic flow and queuing perspective and consequently RMS has adopted the alternate design. As such the change to the alternate design would move the traffic away from residential properties 1-7 Yaldeeme Close (compared to the concept design), which would marginally reduce traffic noise impacts during operation of the proposal. RMS would still construct the noise wall in this location to mitigate operational noise as per the recommendations of the Noise and Vibration Assessment (SKM 2012).

2.9 Ecology

Submission number(s)
4 – Individual

Issue description
One submission from an individual expressed concern regarding:
• The direct and indirect impact to Threatened Ecological Communities (TEC) and threatened species, including those downstream of the study area. The submission emphasised that these communities were particularly important in maintaining connectivity within the highly fragmented habitat prevalent in the area.
• Water quality impact on Pioneer Dairy, Wyong River and Tuggerah Lakes.
• The timing for the frog and microbat surveys. The submission indicated that these surveys should have been undertaken during autumn to spring and presented in the REF.

Response
A Biodiversity Assessment (SKM, 2013b) was prepared as part of the environmental impact assessment and is summarised in Section 6.5 of the REF. The Biodiversity Assessment was prepared in accordance with RMS (2012) Environmental Impact Assessment Practice Note: Biodiversity Assessment (EIA-N06) and included surveys of both terrestrial and aquatic communities during March and July 2012. It concluded that neither a Species Impact Statement, in terms of the Environmental Planning and
Assessment Act 1979, nor a referral, in terms of the Environmental Protection and Biodiversity Conservation Act 1999, was required.

Various safeguards and management measures are identified in Section 6.3.4 of the REF, including the preparation of a flora and fauna management plan in accordance with the RMS Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects.

Assessments of significance undertaken as part of the Biodiversity Assessment (SKM, 2012b) found that the proposal would not have a significant impact on any threatened species, populations or ecological communities given implementation of the management and mitigation measures identified in this REF. Therefore, a Species Impact Statement is not required. However, due to the potential impacts on *Melaleuca biconvexa*, it was recommended that additional survey be undertaken to confirm the number of *Melaleuca biconvexa* impacted by the proposal. The survey of *Melaleuca biconvexa* was undertaken using the visual abundance method as defined in Duncan (2011). The survey results would be used by RMS to identify if a referral is required to be submitted as a precautionary measure to the Australian Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC).

Accordingly, an additional Ecological Survey Assessment was undertaken by Parsons Brinckerhof (PB) from 12 to 14 March 2013, which included targeted surveys for the threatened plant *Melaleuca biconvexa*, and an assessment of the potential occurrence and habitat for threatened frog species (Wallum Froglet and Green and Golden Bell Frog) and microchiropteran bat species. The results of this assessment are presented in Section 3.3, and a summary of the results are included below.

**Impact on TECs, threatened species and wildlife connectivity**

Considerable care was taken during the development of the concept design to minimise impacts to TECs and threatened species. This has included minimising the extent of construction to limit the footprint of the proposal.

The Biodiversity Assessment found that impacts to TECs would be limited, with 0.67 hectares of TEC likely to be cleared, of which 0.15 hectares was assessed as being of high quality.

*Melaleuca biconvexa* is listed as vulnerable under both the Environment Protection and Conservation Act 1999 (EPBC Act) and Threatened Species Conservation Act 1995 (TSC Act). The proposal would affect about 14 per cent of potential habitat for *Melaleuca biconvexa* in the study area; however this comprises only 0.11 per cent of the mapped distribution within Wyong Shire. Various safeguards and management measures are outlined in Section 6.3.4 of the REF, including:

- Identifying opportunities to reduce the requirement for clearing during the detailed design phase, for example:
  - Reducing the width of the alignment in areas where the road adjoins TEC and/or *Melaleuca biconvexa*.
  - Using temporary or permanent retaining walls and/or dry stone walls in place of batters around individual indigenous trees and around stands of *Melaleuca biconvexa* in order to protect vegetation and avoid loss.
- Undertaking additional survey to confirm the number of *Melaleuca biconvexa* impacted by the proposal.
• Retaining individuals of *Melaleuca biconvexa* within the construction footprint where possible.

• Developing and implementing a management plan for minimising impacts to *Melaleuca biconvexa* and *Syzygium paniculatum* species for the proposal, which would include a strategy for replanting these species adjacent to the proposal. Additionally it would include a strategy for avoiding and retaining individuals of *Melaleuca biconvexa* and *Syzygium paniculatum* within the construction footprint where possible.

• Integrating the threatened flora species impacted by the proposal (*Melaleuca biconvexa* and *Syzygium paniculatum*) into the proposed landscaping, including batters, surrounding drainage and sedimentation controls, and any other areas disturbed during construction.

*Maundia triglochinoides* is listed as vulnerable under the TSC Act. Although identified in the vicinity of the proposal, *Maundia triglochinoides* was not identified within the footprint of the proposal. As outlined in Section 6.3.3 of the REF, the Biodiversity Assessment considered that there was a moderate likelihood of this species being present due to the absence of suitable habitat. Section 6.3.4 of the REF notes that targeted surveys for *Maundia triglochinoides* would be undertaken during the detailed design phase, and if any individuals are found, specific measures to protect these individuals would be included in the flora and fauna management plan. This species would also be incorporated into the replanting plan.

The assessment of significance, undertaken as part of the Biodiversity Assessment, concluded that the proposal is unlikely to cause a significant impact on local populations of threatened species or their habitats as listed under the EPBC Act or TSC Act.

Additional assessment as part of *Pacific Highway and Wyong Road Intersection Ecological Survey Report*, (PB 2013), also concluded that the proposal is unlikely to cause a significant impact on local populations of threatened species or their habitats as listed under the EPBC Act or TSC Act. PB (2013) confirmed that there would be no requirement for a Species Impact Statement under the EP&A Act or a referral under the EPBC Act.

Wildlife connectivity was considered in the biodiversity assessment; refer to Section 6.3.3 of the REF. The assessment found that there is currently limited connectivity between habitats at the location where the upgrade is proposed. There is, however, connectivity provided along Tuggerah Creek, as a wildlife corridor for both aquatic and terrestrial flora and fauna exists along the creek. There would be some disturbance to the banks of Tuggerah Creek during construction of the extension of the Tuggerah Rail Overbridge. However, the proposal would not result in further disruption to connectivity in this area. Replanting of indigenous vegetation would occur on the completion of construction to mitigate vegetation lost through the upgrade and to add value to existing habitats. Safeguards and management measures outlined in Section 6.3.4 of the REF detail the requirements of the rehabilitation plan, which would include planting to facilitate fauna passage along Tuggerah Creek in areas in and adjacent to the construction footprint.

**Impact on water quality**

The proposal would involve an extension of the existing wetland on the northern side of Wyong Road (refer to Figure 1-1). The aim of extending the wetland is to:

• Mitigate the loss of wetland area that would need to occur to widen the road.
• Mitigate the loss of indigenous vegetation, including the threatened species *Melaleuca biconvexa*.
• Maintain the hydrology as close as possible to the existing.
• Treat stormwater from the road.

Stormwater would be directed through this wetland, which would have the effect of slowing the flow of the water and filtering pollutants. The wetland would be vegetated with indigenous macrophytes and other indigenous wetland vegetation in keeping with the extant TECs, Sydney Freshwater Wetlands on Coastal Floodplains. The extended wetland would also provide flood storage to mitigate the removal of storage that would occur through the development.

Swales vegetated with macrophytes have also been incorporated into the proposal as an alternative to piped stormwater systems to work together with the wetland in maintaining the hydrology, filtering pollutants from stormwater and providing habitat for indigenous flora and fauna. Further detail on the proposed operational water quality controls is provided in Section 3.2.2 of the REF.

**Frog and microbat surveys**

As outlined in Section 6.3.3 of the REF, the biodiversity assessment found that there was a low to moderate likelihood of the Green and Golden Bell Frog (listed as vulnerable under the EPBC Act and endangered under the TSC Act) and the Wallum Froglet (listed as vulnerable under the TSC Act) occurring in the study area due to habitat available at the site. In terms of proposed safeguards, the REF notes that targeted surveys would be undertaken to identify the presence or otherwise of these species using the OEH survey methodologies.

Frog surveys need to be undertaken when there is the greatest chance of encountering the particular species. The likelihood of detecting frogs during a survey is dependent upon weather conditions. Generally, frogs are more active during warm, wet conditions. The optimal timing of the surveys is based on OEH *Survey Guidelines for Amphibians* and specific *Guidelines for the Green and Golden Bell Frog (Litoria aurea)*. The latter publication recommends that the best time to undertake surveys for the Green and Golden Bell Frog is from August through to March. For the Wallum Froglet (*Cinia tinnula*), the most suitable period for surveys is between November and March.

Targeted surveys were undertaken by PB for both of these frog species during March this year. No individuals of either species was recorded during these surveys. The habitat assessments undertaken as part of the surveys found that the extant habitats were not suited to either species and were generally in a degraded state.

The *Biodiversity Assessment* also found that the proposal would result in the removal of native, planted and exotic vegetation that provides foraging opportunities for cave and tree roosting microbats (various listed as vulnerable under the TSC and / or EPBC Acts). In terms of proposed safeguards, the REF notes that targeted microbat surveys would be conducted by a qualified ecologist in the culverts and bridges within the proposal area prior to construction, including diurnal and nocturnal search, during the most appropriate time of the year.

As with frog surveys, microbat surveys need to be undertaken when there is the greatest chance of encountering the particular species. As for frog surveys, the State and Federal guidelines were followed in determining the timing and methodology for the survey of microbats.
Targeted surveys for microbats were undertaken in March this year by PB (2013). These surveys confirmed the presence of one threatened species (Little Bentwing Bat) and recorded fragments of call sequences suggestive, but not conclusive, of the presence of two other threat-listed microchiropteran bats, the Eastern Bent-wing Bat and the Yellow-bellied Sheathtail Bat. Although these bats and a further five bat species were assessed as having foraging opportunities within the proposed construction footprint due to their local occurrence and highly mobile nature, there are limited roosting opportunities within the proposed construction footprint for both hollow-dwelling or cave-dwelling microchiropteran bat species. These limited roosting sites include culverts and bridges which contain roosting habitat; however no maternity/permanent roost sites in the form of caves are present within the study area.

The additional ecology assessment by PB (2013) concluded that the proposal is unlikely to cause a significant impact on local populations of threatened species or their habitats as listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) or Threatened Species Conservation Act 1995 (TSC Act) provided the mitigation measures as proposed by the SKM (2013) Biodiversity Assessment are adequately implemented. As such there would be no requirement for a Species Impact Statement under the EP&A Act or a referral under the EPBC Act.

2.10 Landscape character, visual impact and urban design

Submission number(s)
8 – Individual

Issue description

One submission from an individual raised a range of concerns associated with the landscape character, visual impact and urban design of the proposal, which included the following issues:

- Concern that the amenity of the individual’s property has been more substantially impacted by the previous upgrades than the surrounding properties and would, again, be more substantially impacted by the proposal. In particular, the proximity (and height) of the proposed retaining wall and cantilevered pathway to the individual’s property boundary would further degrade the property’s visual amenity.

- Opposition to the Casuarina (she-oak) trees that were planted in the last upgrade of the intersection, as they provide little privacy and noise reduction, block sunlight into the property, shed their needles which are messy and block gutters, pose a fire danger and are at risk of falling onto the individual’s property.

The submission identifies various measures to mitigate the visual impacts, including:

- Omitting the cantilevered pathway from the design to reduce overshadowing and avoid impacts on visual amenity.

- Construct the top panel of the noise barrier out of a transparent material to mitigate the visual impacts.
Response

A Landscape Character and Visual Impact Assessment (Peter Andrews and Associates Pty Ltd/Corkery Consulting Pty Ltd, 2013) was undertaken as part of the REF and is summarised in Section 6.4 of the REF. The assessment notes that the residential area to the south-east of the intersection, off Tambelin Street, would be affected visually by the proposal particularly some of the residences on Yaldeeme Close. This is due to the proposal moving closer to residential buildings, the removal of established vegetation which currently screens the existing roadway, the introduction of a cantilevered pathway and construction of new retaining walls. Consequently, the proposal, specifically the south-eastern leg of Wyong Road, would become more visible. The cantilevered footpath would also introduce the potential for overlooking from the new footpath into rear yards and dwellings. There are very minimal opportunities for landscape treatments to reduce the visual impact of the cantilevered footpath and retaining wall adjoining the residential area off Tambelin Street. However, RMS would discuss options with affected residents such as screen planting within the limited space available, the construction of a privacy fence to the rear of affected properties and incorporating suitable screen planting in the rear of backyards. Appropriate screening would be implemented where possible.

A number of urban design objectives and principles were articulated in the Landscape Character and Visual Impact Assessment. One of these principles was to "retain existing Hoop Pines and additional plantings of this species and Eucalypt species, while reducing the extent of Casuarina (she-oak) trees". As a result, one of the main considerations in the development of the landscaping plan was to reduce the extent of Casuarinas in areas likely to be a nuisance and, accordingly, the Casuarina trees (she-oaks) currently located along the Wyong Road westbound approach to the intersection would be removed as part of the landscaping for the proposal. The current proposal has replaced these with Hoop Pines to maintain consistency within the area. However, as Hoop Pines will potentially grow larger than Casuarinas, the type and form of tree to be planted in this location as part of the proposal would be revised in detailed design to ensure that overshadowing of adjacent premises is minimised where possible. Specifically, this would include reviewing the use of Hoop Pines on the corner of the intersection that is adjacent to properties located in Yaldeeme Close.

The Landscape Character and Visual Assessment notes that architectural treatment of individual dwellings would be a preferred option and that transparent panels should be used on any noise walls. The final location and design of any required noise wall mitigation (including the use of transparent material) would be determined during detailed design (refer further to Chapter 4).

The concept design proposed the use of a cantilevered retaining wall/pedestrian pathway in order to accommodate existing water and telecommunication utilities, refer to Appendix F, of the REF. However, following public display of the REF, RMS undertook a Feasibility and Overshadowing Assessment to consider removal of the cantilevered pathway (refer to Chapter 3 and Chapter 4) to reduce overshadowing and visual amenity impacts in response to comments received as part of the display of the REF. Based on the results of the feasibility assessment, RMS has adopted the alternative design, (refer to Chapter 3) which includes removal of the cantilevered pathway.
2.11 Flooding

Submission number(s)
1 – OEH
4 – Individual

Issue description

One submission from an individual raised concern that the increased flooding associated with the proposal would impact on traffic and access to local shops and the train station.

The submission from OEH notes that the meetings between RMS, OEH and WSC had been effective in defining the work required to address flooding issues. However, the submission emphasises that, since previous work in the area has already exacerbated flooding, the preferred mitigation measures should be identified now rather than during the detailed design phase, as suggested in the REF. The OEH submission also recommends that consultation should be undertaken with the owners of commercial properties affected by flooding.

Response

A Flood Impact Assessment (SKM, 2012a) was prepared as part of the environmental impact assessment and is summarised in Section 6.5 of the REF.

Flooding has occurred in Mardi Creek in 1984, 1985 and 1990 and most recently in June 2007. The 1984, 1985 and 1990 floods have been relatively low in magnitude (peak flood level of 4.12 metre Australian height datum (AHD), 4.00 metre AHD and 4.29 metre AHD, respectively, immediately upstream of the Pacific Highway) when compared to the June 2007 event (flood level of 4.84 metre AHD immediately upstream of the Pacific Highway). Part of the township of Tuggerah located on the floodplain of Mardi Creek upstream of the Pacific Highway has experienced local flooding during these events. Flooding was experienced in the industrial/commercial area (known as Tuggerah Industrial Estate), located between Gavenlock Road and the Pacific Highway, in June 2007. Frequent flooding occurs at Anzac Road, 180 metres north of the proposal, due to rainfall runoff originating from Mardi Creek.

Modelling results indicated that both westbound lanes of Wyong Road before the roundabout on Gavenlock Road are currently at risk of flooding in a 1 in 100 Annual Exceedance Probability (AEP) event (refer to Figure 2.1). Lanes of the Pacific Highway north of Anzac Road are also currently at risk of flooding, while only northbound lanes of the Pacific Highway to the south of Anzac Road are at risk.

Areas currently prone to flooding within and around the study area are those that are located within ‘Flood Storage’ areas. These are areas that provide temporary storage of floodwaters during the passage of a flood, with generally low flood velocities. In addition, most flood storage areas are classified as being ‘Low Hazard,’ where floodwaters do not present a danger to personal safety and where flood damage would be low. However, a small portion in the north of the 1 in 100 AEP event area is classified as being ‘High Hazard’, where floodwaters could present a danger to personal safety, could cause structural damage to buildings and where resultant social disruption and financial losses could be high.

The Flood Impact Assessment found that the operational impacts of the proposal would primarily be associated with the change in topography. The resultant impacts on the hydrological regime of Mardi and Tuggerah Creeks are expected to be minor.
Specifically, the assessment identified that the proposal would result in the following:

- A reduction of about 2700 cubic metres of floodplain storage. This reduction in floodplain storage has the potential to increase the 1 in 100 AEP flood levels in Mardi Creek floodplain catchment by up to 0.01 metres in the area between Woodbury Park Drive and the Main Northern Railway.
- Minor increases in the water levels in Mardi Creek and its floodplain in the area between Woodbury Park Drive and the Main Northern Railway.
- An increase in peak flood levels by less than 0.01 metre for the 1 in 2 to the 1 in 100 AEP events, to the area to the north of Anzac Road. No new properties would be impacted.
- Minor flood level increases of up to 0.02 metre in Mardi Creek upstream of Gavenlock Road during the 1 in 2 AEP event, however, these would be limited to the channel and do not impact on adjacent properties.
- A minor increase in the peak flood levels by up to 0.02 metre during the 1 in 2 AEP event on the vegetated parcel of land to the south of Wyong Road and east of Gavenlock Road. Flood levels decrease by up to 0.04 metre during the 1 in 100 AEP event in this location.
- A minor change in the extent of the 1 in 100 AEP event high flood hazard area immediately adjacent to the proposal. There is a negligible change in extent of high flood hazard area elsewhere.
- A higher flood surface on the new west-bound lane of Wyong Road due to the raising of the ground surface for the new lane. This change is contained within the road boundary of the proposal. The depths of flow on the new west-bound lane are similar to the depths of existing flow and are less than 0.1 metre ie 10 centimetres.
- A minor change in the extent of the high flood hazard area immediately adjacent to the proposal. Negligible change in the extent of high flood hazard area elsewhere.
- No change in the patterns of ponding /retention of floodwaters, nor is there a change the duration of inundation on the floodplain.
- No impacts to the pedestrian underpass are anticipated as additional drainage has been provided to divert flows away from the underpass.

As part of the Flood Impact Assessment, the potential impact on flooding resulting from the proposal, with and without mitigation, was estimated for flood events from the 1 in 2 AEP event up to the 1 in 100 AEP event. The assessment found that the impacts of the proposal on the hydrological regime of Mardi and Tuggerah Creeks are expected to be minor (flood level increases would be less than 0.01 metre (or 1 centimetres) and concluded that no flood mitigation controls are required due to the minor flood impact, the high cost of implementation and low flood benefit return. The flood impact assessment indicates that there would be negligible flood level increase in more frequent flood events such as the 1 in 2 AEP event.

Although the Flood Impact Assessment concluded that no flood mitigation controls would be required, it did recommend that the sensitivity assumptions used in the initial flood modelling be confirmed during the detailed design. The reason this assessment is left until detailed design is because the design would have been finalised and there would be greater certainty regarding the sensitivity assumptions.
Figure 2-1 | 1 in 100 AEP provisional flood hazard for the proposal
Dependant on the outcomes of these sensitivity investigations, the need for management measures would be confirmed. Any management measures that would result in a greater footprint than that assessed in the REF would require additional environmental impact assessment.

The owners of commercial properties affected by flooding were notified as part of the display of the REF and invited to provide comments on the REF and associated specialist reports, including the *Flooding Impact Assessment*. Community updates, providing details of the concept design and information on the availability of the REF, were distributed to 1500 local residents and business surrounding the proposal. No submissions were received from these owners.

### 2.12 Air quality

**Submission number(s)**

8 – Individual

**Issue description**

One submission expressed concern regarding the duration of construction and the potential for dust impacts.

**Response**

The REF has considered both the operational and construction phase impacts that would be associated with the proposal. Various mitigation measures have been identified to address these impacts, in particular with regards to impacts on air (refer to Section 6.11 of the REF). These include the development of an *Air Quality Management Plan*, which would provide guidance on:

- Dust monitoring.
- The use of appropriate dust suppression methods, including:
  - Stabilising areas with water spraying.
  - Compaction or revegetation.
  - Covering of stockpile and storage areas.
  - Cessation of dust generating activities in high wind situations where dust cannot be controlled.
- Local residents would be advised of hours of operation and provided with contact details for queries regarding air quality.

The duration of construction would be minimised to limit the extent of impacts on air quality. Moreover, the proposal would be constructed in five stages to minimise impacts as well as the need for night works (refer to Section 3.3.2 of the REF).

### 2.13 Land use and property

#### 2.13.1 Property impact

**Submission number(s)**

8 – Individual
Issue

One submission from an individual expressed concern that long history of road construction and operation has impacted negatively upon the individual’s property and amenity and that there had been little consultation or little done to mitigate these impacts. The submission suggested that the previous upgrades had only had benefits to the Supa Centre Tuggerah, with little consideration for the impact on the individual’s amenity and property values.

Response

RMS has prepared an REF to document the likely impacts of the proposal on both the natural and social environment surrounding the proposal. Sections 6.12 and 6.13 of the REF specifically describe the potential impacts of the proposal for land use and property and social and economic issues respectively, including various safeguards and management measures. The REF notes that a number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. Further amelioration of these impacts would occur during the detail design.

RMS has been consulting and would continue to do so with the affected property owner during the preparation of this submissions report, including to provide more information about potential property impacts and to consider issues raised. RMS is committed to working with residents to address concerns raised by residents and would consider all reasonable and feasible mitigation measures.

Additional feasibility investigations have been undertaken in response to the submissions received during the display of the REF. Specifically, consideration was given to reducing the impacts to residential properties 1-7 Yaldeeme Close. The results of the feasibility investigations have indicated that the removal of one left turn lane from Wyong Road westbound to the Pacific Highway southbound (alternate proposal) would have minimal impacts to traffic flow and queuing. Consequently, RMS has adopted the alternate design which would result in a 3.5 metre reduction in width of the road corridor leading to a shorter underpass extension and increased clearance between the existing boundary fence of properties in Yaldeeme Close, Tuggerah and the retaining wall proposed on the southern side of the eastern leg of Wyong Road. This lane removal would remove the need for a cantilevered pathway in this location, hence the construction in this area would be simpler which would reduce the construction period and associated costs. Refer to Section 3.1 for further information on the feasibility assessment and Chapter 4 for the changes to the proposal.

RMS would continue to liaise with the property owner as these investigations continue and once a final decision has been reached to ensure that they have a clear understanding of the potential impacts on their property. Assuming a decision is made to proceed with the proposal, RMS would continue to liaise with affected property owners during the detailed design stage, including about landscaping and choice of plants replanted.

2.13.2 Property access

Submission number(s)

8 – Individual
Issue description
One submission from an individual requested that the rear access from the existing gate, located at the back of the residents' property onto the pathway and pedestrian underpass, be maintained during construction and operation.

Response
The existing pedestrian and cycle pathway network would be upgraded to improve pedestrian safety and access (refer to section 3.2.2 of the REF). Access from the rear of the property onto the pathway and pedestrian underpass would be maintained during the operation of the proposal. However, although every attempt would be made to maintain access during construction, there would be periods during which the access would need to be closed due to safety considerations. The resident would be given notice before any such disruption would occur.

2.13.3 Property acquisition
Submission number(s)
9 – Local business

Issue description
One submission from a local business queried the property acquisition associated with the proposal. The submission noted that the proposal appeared to be at odds with the development of the Tuggerah Town Centre as it would impact on land earmarked for development. The submission requested that additional information be provided regarding the amount of potential acquisition of the land owned by the business. The submission emphasised that the current design was unacceptable without further consultation.

Response
Property acquisition is outlined in Section 3.6 of the REF and illustrated in Figure 3-16 of the REF.

As outlined in Section 2.1 of the REF, the proposal has been informed by and is consistent with the proposed development of the Tuggerah Town Centre. RMS has consulted with the Department of Planning and Infrastructure (DP&I) on traffic and transport requirements for the proposed Tuggerah Town Centre. The proposal would provide adequate capacity for future growth in the area with and without the proposed Tuggerah Town Centre development. Moreover, the land that would be permanently acquired as part of the proposed would not affect the future development for the planned town centre.

Following the display of the REF, RMS has undertaken ongoing consultation with the business owner. On 8 April 2013 RMS provided clarity to the business owners, as to the extent of land that would be permanently acquired and extent of land that would be leased. This was then confirmed in writing on 15 April 2013.

2.14 Pedestrian and cyclist facilities
Submission number(s)
4 – Individual
5 – Individual
Issue description

Three submissions from individuals raised the following issues associated with the pedestrian and cyclist facilities outlined in the proposal:

- Pedestrian safety and access can only be improved through the construction of off-road crossings including pedestrian tunnels or bridges.
- The unlit existing pedestrian underpass and approaches pose safety concerns. An at-grade pedestrian crossing would enable pedestrians to avoid the underpass.
- The cantilever pathway is not considered necessary for pedestrians, due to the availability of walkways in the other part of the study area. In addition, the cantilever pathway does not follow a particular desire line and is costly relative to its likely benefits.

The WSC submission raised the following queries:

- Further detail regarding the upgrade to the pedestrian underpass, with particular emphasis on visibility, safety and security, especially for those with a disability
- What is proposed to assist pedestrians and off road cyclists to cross Gavenlock Road, south of Wyong Road, to access Westfield.
- Whether the pedestrian crossing points on all slip lanes of the intersection would be signalised.
- Whether pedestrian fencing is proposed or required.
- The lack of provision for on-road cycle ways for cyclists approaching:
  - The Pacific Highway and Wyong Road intersection eastbound along Wyong Road.
  - Wyong Road and Gavenlock Road roundabout westbound along Wyong Road.

Response

Pedestrian and cyclist network

The key features of the pedestrian and cyclist network are illustrated in Figure 2-1.

The existing pedestrian and cycle pathway network within the study area would be upgraded as part of the proposal to improve pedestrian safety and access (refer to Section 3.2.2 of the REF) and would include the installation of signalised at-grade pedestrian crossings on all four legs of the intersection, including the slip lanes. The existing pedestrian underpass would be extended to the north-east and south-west underneath the south-eastern leg of Wyong Road. Improvements to the general amenity of the underpass would also be undertaken as part of the proposal including provision of additional lighting. The provision of additional lighting both within the underpass and on the approaches to the underpass and the creation of improved sight distance on the approaches, would improve pedestrian safety and security. As such there would be opportunities for pedestrians to use above ground (at-grade) crossings or an upgraded pedestrian underpass to safety cross the intersection.
The existing pedestrian/cyclist shared path network would be extended and improvements made to existing off-road connections located adjacent to the proposal (refer to Figure 3-7 of the REF). This includes connections to the following links:

- Tuggerah Railway Station.
- Tuggerah Supa Centa.
- Tuggerah Business Park.
- Westfield Shopping Centre.
- The Anzac Road precinct.

All proposed shared paths have been extended to link to existing shared paths to cater for anticipated pedestrian/off-road cyclist movements through the proposal. Specific upgrades to the pedestrian and cyclist network include:

- Provision of a shared path along the southern side of Wyong Road to the west of the intersection.
- Extension to existing shared paths on the northern and southern sides of the eastern leg of Wyong Road.
- Provision for shared paths on the western and eastern sides of the northern leg of the Pacific Highway.
- Provision for a shared path on the western side of the southern leg of the Pacific Highway to the pedestrian refuge that currently exists to the south of Tambelin Street.
- Realignment of the path from Tuggerah Railway Station that links to the existing Wyong Road underpass and reconnects to the kerbside shared path at Tambelin Street.
- Extension of the shared path on the northern side of Wyong Road (east of the intersection) to the Supa Centa entrance and inclusion of a new pedestrian refuge in Bryant Drive.
- Removal of the short section of the existing shared path along the service road to the rear of Tuggerah Supa Centa.
- Provision of a section of path extending from beneath the rail overbridges extending in a northerly direction and terminating at a rear entrance point to the Tuggerah Supa Centa.
- Provision of shared (pedestrian/cyclist) pathways for all footpaths within the proposed intersection footprint for off road (recreational) cyclists.
- Consistency in the detailing of barriers, street lighting, pedestrian fences and safety/privacy screens. To the extent possible, this detailing would integrate with the detailing of existing roadside elements.

In light of these proposed improvements to the pedestrian network, provision of a pedestrian bridge is not considered necessary. Any additional benefits that may be associated with this option would not justify the significant additional cost.

All upgrades to the pedestrian network have considered disability access requirements. All pathways being upgraded as part of the proposal can accommodate wheelchairs. The grade of the existing pedestrian underpass would be reduced as a result of the proposal which would improve access for the disabled in this location. However, the at-grade pedestrian crossings would be the preferred crossing points for mobility impaired due to the flatter grades of these pathways.

Existing pedestrian and cyclist facilities to cross Gavenlock Road south of Wyong...
Road, to access Westfield, would be retained as this is outside of the limit of works for the proposal. There is an existing pedestrian bridge across Wyong Road to the south of the Wyong Road and Gavenlock Road intersection. A pedestrian pathway is provided on Gavenlock Road about 200 metres south of the entrance to Westfield. Moreover, the posted traffic speed along this section of Gavenlock Road is 60 kilometres per hour. These facilities would also be available to off-road cyclists. Moreover, there are existing on-road cycleways marked on Gavenlock Road, facilitating cyclist entrance into Westfield.

Cantilevered pathway

The cantilevered pathway was required as part of the Concept Design due to impacts to utilities. However, based on the results of the feasibility assessment, it is no longer required as the alternative design has been adopted. This would result in about a 3.5 metre reduction in width of the road corridor leading to a shorter underpass extension and remove the need for a cantilevered pathway in this location as there would be enough room to accommodate existing utilities. Refer to Chapter 3 for further information on the feasibility assessment and Chapter 4 for the changes to the proposal.

Pedestrian fencing

The requirement for pedestrian fencing was investigated during the concept design, refer to Figure 2.2. Fencing to protect pedestrians falling from heights at all retaining walls would be required. No pedestrian fencing has been proposed on median islands as it was determined that this would not be required. Signage has been provided to deter pedestrians walking along the western leg of Wyong Road adjacent to the northbound lanes where there is currently no pedestrian footpath nor is there one proposed. Landscaped medians have also been provided where the median width allows which would aid in pedestrian deterrence.

On-road cycleway

As outlined previously, shared (pedestrian/cyclist) pathways have been provided for all footpaths within the proposed intersection footprint for off road (recreational) cyclists. Moreover, on-road cyclist provisions have been provided in the shoulders of the Pacific Highway and Wyong Road. On-road cyclist lanes have only been provided at merge areas where it is deemed safe.

The design currently includes an on-road cycleway westbound along Wyong Road that continues around the corner into Gavenlock Road. Provision is made for cyclists to merge right into the main traffic flow across the dedicated left-turning traffic lane and into a dedicated cycleway around 30 metres from the corner of the Wyong Road and Gavenlock Road roundabout.

The left turn lanes along the eastbound approach of Wyong Road to the Pacific Highway and Wyong Road intersection deviate 200 metres before the intersection. Accordingly, there is no safe way to allow a continuous on-road cycleway through the intersection. A cycleway is provided on the northern edge of the eastern approach of Wyong Road and cyclists can cross the intersection at the at-grade pedestrian crossings.
3 Additional assessment

Following the display of the REF additional assessments were undertaken for the upgrade of the Pacific Highway and Wyong Road intersection, including:

- A *Feasibility and Overshadowing Assessment* (SKM, 2013) (refer to Appendix B). This was undertaken to investigate modifying the proposal to reduce its footprint in response to comments received during the public display period of the REF. The feasibility component of the report assessed the impacts associated with the removal of one of the two left turn lanes from Wyong Road (westbound) onto the Pacific Highway (southbound). The overshadowing component of the report assessed the impacts of overshadowing by the proposal on the seven existing properties in Yaldeeme Close (No. 1, 2, 3, 4, 5, 6 and 7). It also outlined the impacts of the existing situation, the 100% Concept Design and the Alternate Design. The results of feasibility assessment and the overshadowing assessment are summarised in Section 3.1 and Section 3.2 respectively.

- An additional *Ecological Survey Assessment* (PB, 2013) (refer to Appendix C) was undertaken as recommended in the *Biodiversity Assessment* (SKM, 2013b). The additional survey included targeted surveys for the threatened plant *Melaleuca biconvexa*, to confirm the number of *Melaleuca biconvexa* impacted by the proposal. The survey of *Melaleuca biconvexa* was undertaken using the visual abundance method as defined in Duncan (2011). Additionally, an assessment of the potential occurrence and habitat for the threatened frog species (Wallum Froglet and Green and Golden Bell Frog) and microchiropteran bat species was undertaken. The results of the additional ecological assessment by PB (2013) is summarised in Section 3.3.

3.1 Feasibility assessment

As a result of comments (refer to Section 2.10) received during the public display period of the REF, RMS undertook a feasibility assessment to investigate modification and reduction of the concept design proposal footprint (refer to Figure 3-1) in order to minimise impacts to residential properties located to the south of the Pacific Highway and Wyong Road intersection. An alternate design was proposed which includes the removal of one of the two left turn lanes from Wyong Road (westbound) into the Pacific Highway (southbound) (refer to Figure 1-2 and Figure 3-1).

The main differences between the alternate design and the concept design are:

- A 3.5 metre width reduction in the exit taper and a 1.5 metres width reduction at the left turning slip lane on Wyong Road (westbound) into the southbound lane of the Pacific Highway.
- A 2.4 metre width reduction through the centreline of the Wyong Road pedestrian underpass.
Additional traffic analysis was undertaken (refer to Appendix D) as part of the feasibility assessment to assess the performance of the alternate design for future years scenarios (2025 and 2035), using SIDRA and Paramics modelling. The traffic modelling included a low growth scenario (excluding the proposed Tuggerah Town Centre Development) and a high growth scenario (including the proposed Tuggerah Town Centre Development). Comparative analysis of the double (concept design) and single (alternate design) turning lane configurations was also undertaken and considered the intersection performance and queue lengths. A sweep path analysis of the alternate design was also included to ensure the design could accommodate a 19 metre long semi-trailer vehicle.

### 3.1.1 Results of the feasibility assessment

The results of the feasibility analysis identified the following impacts associated with the alternate design:

- The cantilevered section of retaining wall (RW-C) would no longer be required as the offset from the water main would be sufficient to provide the required clear distance to the retaining wall piles. This would result in a shorter construction program due to a simpler construction method which would reduce construction costs. The duration of construction activities directly behind 5 Yaldeeme Close would also be reduced, resulting in increased access to the property’s rear gate.

- Concrete encasement and piling of the water main would still be required. Wyong Shire Council indicated their preference to concrete encase and pile the water main to eliminate the requirement for future maintenance in this location.

- The length of the underpass extension to the south would be reduced by 2.4 metres (at the culvert centreline). This would improve pedestrian safety by increasing pedestrian sight line from the south into the underpass and a reduction in overall underpass length.

- A reduction in overall pavement area.
3.1.2 Results of the additional traffic modelling

For the comparative assessment of proposed options, the intersection operation and queuing at the Pacific Highway and Wyong Road intersection were assessed. The assessment was completed for the morning and afternoon peak demands for 2025 and 2035, for low and high growth scenarios (refer to Table 3-1 and Table 3-2 respectively). These tables summarise the average delay (seconds), the degree of saturation and the level of service (LoS) for each scenario. The LoS determined for signalised intersections is the weighted average delay for all movements in the intersection. Generally, intersection operation at LoS C or better is considered ideal. However, in many future development situations, LoS D is still considered acceptable. Intersections operating LoS E or LoS F indicate unstable operation, resulting in excessive delays and would require further investigation.

Table 3-1 Pacific Highway and Wyong Road intersection results summary – 2025

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Low Growth Scenario</th>
<th>High Growth Scenario</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Ave Delay (seconds)</td>
<td>LoS</td>
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<td>Morning Peak</td>
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<td>2-left lanes</td>
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<td>C</td>
</tr>
<tr>
<td>1-left lane</td>
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<tr>
<td>Afternoon Peak</td>
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<td></td>
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<td>C</td>
</tr>
<tr>
<td>1-left lane</td>
<td>42.3</td>
<td>C</td>
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</tbody>
</table>

Table 3-2 Pacific Highway and Wyong Road intersection results summary – 2035

<table>
<thead>
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<th>Scenario</th>
<th>Low Growth Scenario</th>
<th>High Growth Scenario</th>
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<tbody>
<tr>
<td></td>
<td>Ave Delay (seconds)</td>
<td>LoS</td>
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<tr>
<td>Morning Peak</td>
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<tr>
<td>2-left lanes</td>
<td>38.9</td>
<td>C</td>
</tr>
<tr>
<td>1-left lane</td>
<td>41.3</td>
<td>C</td>
</tr>
<tr>
<td>Afternoon Peak</td>
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<td></td>
</tr>
<tr>
<td>2-left lanes</td>
<td>43.5</td>
<td>D</td>
</tr>
<tr>
<td>1-left lane</td>
<td>43.5</td>
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</tbody>
</table>

The intersection LoS has been evaluated using SIDRA to allow for a comparison of performance between the double left turning lanes (concept design) and single left turning (alternate design) configurations. These results were assessed in conjunction with the performance from the Paramics models. The SIDRA results for all future demand scenarios reveal the following:

2025 models:
- The single left turning lane model performs comparably to the double left turning lanes model for the morning period. While LoS drops from C to D for
the high growth scenario, the average delay is increased by less than 3 seconds, indicating only a minimal decline in performance.

- The afternoon peak results are very similar between both scenarios. Performance of the scenarios assessed under the low growth models is almost identical. The high growth scenario experiences an increase in average delay of less than 2 seconds and the LoS increases from LoS C to LoS D.

2035 Models:

- The single left turning lane morning models experience a minimal increase in average delay of approximately 3 seconds when compared to the double left turning lanes’ model scenario. Similarly to the 2025 models, the intersection LoS drops from C to D under high growth scenario.
- The single left turning lane afternoon peak models perform identically to the double left turning lanes model with the average delay and LoS remaining consistent for both the low and high growth scenarios.

The single left turning lane and the double left turning lanes options operate comparably under all future demand scenarios. Traffic volumes which perform the left turning movement from Wyong Road westbound into the Pacific Highway southbound are relatively low and the results indicate that a single left turning lane is sufficient for future traffic demands in the Wyong area for both morning and afternoon peak periods for the low and high growth scenarios.

The traffic modelling found that queuing at the Pacific Highway and Wyong Road intersection remains comparable for the concept design and the alternate design. As such a second left turning lane is not required to reduce the queuing at the intersection and the queuing does not impede adjacent through lanes and cause delays or congestion for northbound traffic.

Based on this assessment and comparison of the traffic modelling analysis results for the Paramics and SIDRA modelling, the alternate design with a single left turning lane is sufficient. The increase in intersection delay is nominal and has minimal impact on the operation of the Pacific Highway and Wyong Road intersection under low and high growth scenarios.

3.2 Results of the overshadowing assessment

The overshadowing assessment was undertaken using the Autodesk program 3DS Max and considered five different scenarios for the 21 June (the shortest day of the year) and included the following:

- Option 1 – Existing without trees.
- Option 2 – Existing with trees.
- Option 3 – Concept design with a noise wall.
- Option 4 – Alternate design with a noise wall.
- Option 5 - Alternate design with noise wall and landscaping features.
Options 1-4 considered as part of the overshadowing assessment do not include details of the landscaping plan for the proposal (refer to Appendix H of the REF), whilst option 5 does. Due to the location of the adjacent properties, the time of day where shadowing has the largest impact on the properties of 1 - 7 Yaldeeme Close is 9am and, as such, figures of the 9 am scenarios are shown for options 1 – 5 in Figure 3-2 to 3-6 below. Figures of the 12 noon and 3pm scenarios are provided in Appendix B. The following is a summary of the results obtained from the assessment for each scenario:

**Option 1 – Existing without trees**

**Figure 3-2** illustrates the impacts of shadowing if the existing trees were removed from the existing intersection configuration. The option 1 scenario is effectively the best outcome for reducing shadows on the properties, however, it is not feasible as it would not meet the proposal objectives (refer to Section 2.3 of the REF). It has been provided as a base case for the assessment. The shadow impacts of the existing embankment formation are only evident in the 9am depiction.

![Figure 3-2 Option 1 – Existing without trees](image)

**Option 2 – Existing with trees**

**Figure 3-3** depicts a more accurate representation of the existing intersection configuration when compared with option 1 as it shows the impact that shadowing has on the affected properties due to existing vegetation and landform. The images show that 5 Yaldeeme Close is under shadow for the majority of the day and that 4 and 6 Yaldeeme Close are heavily shaded in the early morning hours.
Option 3 – Current 100% Concept Design with noise wall

A four metre high noise wall was adopted for this scenario based on the recommendation from the Noise and Vibration Assessment (refer to Appendix M of the REF) undertaken as part of the REF for the concept design (refer to Figure 3-4). For the purpose of the assessment, the worst case material (opaque) scenario has been adopted in the model. Substantial shadowing can be noticed throughout the majority of the day due to the vicinity of the retaining wall and the height of the noise wall above the existing dwelling. Overshadowing is at its worst in the morning.
Option 4 – Alternate Design with noise wall

Similar to option 3, a four metre high noise wall using opaque material was adopted for the alternate design scenario based on the recommendation from the Noise and Vibration Assessment (refer to Appendix M of the REF) (refer to Figure 3-5). The extent of overshadowing on adjacent properties is reduced in this option when compared to option 3 (refer to Figure 3-5). There is not a substantial increase in shadowing in comparison to the existing options with trees such as option 2, refer to Figure 3-3).

Figure 3-5 Option 4 – Alternate design with noise wall

Option 5- Alternate design with noise wall and landscaping features.

Like options 3 and 4, option 5 incorporates a four metre high noise wall as per the recommendation of the Noise and Vibration Assessment (refer to Appendix M of the REF). In addition, trees proposed as part of the landscaping plan (refer to Appendix F of the REF) have also been included (refer to Figure 3-6).

The trees and relative shadowing included in Figure 3-6 below is based on the current tree species selected as part of the landscaping plan, i.e. the Hoop Pine, refer to Appendix H of the REF. Overshadowing impacts are greater for properties 1-4 Yaldeeme Close based on the presence of existing vegetation. For property 5 Yaldeeme Close the overshadowing impacts are slightly increased in the front yard compared to option 4 (refer to Figure 3-5) however this is also the result of existing trees located on this property as opposed to an impact from the alternate design. For property 7 Yaldeeme Close the overshadowing impacts are similar to that anticipated for option 4 (refer to Figure 3-5).

Overshadowing assessment conclusion

The assessment of the overshadowing impacts of the existing intersection configuration, the concept design and the alternate design on the residential properties adjacent to the proposed works on 1-7 Yaldeeme Close (No 1, 2, 3, 4, 5, 6 and 7) has been undertaken. RMS has considered the outcomes of the overshadowing assessment, in conjunction with the recommendations of the Noise and Vibration Assessment (refer to Appendix M of the REF) and have found that Option 4 - alternate design with noise wall (refer to Figure 3-5) provides the best
outcome in terms of minimising overshadowing and noise impacts to adjacent properties. The noise wall design would be further refined at the detailed design phase for the inclusion of transparent material in the top section of the noise wall, which could assist in reducing overshadowing. Further investigation into additional operational noise reduction treatments such as architectural treatments, would also need to be undertaken during the detailed design phase.

Figure 3-6 Alternate design with noise wall and landscaping features

3.3 Additional Ecology Assessment

A Biodiversity Assessment was prepared as part of the environmental impact assessment and is summarised in Section 6.5 of the REF. The Biodiversity Assessment (SKM, 2013b) was completed to assess the potential impacts of the proposal under Part 5 of the Environmental Planning & Assessment Act 1979 (EP&A Act).

The Biodiversity Assessment (SKM, 2013b) recommended that additional targeted ecology surveys be undertaken to:

- Confirm the number of the threatened plant Melaleuca biconvexa impacted by the proposal and to identify if a referral would be required to be submitted as a precautionary measure to the DSEWPaC. The survey of Melaleuca biconvexa would be undertaken using the visual abundance method as defined in Duncan (2011).
- Assess the potential occurrence and habitat for the threatened frog species (Wallum Froglet and Green and Golden Bell Frog) and microchiropteran bat species.

RMS commissioned PB to undertake the additional ecology survey assessment in March 2013 (refer to Appendix D). The Ecological Survey Assessment completed by PB (2013), included a site inspection of the proposed construction footprint. The site inspection was undertaken from 12 to 14 March 2013. The findings of the Ecological Survey Assessment are summarised below.
Threatened flora

**Threatened Ecological Communities (TECs)**

The vegetation within the study area was dominated by native vegetation with the dominant vegetation community being Swamp Oak Floodplain Forest. Three other native vegetation communities occurred within the study area, including, Freshwater Wetlands, River-flat Eucalypt Forest and Swamp Sclerophyll Forest. Three modified vegetation communities of roadside vegetation, exotic vegetation and planted eucalypts were also recorded within the study area (SKM, 2013b).

The proposed construction footprint would require the removal of up to 0.26 hectares of Swamp Oak Floodplain Forest, 0.24 hectares of Freshwater Wetlands and 0.17 hectares of River-flat Eucalypt Forest (SKM, 2013b). All three of these communities are listed as endangered under the TSC Act. These TECs have been previously assessed as part of the *Ecological Assessment Report* (SKM 2013b) for the proposal and the current study has not changed this finding. A further 2.08 hectares of modified vegetation communities of roadside plantings, exotic vegetation and planted Eucalypts could also be removed as part of the proposal.

No endangered populations listed under either the TSC Act or the EPBC Act were recorded within the study area during this assessment (PB, 2013).

**Melaleuca biconvexa**

Detailed targeted surveys undertaken by PB (2013) for *Melaleuca biconvexa* estimated that approximately 297 tree stems have the potential to be impacted upon by the proposal. However these numbers are unlikely to be significant, due to the large populations located elsewhere within the Wyong local government area. The proposal has the potential to remove 6 per cent of the population within the study area, 5 per cent in the local catchment and less than 1 per cent in the locality. As such, it is considered that no further impact assessment is required as the original conclusion that that proposal would not have a significant impact on *Melaleuca biconvexa* (SKM 2013) remains valid.

**Syzygium paniculatum**

Approximately 18 individuals of *Syzygium paniculatum* were recorded within the study area. These individuals appeared to be planted as they were at the base of the roadside plantings or occurred in close proximity. Seventeen of the individuals have the potential to be impacted upon by the proposal. The original conclusion that the proposal is unlikely to have a significant impact upon *Syzygium paniculatum* (SKM 2013) remains valid, and therefore no further assessment is required.

Threatened fauna

**Migratory fauna**

An assessment of habitat for threatened or migratory fauna was undertaken across the proposed construction footprint and the wider locality. This assessment found that the loss of a small amount of potential habitat for locally occurring bat, bird and frog species is unlikely to represent a significant impact upon local populations. This is particularly so in light of the abundance of high quality habitat elsewhere in the vicinity and wider locality of the study area.
The Black-faced Monarch, an EPBC Act listed migratory bird species, was also recorded during survey works.

**Threatened fauna**

Although threatened fauna species were not recorded during current field surveys, potential habitat for Eastern False Pipistrelle, Eastern Freetail Bat, Greater Broad-nosed Bat, Large-eared Pied Bat and Southern Myotis was recorded.

Remaining threatened fauna recorded elsewhere from the wider locality, are considered to have a low likelihood of occurrence based on the availability of habitat within the study area (refer to Appendix D for further detail).

**Green and Golden Bell Frog and Wallum Froglet**

Targeted surveys for threat-listed Green and Golden Bell Frog and Wallum Froglet, were completed within the study area over three days and one night in March 2013. Desktop investigation of the distribution and historical presence of these species in the wider locality found that there are no previous records for these species within the study area or its vicinity.

Although the study area contained sub-optimal quality potential habitat for The Green and Golden Bell Frog, mainly in the form of freshwater wetlands, this species was not recorded.

The study area also contain potential habitat for the Wallum Froglet, mainly in the form of swamp forest, but this species was not recorded. In the locality, previous records for this species predominately occur approximately four kilometres to the north of the study area.

The habitat assessments conducted in March 2013 found that the habitats were not suited to either species and were generally in a degraded state (PB 2013).

**Microchiropteran bats**

The Little Bent-wing Bat (*Miniopterus australis*), which is listed as vulnerable under the TSC Act, was recorded within the study area via Anabat recording. A further two threatened species, Eastern Bentwing Bat (*Miniopterus schreibersii*) and Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*), were potentially identified as occurring via Anabat recording. Although these bat species were assessed as having foraging opportunities within the proposed construction footprint due to their local occurrence and highly mobile nature, there are limited roosting opportunities within the proposed construction footprint for both hollow-dwelling or cave-dwelling microchiropteran bat species. Limited roosting sites within the study area include culverts and bridges which contain roosting habitat. No maternity/permanent roost sites in the form of caves are present within the study area.

Findings from the Ecological Survey Assessment (PB 2013) were consistent with and did not significantly change the findings of the Biodiversity Assessment (SKM 2013). Therefore no additional impact assessments for these microchiropteran bat species were completed.
Summary

Four threatened ecological communities, three threatened species of plant, nine threatened species of microbat and two threatened species of frog were either recorded or found to have potential habitat within the proposed construction footprint.

Significance assessments have been completed previously and assessed as part of the *Biodiversity Assessment Report* (SKM, 2013b) for all the species raised in the PB (2013) report. The findings of the additional study by PB (2013) were found to be consistent with the findings of *Biodiversity Assessment Report* (SKM, 2013b). Therefore no additional impact assessments were undertaken or recommended as part of this report.

The proposal is still considered to be unlikely to impose a significant impact on local populations of threatened species, endangered communities or their habitats as listed under the EPBC Act or TSC Act., There would be no requirement for a Species Impact Statement under the EP&A Act or a referral under the EPBC Act.
4 Changes to the proposal

4.1 Removal of one left turn lane from Wyong Road westbound to the Pacific Highway southbound and inclusion of a noise wall.

4.1.1 Description

Following public display of the REF, and consideration of submissions, RMS changed the proposal to remove one left turning lane from Wyong Road westbound to the Pacific Highway southbound (refer to Figure 1-2) to reduce impacts to residential properties 1-7 Yaldeeme Close. This would remove the need for a cantilevered pathway in this location and result in about a 3.5 metre reduction in width of the road corridor leading to a shorter pedestrian underpass extension and increased clearance between the existing boundary fence of the individual’s property and the retaining wall proposed on the southern side of the eastern leg of Wyong Road.

A four metre high and 200 metre long noise wall as proposed in the Noise and Vibration Assessment (SKM, 2013a) would be constructed to reduce noise impacts to residents in Yaldeeme Close (refer to Figure 4-1). The noise wall would extend northwest from Tambelin Street along the edge of the pedestrian pathway located along the southbound lane of the Pacific Highway and wrap around the corner along the outer edge of the westbound lane of Wyong Road. The Landscape Character and Visual Assessment notes that architectural treatment of individual dwellings would be a preferred option and that transparent panels should be used on any noise walls. The final location and design of any required noise wall mitigation (including the type of material and the use of transparent material) would be determined during detailed design.
Figure 4-1 | Noise wall
4.1.2 Environmental impact assessment

Existing Environment

The proposal is in modified urban environment which includes a mix of residential commercial/business, industrial and transport related land uses. The road reserves of the existing Pacific Highway and Wyong Road which comprise roadside plantings dominated by Swamp Oak (*Casuarina glauca*). Some small areas support vacant modified forested lands including private and crown lands including the southwestern areas of the study area and east of the rail corridor. Habitat for flora and fauna is modified in nature and highly fragmented by major roads and a rail corridor with limited connectivity. The remaining habitats are very small in scale and provide limited resources for rare or threatened fauna species.

Construction

The changes to the left hand turning lane from Wyong Road Westbound to the Pacific Highway southbound would remain within the existing proposal corridor.

All works for the left hand turning lane would be undertaken as part of the construction of the proposal. There would be no additional impacts to traffic movements and access as a result of the lane removal and this impact would be unchanged relative to that assessed in the REF.

The removal of one of the two left turn lanes from Wyong Road would reduce the overall construction footprint and reduce property impacts for properties located to the south of the Pacific Highway and Wyong Road intersection.

The alternative design would not require the cantilevered section of retaining wall (RW-C) as the offset from the water main is sufficient to provide the required clear distance to the retaining wall piles. This would result in a shorter construction program and reduce the time construction activities are directly behind Yaldeeme Close. A reduction of construction costs of approximately $150,000 could also be achieved.

Operation

The single left turning lane is sufficient for future traffic demands and the increase in intersection delay is nominal and would have minimal impact on the operation of the Pacific Highway and Wyong Road intersection. The traffic modelling (refer to Section 3.1.2) demonstrates that the single left turning lane and the double left turning lane options operate comparably under all future demand scenarios, therefore, the alternative design would have limited impact on the operation of the intersection.

The length of the pedestrian underpass extension to the south would be reduced by 2.4 metres (at the culvert centreline). This would improve pedestrian safety by increasing pedestrian sight line from the south into the underpass, reducing lighting issues and reducing the overall underpass length.

A single left turning lane would increase the clearance between the existing boundary fence of properties along Yaldeeme Close and the retaining wall proposed on the southern side of the eastern leg of Wyong Road. The increased distance to the proposal would assist to reduce the social and noise impacts from the proposal to address submission number 8 in Sections 2.7, 2.8 and 2.13.
The proposed noise wall would be relocated 3.5 metres to the northeast of the location proposed in the *Noise and Vibration Assessment* (SKM, 2013a) (refer to Figure 4-1). Consequently, the operational noise levels, as modelled in the *Noise and Vibration Assessment* (SKM 2013a), may be marginally less than originally predicted as the noise sources resulting from the proposal would be further away than originally anticipated. However, the change in noise impacts are considered to be negligible and the recommendations that were originally proposed are still considerable applicable.

The construction of the noise wall would create overshadowing impacts to properties 5 and 6 Yaldeeme Close Tuggerah during the morning with the greatest impacts occurring around 9:00am (refer to Figure 3.6). The overshadowing impact on the roofs of properties 5 and 6 Yaldeeme Close would be less than that currently occurring as a result of shadows from adjacent trees (refer to Figure 3-2), however, the overshadowing assessment did not include the trees proposed as part of the landscaping plans (refer to Appendix H of the REF). The back yards of these two properties would also be completely overshadowed by the alternate proposal and noise wall compared to the existing situation where light is dappled and includes pockets of light.

The construction footprint for the proposal has been reduced in the area adjacent to the alternate design and the amended left hand turning lane exiting Wyong Road westbound and entering the Pacific Highway southbound. However, the limits of the environmental impact assessment undertaken in the REF has already assessed this area and, as such, no additional environmental assessment is required.

### 4.1.3 Revised management and mitigation measures

The following additional management and mitigation measure would be included as part of the changes to proposal:

- RMS would undertake additional assessment to investigate the use of a transparent noise wall to minimise overshadowing impacts to residential properties 5 and 6 Yaldeeme Close, Tuggerah.
5 Environmental management

The REF for the upgrade of the Pacific Highway and Wyong Road intersection at Tuggerah identified the framework for environmental management, including management and mitigation measures that would be adopted to avoid or reduce environmental impacts (Chapter 7 of the REF).

After consideration of the issues raised in submissions and changes to the proposal, the management and mitigation measures have been revised for:

- Traffic and transport (Section 2.7.1).
- Noise and vibration (Section 2.8).
- Landscape, visual impact and urban design (Section 2.10).
- Hydrology and hydraulics (Section 2.11).
- Biodiversity (Section 2.9)

Should the proposal proceed, environmental management would be guided by the framework and measures outlined below.

5.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified 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 management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Project Environmental Management Plan (PEMP) and a Contractors Environmental Management Plan (CEMP) would be prepared to describe safeguards and management measures identified. The PEMP outlines all REF safeguards, while the CEMP is developed by the Contractor and focuses on those safeguards applicable to the construction. These plans would provide a framework for establishing how the safeguards and management measures would be implemented and who would be responsible for their implementation.

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

5.2 Summary of safeguards and management measures

Environmental safeguards outlined in this document would be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards would minimise any potential adverse impacts arising from the proposal on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.
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<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
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<tbody>
<tr>
<td>1</td>
<td>General</td>
<td>All environmental safeguards must be incorporated within the Project Environmental Management Plan (those relevant to the detailed design stage). Relevant mitigation measures for the contractor during construction would be included into the contract specifications, and these safeguards would be addressed by the contractor in the Contractor’s Environmental Management Plan.</td>
<td>Project manager</td>
<td>Pre-construction</td>
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<td>2</td>
<td>General</td>
<td>Any works resulting from the proposal and as covered by the REF may be subject to environmental audits or inspections at any time during their duration.</td>
<td>Project manager and regional environmental staff</td>
<td>Pre-construction After first audit</td>
</tr>
<tr>
<td>3</td>
<td>General</td>
<td>Relevant environmental contract specifications must be forwarded to the Roads and Maritime Services Senior Environmental Officer for review at least 10 working days prior to the tender stage. A contractual hold point must be maintained until the CEMP is reviewed by the Roads and Maritime Services Senior Environmental Officer.</td>
<td>Project manager</td>
<td>Pre-construction</td>
</tr>
<tr>
<td>4</td>
<td>General</td>
<td>The Roads and Maritime Services Project Manager must notify the Roads and Maritime Services Environmental Officer, Central Coast Office, at least 5 days prior to work commencing.</td>
<td>Project manager</td>
<td>Pre-construction</td>
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<tr>
<td>5</td>
<td>General</td>
<td>All businesses and residences likely to be affected by the proposal must be notified at least 5 working days prior to the commencement of the proposed activities.</td>
<td>Project manager</td>
<td>Pre-construction</td>
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<tr>
<td>6</td>
<td>General</td>
<td>Environmental awareness training must be provided, by the contractor, to all field personnel and subcontractors.</td>
<td>Contractor</td>
<td>Pre-construction and during construction as required.</td>
</tr>
<tr>
<td>6a</td>
<td>General</td>
<td>This REF would be placed on public display for comment. Following the submissions period, RMS would collate submissions. After consideration of community comments RMS would determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are necessary. The toll free information line would also be available for any queries that the</td>
<td>RMS</td>
<td>Pre-construction and during construction</td>
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<td>community or affected road users may have during the public display period and during construction. Additionally, RMS would continue to update the project website and issue community updates during the display of this REF and during construction. The project website address is as follows: <a href="http://www.rta.nsw.gov.au/roadprojects/projects/central_coast_region/pacific_highway/wyong_rd/index.html">http://www.rta.nsw.gov.au/roadprojects/projects/central_coast_region/pacific_highway/wyong_rd/index.html</a></td>
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<td></td>
<td>All directly affected landholders would be consulted prior to commencement of construction activities and access to private properties would be maintained, in consultation with individual landholders. Consultation would be undertaken with those property owners whose land would be acquired to ensure that their concerns are clearly understood and can be addressed wherever possible. Consultation would also be undertaken with affected landowners prior to and during construction in regards to noise impacts, individual noise mitigation treatments and night works.</td>
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|     | RMS would continue to consult with government agencies such as DPI (Fisheries and Aquaculture), RailCorp, Wyong Shire Council, bus operators and emergency service providers prior to and during construction with regards to: | • Staging plans.  
• Traffic management.  
• Road and rail shut-downs.  
• Impacts to waterways.  
• Fish passage.  
• Activities identified as dredging/reclamation works. |                |        |
<p>|     | RMS would undertake ongoing consultation with WSC with regards to impacts to water, sewage and hydrology through the detailed design phase. |                                                                                           |                |        |
|     | RMS would continue to consult with service providers such as Telstra, Optus, Jemena and Energy Australia to ensure the final concept design adheres to their requirements and to ensure no services are inadvertently impacted by the proposal. |                                                                                           |                |        |</p>
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<tr>
<td><strong>Traffic and transport</strong></td>
<td><strong>7</strong></td>
<td>Impacts to traffic and access during construction</td>
<td>A detailed construction traffic management plan (CTMP) would be prepared during the detailed design phase. The CTMP would be prepared in accordance with the RMS <em>Guide to Traffic Control at Work Sites</em> and would include guidelines, general requirements and procedures to be used when activities or areas of work have a potential impact on existing traffic arrangements. The CTMP would be submitted in stages to reflect the progress of work and would:</td>
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<td>• Identify the traffic management requirements during construction for rail, road, heavy vehicle, pedestrian and cycle traffic.</td>
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<td>• Describe the general approach and procedures to be adopted when producing specific traffic control plans.</td>
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<td>• Provide for the continuous, safe and efficient movement of traffic for both the public and construction workers.</td>
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<td>• Maintain the capacity of local roads.</td>
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<td>• Identify temporary speed restrictions to ensure safe driving environmental around work zones.</td>
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<td>• Minimise impacts on through and local traffic.</td>
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<td>• Maintain safe access to local roads, business and properties wherever possible. Where access would be temporarily interrupted residents and business owners would be notified prior to any work commencing and alternative access routes implemented where practical.</td>
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<td>• Provide temporary works and traffic signals.</td>
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<td>• Identify the number and width of traffic lanes in operation.</td>
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<td>• Identify traffic barrier requirements and placement.</td>
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<td></td>
<td></td>
<td>• Include methods for implementing the traffic management plan.</td>
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<td>• Include methods for minimising road user delays.</td>
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<td>• Provide appropriate warning and advisory signposting.</td>
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<td>• Consider other developments that may also be under construction, to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic.</td>
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<td>• Provide designated pedestrian and cyclist access through and/or around the construction site to maximise connectivity, maintain access and allow safe movements.</td>
<td>Construction contractor</td>
<td>Pre-construction</td>
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| 8   | Impacts to traffic flow and property access during construction        | • Ensure that truck movements are kept outside school zone times.  
• Monitoring and auditing of traffic control measures.  
• Provide details of construction site parking for road and construction plant and staff. Note the ancillary site located on the old road way between Gavenlock Road and the Pacific Highway is suitable for car parking and possibly the construction compound site.  
• Include measures for managing complaints.  
• Make provision for consultation with relevant local government authorities, emergency services, the community and transport service providers, as appropriate. | Construction contractor | Pre-construction & construction |
| 8a  | Degradation to local roads used as haul routes.                        | Traffic control plans (TCPs) would be prepared for the appropriate stage of works and implemented by suitably qualified personnel. Implementation of TCPs would be inspected as required for the duration of the construction phase in accordance with the RMS *Traffic Control at Worksites Manual*. | Construction contractor | Pre-construction and construction |
| 9   | Modification of public transport routes and stops                      | Temporary bus stops would be installed to replace the two bus stops on the Pacific Highway that would be lost during construction. Temporary bus stops would be located as close as reasonable (no further than 100 metres) to existing stops to limit impact to commuters and bus operators.  
   During selection of bus stop locations, RMS would continue to consult with Busways, Red Bus Service and CityRail to identify appropriate sites.  
   Bus stops would be reinstated after construction is complete. | Construction contractor/ RMS | Pre-construction |
| 10  | Impacts to rail traffic from rail track possessions                    | The timing and duration of rail track possessions would be scheduled through consultation with RailCorp, and where possible be undertaken concurrently with other track possessions.  
   In addition, the design of the bridge would be developed during the detailed design phase to minimise the number of track possessions required during construction. | Construction contractor/ RMS | Pre-construction |
| 10a | Impacts to During detailed design RMS would consult with WSC and CCM to ensure the design of |  
   Pacific Highway and Wyong Road intersection upgrade  
   Submissions report | Construction | Pre- |
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<tr>
<td></td>
<td><strong>CCM development</strong></td>
<td>the proposal and the design of the proposed upgrade of the CCM football club remain aligned and that the proposed cyclist/pedestrian strategy is retained. The RMS environmental officer would also be consulted and would advise of any further environmental impact assessment requirements associated with any design changes.</td>
<td>contractor/ RMS</td>
<td>construction</td>
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<tr>
<td>Noise and Vibration</td>
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<tr>
<td>11</td>
<td>Impacts to sensitive receivers from operational noise</td>
<td>Following consultation with affected landholders, feasible and reasonable measures that could be selected to manage potential operational noise impacts, would be identified. All feasible and reasonable measures would be considered in accordance with the NSW Road Noise Policy (DECCW, March 2011) and Practice Note iv of the <strong>RMS Environmental Noise Management Manual</strong> (ENMM).</td>
<td>RMS</td>
<td>Detailed design</td>
</tr>
<tr>
<td>12</td>
<td>Impacts to sensitive receivers from operational noise</td>
<td>During detailed design, consideration would be given to combining/extending retaining walls for noise mitigation.</td>
<td>Detailed design contractor</td>
<td>Detailed design</td>
</tr>
<tr>
<td>12a</td>
<td><strong>Impacts to sensitive receivers from operational noise</strong></td>
<td>During detailed design, consideration would be given to the installation of signage to discourage the use of compression braking.</td>
<td>Detailed design contractor</td>
<td>Detailed design</td>
</tr>
<tr>
<td>13</td>
<td>Impacts to sensitive receivers from operational noise</td>
<td>Post-construction monitoring would be undertaken in accordance with Practice Note viii of <strong>RMS Environmental Noise Management Manual</strong>. The monitoring would be undertaken between 6- 12 months of opening of the project to identify the effectiveness of the operational noise mitigation measures. Where noise levels exceed the predictions all further feasible and reasonable measures would be considered.</td>
<td>RMS</td>
<td>Post construction</td>
</tr>
<tr>
<td>14</td>
<td>Impacts to sensitive receivers from construction</td>
<td>A construction noise and vibration management plan (CNVMP) would be prepared as part of the CEMP prior to construction. The CNVMP would address all stages of construction.</td>
<td>Construction contractor</td>
<td>Pre construction</td>
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<td>No.</td>
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| noise | This plan would include but not be limited to:  
- Identification of nearby and potentially affected properties and residences. This would be detailed in text and shown spatially on a map.  
- A risk assessment to identify potential risk for discrete work elements/activities likely to affect residents. This would guide the development of the construction timetable and the identification of feasible and reasonable mitigation measures including measures to mitigate impacts from use of the access track between Tambelin Street and Wyong Road.  
- Feasible and reasonable noise control measures to reduce out of hour's noise levels.  
- Mitigation measures to control and minimise the impacts of construction noise and vibration in consideration of the requirements of Section 5 of the ENMM.  
- A process for assessing the performance of the implemented mitigation measures.  
- Description of approved hours of work and work to be undertaken.  
- Outline complaints handling and consultation protocols. | Construction contractor | Pre-construction |

15 | Impacts to sensitive receivers from construction noise | The access track between Tambelin Street and Wyong Road would only be used for construction access to basin B500S and retaining wall RW-C and for operational access to retaining wall RW-C. If any other uses are required, prior to those uses occurring, the RMS Senior Environmental officer would be consulted to advise of any further environmental impact assessment requirements. | Construction contractor | Pre-construction |

16 | Impacts to sensitive receivers from construction noise | Site specific mitigation measures would be included in the CNVNP to control and minimise the impacts of construction noise associated with the construction compound site, access tracks, out of hours work and proximity to sensitive noise receivers. | Construction contractor | Pre-construction |

17 | Impacts to sensitive receivers from construction noise | Construction timetabling would be organised to minimise noise impacts. Timetabling considerations may include time and duration restrictions and respite periods.  
The nearest noise receptors would be notified of the construction work schedule and expected noise levels prior to construction.  
Where rock breaking/ hammering is to be undertaken within 10 metres of any occupied | Construction contractor | Pre-construction |
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<th>Environmental safeguards</th>
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<tbody>
<tr>
<td>18</td>
<td>Impacts to sensitive receivers from construction noise</td>
<td>dwelling, occupants should be notified of the works and the duration of activity. Activity would be restricted to no more than 2 hours in any working day.</td>
<td>Construction contractor</td>
<td>Pre-construction and construction</td>
</tr>
<tr>
<td>19</td>
<td>Impacts to sensitive receivers from construction noise</td>
<td>Plant and equipment would be selected and oriented where possible to reduce noise emissions to sensitive receivers. Concentrated noise sources (such as batch plants and piling rigs) would be located as far from sensitive receivers as possible.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>20</td>
<td>Impacts to sensitive receivers from construction noise</td>
<td>Where possible, noisy plant would not be operated simultaneously and/or close together. This would include equipment operating at separate work sites to avoid cumulative noise impacts.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>21</td>
<td>Impacts to sensitive receivers from construction noise</td>
<td>Quieter construction methods, plant and equipment would be used where practicable, feasible and reasonable.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>22</td>
<td>Impacts to sensitive</td>
<td>Alternatives to noisy electronics (such smart reversing alarms) would be used where workplace health and safety issues can be safely managed.</td>
<td>Construction contractor</td>
<td>Construction</td>
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<tr>
<td>No.</td>
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<td>Environmental safeguards</td>
<td>Responsibility</td>
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<tr>
<td>23</td>
<td>Impacts to sensitive receivers from construction noise</td>
<td>The use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby residents would be avoided.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>24</td>
<td>Impacts to sensitive receivers from construction noise</td>
<td>Where possible, the use of equipment that generates impulsive noise would be avoided.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>25</td>
<td>Impacts to sensitive receivers from construction noise</td>
<td>The need for vehicle reversing and therefore use of reversing alarms (particularly at night) would be minimised by arranging for one-way site traffic routes where possible.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>26</td>
<td>Impacts to sensitive receivers from construction noise and vibration</td>
<td>Regular toolbox talks regarding the need to minimise noise and vibration would be undertaken.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>27</td>
<td>Impacts to sensitive receivers from construction noise and vibration</td>
<td>Noisy activities would be routinely identified and improvement techniques adopted.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
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<tr>
<td>28</td>
<td>Impacts to sensitive receivers from construction noise and vibration</td>
<td>A community liaison telephone number and site contact would be provided so that noise and vibration related complaints can be received and addressed in a timely manner.</td>
<td>RMS project manager</td>
<td>Construction</td>
</tr>
<tr>
<td>29</td>
<td>Impacts to sensitive receivers from construction noise and vibration</td>
<td>Construction noise and vibration monitoring would be carried out in accordance with the <em>RMS Environmental Noise Management Manual</em> during high noise risk and high vibration risk activities and, where appropriate, in response to complaints. If noise or vibration levels from the works exceed the predicted levels at the nearest sensitive receivers, work practices would be modified and/or additional feasible and reasonable management measures implemented.</td>
<td>RMS project manager/ construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>30</td>
<td>Impacts to sensitive receivers from construction noise and vibration</td>
<td>Where actual construction activities differ from those assessed in the Noise and Vibration Assessment (refer to Appendix M of the REF), the construction contractor would confirm the level of impact through additional assessment.</td>
<td>Construction contractor</td>
<td>Construction</td>
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<tr>
<td>31</td>
<td>Vibration impacts to sensitive receivers</td>
<td>Separation distances would be increased wherever feasible and reasonable between vibration source and sensitive receivers, with a view to reducing impacts.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>32</td>
<td>Vibration impacts to sensitive receivers</td>
<td>Alternatives to high vibration source plant and equipment would be used where practical and where feasible, with a view to reducing impacts.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>33</td>
<td>Vibration impacts to sensitive receivers</td>
<td>Where piling, hydraulic hammering or dynamic compaction is proposed within 40 metres of any structure (residential or commercial) or utility/service, a building condition survey would be conducted and preliminary vibration monitoring undertaken by a qualified contractor.</td>
<td>Construction contractor</td>
<td>Construction</td>
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<tr>
<td>34</td>
<td>Vibration impacts to sensitive receivers</td>
<td>Rock breaking/hammering would not be undertaken within five metres of any non-heritage structure, unless specific evidence is provided to indicate vibration levels at sensitive receivers are below proposal specific criteria.</td>
<td>Construction contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>35</td>
<td>Vibration impacts to sensitive receivers</td>
<td>Where rock breaking/hammering is undertaken within 10 metres of any occupied dwelling, occupants should be duly notified or the works and the duration of the activity should be restricted to no more than two hours any working day</td>
<td>Construction contractor</td>
<td>Construction</td>
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**Ecology**

<p>| No. | Impact on flora and fauna                                              | A flora and fauna management plan would be prepared as part of the construction environmental management plan (CEMP). It would be prepared in accordance with the RMS Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) (Biodiversity Guidelines). The plan would include a clearing procedure in which would include: |
|-----|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|----------------------|-----------------------------|
| 36  |                                                                         | - Staged habitat removal in accordance of Guide 4 of the Biodiversity Guidelines.                                  | Construction contractor | Pre-construction and during construction |
|     |                                                                         | - The process for pre-clearing surveys in accordance with Guide 1 of the Biodiversity Guidelines, which would include a suitably qualified and licensed fauna ecologist searching the trees, undergrowth, culverts burrows, wetlands and other aquatic areas (including vegetated swales and creekbanks) for the presence of fauna immediately prior to clearing. The ecologist would relocate any fauna found to a previously identified safe location. |
|     |                                                                         | - A process for fauna handling in accordance with Guide 9 of the Biodiversity Guidelines including a requirement to contact a local vet and wildlife handler prior to vegetation clearance to ensure they would be willing to treat any fauna injuries that may occur during clearing and other construction activities. |
|     |                                                                         | - Identifying, defining and managing exclusion zones for construction sites, including temporary fencing requirements, to avoid damage to vegetation. Maps of exclusion zones would be provided and developed in accordance with Guide 2 of the Biodiversity Guidelines. |
|     |                                                                         | - Provision for the education of all construction personnel with regards to the importance of clearing limits, exclusion zones and remnants/individual trees of value. |
|     |                                                                         | - Coarse woody debris and rocks removed in the process of clearing shall, where |                      |                             |</p>
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|     |        | practical, be placed in adjacent areas of vegetation in accordance with Guide 5 of the Biodiversity Guidelines.  
• A procedure for managing the impact on aquatic and riparian zones during construction of the bridge pylons and other works adjacent to Tuggerah Creek and wetlands in accordance with Guide 10 of the Biodiversity Guidelines. | Construction Contractor | Construction |
| 37  | Impacts to retained vegetation | Vehicles and equipment would not be stored, and stockpiles would not be located, within the drip line of trees to be retained. | Construction Contractor | Construction |
| 38  | Removal of vegetation | A suitably qualified ecologist would be engaged in consultation with RMS Environmental Officer during detailed design to develop and implement a rehabilitation plan. The plan would cover all areas impacted by construction. It would include but not be limited to the following:  
• Seed collection, propagation and growing of local provenance indigenous species for use in rehabilitation.  
• Replanting species representative of the natural ecological communities of the immediate area including TECs and threatened species.  
• Replanting of foraging species for the Grey Headed Flying Fox including such species as the Forest Red Gum (*Eucalyptus tereticornis*).  
• Re-establishment of habitat would take into account Guide 3 of the Biodiversity Guidelines (RTA 2011).  
• Swales would be planted with indigenous wetland plants with a particular focus on macrophytes.  
• Planting would include measures to facilitate fauna passage along Tuggerah Creek in areas in and adjacent to the construction footprint. | RMS project manager | Pre-construction and post-construction |
| 39  | Removal of vegetation | Measures involving minimising the construction footprint and subsequent removal of vegetation would be considered in the detailed design. Specific measures include:  
• Avoiding threatened flora species where possible.  
• Minimise impacts to areas of higher condition terrestrial and aquatic habitats.  
• Minimise impacts to threatened ecological communities.  
• Maintaining existing water quality and hydrological flow regimes. This would also include consultation with a senior RMS environmental officer to confirm sedimentation basin sizes and staging to minimise the impact to vegetation at any one stage of construction. | RMS project manager | Detailed design |
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| 40  | Removal of vegetation | During the detailed design phase opportunities to reduce the requirement for clearing would be sought and undertaken where possible. This could include:  
- Reducing the width of the alignment in areas where the road adjoins TEC and/or *Melaleuca biconvexa*.  
- By use of temporary or permanent retaining walls and/or dry stone walls in place of batters around individual indigenous trees and around stands of *Melaleuca biconvexa* in order to protect vegetation and avoid loss. | Construction contractor | Pre-construction |
<p>| 41  | Impact on aquatic ecosystems | The design of creek and waterway crossings would be in accordance with “Why do fish need to cross the road? Fish passage requirements for waterway crossings” (Fairfull and Witheridge 2003) to maintain fish passage. | RMS project manager | Detailed design |
| 42  | Impact on <em>Melaleuca biconvexa</em> | Additional survey to confirm the number of <em>Melaleuca biconvexa</em> impacted by the proposal would be undertaken using the visual abundance method as defined in Duncan (2011). The survey results would be used by RMS to identify if a referral is required to be submitted as a precautionary measure to DSEWPaC. | RMS project manager | Pre-construction |
| 43  | Impact on <em>Melaleuca biconvexa</em> and <em>Syzygium paniculatum</em> | Individuals of <em>Melaleuca biconvexa</em> and <em>Syzygium paniculatum</em> within the construction footprint would be retained where possible. A management plan for minimising impacts to <em>Melaleuca biconvexa</em> and <em>Syzygium paniculatum</em> species would be developed for the proposal and would include a strategy for replanting these species adjacent to the proposal. | Construction contractor | Construction |
| 44  | Impacts to microbat roosting habitat in culverts and bridges | Microbat surveys would be conducted by a qualified ecologist in the culverts and bridges within the project area prior to construction including diurnal and nocturnal search. The surveys would be undertaken in the most optimal season for the detection of threatened microbats (September to March). A qualified fauna ecologist would undertake a search of culverts and the bridge for microbats 24 hours prior to disturbance of these areas. The search would use adequate methods, such as inspections with an endoscope, to investigate small crevices. If microbats are detected during these surveys, a microbat management plan would be prepared and submitted to RMS Environment for approval at least ten days prior to the commencement of implementation. | RMS project manager | Pre-construction |</p>
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<tr>
<td>45</td>
<td>Impacts to Wallum Froglet and Green and Golden Bell Frog</td>
<td>Targeted surveys would be undertaken to identify the presence or otherwise of these species during the detailed design phase in accordance with OEH/DSEWPaC survey methodologies. These surveys would be undertaken during the 2012/2013 summer period so that they are completed prior to March 2013. If any Green and Golden Bell Frogs or Wallum Froglets are identified then the RMS Senior Environmental officer and the RMS Senior specialists (Biodiversity) would be notified and would advise on any further assessment requirements. Additionally, if threatened frogs are found during pre-clearing surveys (undertaken in accordance with safeguard 36) a management plan would be developed and would include measures for protecting the frog’s habitat as well as providing hygiene requirements for managing the possible spread of chytrid fungus that can infect frogs. The management plan would be submitted to RMS Environment for approval at least ten days prior to the commencement of clearing.</td>
<td>RMS project manager</td>
<td>Pre-construction</td>
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<tr>
<td>46</td>
<td>Impact to Maundia triglochinoides</td>
<td>Targeted surveys for Maundia triglochinoides would be undertaken during the detailed design phase. If any individuals are found, specific measures to protect individuals as much as possible would be included in the flora and fauna management plan.</td>
<td>Construction contractor</td>
<td>Construction</td>
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<tr>
<td>47</td>
<td>Controlling the spread of noxious weeds</td>
<td>A weed management plan would be developed as part of the CEMP. Noxious weeds would be disposed of to a licensed waste facility.</td>
<td>Construction contractor</td>
<td>Construction</td>
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<tr>
<td>48</td>
<td>Controlling the spread of pathogens</td>
<td>To avoid the introduction of pathogens into the area, all new plant and top soil material brought to site would be certified disease-free by the supplier. Vehicle and boot wash down procedures and facilities would be made available to ensure vehicles and footwear are free of pathogens before entering and leaving site. Construction works would be programmed to move from uninfected areas to any known infected areas.</td>
<td>Construction contractor</td>
<td>Construction</td>
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<tr>
<td>49</td>
<td>Wildlife connectivity</td>
<td>Revegetation around and beneath the rail overbridge would aim to provide some cover for fauna approaching and exiting the structure.</td>
<td>Construction contractor</td>
<td>Construction</td>
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<td>50</td>
<td>Impacts to TECs</td>
<td>Prior to clearing, exclusion zones would be erected to identify environmentally sensitive areas such as TECs. The location of TECs would be mapped and identified in the CEMP.</td>
<td>Construction contractor</td>
<td>Construction</td>
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### Landscape, visual and urban design

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<tr>
<td>51</td>
<td>Change of landscape character and visual impact</td>
<td>Detailed design would be undertaken according to the urban design vision, objectives and principles which underpin the concept design.</td>
<td>RMS</td>
<td>Detailed design</td>
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<tr>
<td>52</td>
<td>Change of landscape character and visual impact</td>
<td>RMS would discuss screening options with residents in Yaldeeme Close such as screen planting within the limited space available, the construction of a privacy fence to the rear of affected properties and incorporating suitable screen planting in the rear of backyards. Appropriate screening would be implemented where possible. Plants would be of a growth height and form to ensure that overshadowing of adjacent premises is minimised. This would include reviewing the use of Hoop Pines on the corner of the intersection that is adjacent to properties located in Yaldeeme Close.</td>
<td>Detailed design contractor</td>
<td>Detailed design</td>
</tr>
<tr>
<td>53</td>
<td>Visual impact of altered road character from clearance of vegetation including TECs</td>
<td>The road corridor would be enhanced with new planting where possible. The planting would be consistent with the existing planting treatment along Wyong Road (western approach) and the Pacific Highway (northern approach). Wherever possible, indigenous plant species would be adopted where new landscape works are adjacent to TEC’s. Replanting of large trees would consider services and maintenance access requirements and potential overshadowing of adjacent properties. Existing vegetation would be maintained and protected wherever possible.</td>
<td>Design contractor</td>
<td>Design</td>
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<td>54</td>
<td>Visual impact of retaining</td>
<td>In consultation with Wyong Shire Council and any interested/identified community groups, the design of retaining walls would adopt a consistent approach including surface treatments,</td>
<td>Design contractor</td>
<td>Design</td>
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|    | walls                                                                  | colours and detailing. This would also achieve a simple, uncluttered design. The only exception to this is the wing walls and portals of the underpass where local street/community artists would provide a mural to discourage random graffiti and make the area welcoming.  
Retaining wall texture would be designed to:  
• Minimise the opportunity for graffiti through selection of surface texture.  
• Use screen planting to reduce the visual impact of the retaining walls.                                                                                                         |                      |        |
| 55  | Visual impact of new street furniture on the road character            | A consistent approach to the detailing of barriers, street lighting, pedestrian fences and safety/privacy screens would be undertaken. To the extent possible, this detailing would integrate with the detailing of existing roadside elements. | Design contractor    | Design |
| 56  | Change in visual amenity of the underpass                              | The quality of the existing underpass and proposed extension would be improved with:  
• Adequate lighting.  
• The incorporation of appropriate wall surface treatments.                                                                                                                  | Design contractor    | Design |
<p>| 57  | Visual impact of cantilevered footpath                                | Consultation would be undertaken with relevant servicing authorities to identify if there is potential to incorporate some screen planting over existing services. Liaison with residents would be undertaken to incorporate some screen planting in the rear of backyards wherever possible. | RMS                  | Design |
| 58  | Impact of acoustic treatments                                         | Consideration would be given to the urban design implications of acoustic treatments. For example, The use of transparent panels would be considered for the top panels of the noise barrier during detailed design. | RMS                  | Design |
| 59  | Visual impact of the new rail overbridge                              | The new rail overbridge would adopt a similar depth, structure and similar supporting piers to the existing bridge.                                                                                                | Design contractor    | Design |
| 60  | Visual impact of the construction crew                                 | Work sites would be tidied at the end of each working day. Rubbish and garbage would be appropriately disposed of at an appropriately licensed facility. Vegetation would be maintained as long as possible, and removed according to construction | Construction contractor | Construction |</p>
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<td></td>
<td>stockpiles, plant and equipment during construction</td>
<td>staging requirements. Cleared areas would be progressively rehabilitated as each construction stage is completed, in accordance with the landscaping <strong>replanting</strong> plan and the rehabilitation plan (refer to Section 6.3.4 of the REF).</td>
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<td>Hydrology and hydraulics</td>
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| 61  | Impact of the proposal on flooding during operation | During detailed design the following investigations would be undertaken and includes assessing the:  
- Sensitivity of the built environment to the forecast tailwater levels of an ARI 100 year event.  
- Sensitivity to culvert blockage due to debris in the floodwater.  
- Investigation of additional flood mitigation options, if the previous two sensitivity studies indicate these would be necessary.  
Dependant on the outcomes of these investigations, flood mitigation could require further consideration.  
During detailed design sensitivity assumptions used in the initial flood modelling would be confirmed when the design has been finalised and there is greater certainty regarding these assumptions. Dependent on the outcomes of these sensitivity investigations, the need for management measures would be confirmed. Any management measures that would result in a greater footprint than that assessed in the REF would require additional environmental impact assessment. | Design contractor | Detailed design |
| 62  | Impact of proposal on flooding during construction | A flood management plan would be prepared to manage any potential flooding in and around the proposal during construction. This would include:  
- Regular weather monitoring.  
- Procedures to move plant and equipment out of identified flood-prone areas. | Construction contractor | Pre-construction, construction |
<p>|     | Landform, geology and soils | | | |
| 63  | Acidification of waterways and soils | An acid sulfate soils Management Plan would be prepared in accordance with the <em>Guidelines for the Management of Acid Sulfate Materials</em> (RTA 2005c). It would include processes and procedures for minimising and avoiding exposure of acid sulfate soils, as well as the management, handling, storage and disposal of acid sulfate soils. | Construction contractor | Pre-construction |</p>
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<tr>
<td>64</td>
<td>Discovery of previously unidentified contaminated land</td>
<td>A Contaminated Land Management Plan would be prepared as part of the CEMP for the rehabilitation requirements, classification, transport and disposal requirements of any contaminated land close to or within the construction footprint. It would be prepared in accordance with the <em>Contaminated Land Act 1997</em> and relevant OEH Guidelines.</td>
<td>Construction contractor</td>
<td>Pre construction and during construction</td>
</tr>
<tr>
<td>65</td>
<td>Discovery of previously unidentified contaminated land</td>
<td>In the event that indication of contamination is encountered (such as odorous or visually contaminated materials), work in the area would cease immediately and the RMS Senior environmental officer would be contacted to advise, in consultation with a contaminated land specialist on the appropriate action. Works that may disturb the find would not re-commence until advised by the RMS Senior environmental officer.</td>
<td>Construction contractor and RMS project manager</td>
<td>Construction</td>
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| 66  | Contamination of environment from machinery fuel and oil leaks        | A fuel truck would be used during construction to refuel vehicles. This truck would be appropriately bunded and carry spill kit material. Should fuels, chemicals and liquids be stored they would be:  
  - Stored at least 50 metres away from any waterways or drainage lines.  
  - Stored in an impervious surface or undertaken off-site. | Construction contractor           | Construction                 |
<p>| 67  | Contamination of environment from machinery fuel and oil leaks        | Machinery would be kept in good working order according to the manufacturers specifications and would be checked daily to ensure that no oil, fuel or other liquids are leaking from the machinery. | Construction contractor           | Construction                 |
| 68  | Asbestos contamination associated with the retained water pipelines underneath Wyong Road | The 45 metres of asbestos pipes retained under Wyong Road would be reported to the OEH and WSC for inclusion in the Contaminated Land Public Record (see <a href="http://www.environment.nsw.gov.au/prclmapp/searchregister.aspx">http://www.environment.nsw.gov.au/prclmapp/searchregister.aspx</a>). | Construction contractor           | Post-construction             |
| 69  | Destabilisation of disturbed                                          | A site stabilisation plan, inclusive of a SWMP and an ESCP, would be prepared as part of the CEMP. The plan would include but not be limited to the following:                                                                 | Construction contractor           | Construction                 |</p>
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| 70  | Pollution as a result of sediment entering waterways during construction | A soil and water management plan (SWMP) would be developed to include controls that would limit movement of sediment (erosion controls) and remove sediment from runoff before discharge to watercourses (sediment controls). It would be prepared in accordance with the *Managing Urban Stormwater – Soils and Construction, Volumes 1 and 2D* (Landcom, 2004 and DECCW, 2008) and *RTA Road Design Guideline: Section 8 Erosion and Sedimentation* (RTA 2003) and *QA Specification G38 Soil and Water Management (Soil and Water Management Plan)* (RMS 2011a). The SWMP would include, but not be limited to procedures for controlling the following standard activities:  
  - Mud and litter transfer.  
  - Maintenance and cleaning of sediment control works.  
  - Soil and stockpile management (in accordance with *RMS Stockpile Site Management Guideline* (RTA 2011f)).  
  - Work within wetlands and in Tuggerah Creek.  
  - Dewatering of sediment basins and excavations (in accordance with *RMS Technical Guideline - Environmental Management of Construction Site Dewatering*). | Construction contractor | Pre-construction |
<p>| 71  | Pollution as a result of sediment entering waterways during | The SWMP would include a preliminary erosion and sediment control plan (ESCP) prepared in accordance with <em>Managing Urban Stormwater – Soils and Construction, Volumes 1 and 2D</em> (Landcom, 2004 and DECCW, 2008), which would identify the erosion and sediment control measures that would be implemented on site. Progressive ESCPs would be developed throughout construction to reflect the changes in activities and risk throughout the construction process. The plan would include diagrams of | Construction contractor | Pre-construction |</p>
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| 72  | Pollution as a result of sediment entering waterways during construction | The SWMP would include a program for inspecting sediment and erosion controls, including:  
  - Weekly inspection of erosion and sediment control measures and prior to forecast rainfall events to ensure measures are in place, and functioning in the event of a rainfall event.  
  - Inspection of erosion and sediment control measures during rainfall events that cause runoff, to ensure controls are working effectively. | Construction contractor | Pre-construction |
| 73  | Pollution as a result of sediment entering waterways during construction | In preparation of the SWMP and associated ESCPs, the recommendations of the *Construction Water Quality Control Appraisal Report* developed by TREES (2012), included as Appendix C of the REF, would be considered. A summary of the specific erosion and sediment controls to be implemented as recommended by TREES (2012) is included in Section 2.6.1 of the REF. | Construction contractor | Pre-construction |
| 74  | Downstream water quality impacts                                       | A water quality monitoring plan would be undertaken in accordance with the RMS *Guideline for Construction Water Quality Monitoring* (RTA undated). The plan would focus on water quality of Mardi Creek and Tuggerah Creek. Additional to that outlined in the abovementioned guideline, the plan would include:  
  - Baseline wet and dry weather monitoring of Mardi Creek and Tuggerah Creek upstream and downstream of the construction footprint prior to construction.  
  - Monitoring of pH, dissolved oxygen, conductivity, turbidity, total suspended solids, oils and grease would be undertaken.  
  - Measurement of the variables described above would be undertaken during construction at identified water monitoring sites on Mardi Creek and Tuggerah Creek after high rainfall events that result in substantial runoff.  
  - A monthly water quality monitoring program would also be implemented regardless of rainfall events to monitor the main water quality parameters and to compare data with pre-construction background levels.  
  - An assessment of the adequacy of all water quality control and erosion and sediment control measures would be undertaken should monitoring show a decline in water quality. | RMS                     | Pre construction, construction |
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| 75  | Contaminants entering receiving environments during construction | The following measures would be implemented to minimise the risk of contaminants entering receiving environments:  
- All fuels, chemicals and liquids would be stored and disposed of in accordance with DECC Storing and Handling Liquids: Environmental Protection Participants Manual (May 2007).  
- Refuelling of plant and equipment would occur via on site storage in impervious bunded areas located a minimum of 50 metres from drainage lines or waterways. (also refer to control measure 66)  
- Plant, equipment and vehicle wash down would occur in a designated bunded area away from waterways and drainage lines.  
- All concrete washout would occur into a sealed receptacle or bunded concrete washout with an impermeable liner. The concrete washout must be sized to be 120% of the estimated volume of the waste that would be received into the washout at any one time.  
- Any material transported onto pavement surfaces would be swept and removed at the end of each working day. | Construction contractor | Operation, post-operation |
| 76  | Accidental spill / contamination of the surrounding environment during construction | A site specific emergency spill plan would be developed, and include spill management measures in accordance with the RMS Code of Practice for Water Management and Bunding and Liquid Chemical Storage, Handling and Spill Management (DEC 2005a). Should a spill occur during construction, the emergency spill plan would be implemented and the RMS regional environmental officer, Central Coast Region would be contacted immediately. Emergency spill kits would be kept at areas identified as having the highest spill at all times during construction. | Construction contractor | Construction |
| 77  | Contaminants entering receiving environments during operation | Operational controls to manage accidental spills during operation would include:  
The provision of shut off valve on the downstream side of drainage lines 01 (for catchment B), 03 (for catchment C) and E5 (for catchment F) (refer to Section 3.3.1 and Appendix D of the REF) to contain any accidental spills and contaminants entering the freshwater wetland located on the north-western side of the Pacific Highway and Wyong Road | RMS | Operation |
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<td></td>
<td>operation</td>
<td>intersection. The design of the shut off valve would be further refined during detailed design. A site specific spill management response plan would be developed in consultation with local emergency services. The emergency spill response procedure may include such strategies as deploying the shut-off valves or containing the spill in-situ on the road before it reaches the drainage system by placing absorbent material in the spill and sandbagging swales adjacent to the alignment. Annual checks of the shut-off valves would be undertaken to ensure the device remains functional.</td>
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<td>78</td>
<td>Water quality impacts during operation</td>
<td>Operational controls to improve the water quality of stormwater runoff from the road would include a constructed wetland and a vegetated swale as described in Section 3.2.2. Detailed design of these operational water quality measures would: • Finalise the dimensions and locations of the measures. • Incorporate water sensitive urban design principles. • Ensure that suitable maintenance access is provided. • Identify appropriate indigenous wetland plants (in particular macrophytes) to be planted. • Design of these water quality measures would be undertaken by a consultant experienced in water sensitive urban design and in consultation with the RMS Environmental Officer.</td>
<td>Design contractor</td>
<td>Detailed design</td>
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**Groundwater**

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<tr>
<td>79</td>
<td>Dewatering</td>
<td>A dewatering plan would be prepared to manage any dewatering activities for the proposal. It would be prepared in accordance with the <em>Environmental Management of Construction Site Dewatering Guideline</em> (RTA 2011) and would include: • Description and justification of all selected dewatering methods. • Description of onsite water reuse requirements. • Design requirements for each offsite discharge location to prevent erosion. • Description of the water quality treatment techniques to be used. • Water sampling and testing regime to validate water quality before and (if required) during dewatering. • Proposed monitoring and supervision regime.</td>
<td>Construction Contractor</td>
<td>Pre-construction</td>
</tr>
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<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
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<tr>
<td>80</td>
<td>Intercepting water table during construction</td>
<td>As dewatering would be required for the boring and piling activities for the installation of pylons for the rail overbridge and retaining walls, a dewatering licence from the NOW would be sought prior to the interception of the aquifer or the commencement of construction of the groundwater bores or dewatering.</td>
<td>Construction Contractor</td>
<td>Pre-construction</td>
</tr>
</tbody>
</table>

### Aboriginal cultural heritage

| 81  | Unexpected Aboriginal heritage find        | The following safeguards would be applied to manage unexpected Aboriginal heritage finds:  
- The CEMP would include a procedure for unexpected Aboriginal finds, which would be the implementation of the RMS *Unexpected Archaeological Finds Procedure (2011b)*.  
- Construction personnel would receive basic toolbox training in the recognition of Aboriginal cultural heritage material and sites.  
- When any soil, vegetation clearing or leaf litter removal activities are conducted, workers should be observant and keep a look out for rock engravings, surface shell, bone, rocks or any other Aboriginal cultural heritage material.  
- Should any Aboriginal objects be uncovered during construction, works would immediately cease in the vicinity of the find. Guidance would be sought from the RMS Aboriginal Cultural Heritage Advisor. The Planning and Aboriginal Heritage Section of the OEH would then be notified by the RMS. | Construction Contractor | Pre-construction and construction |

### Non-Aboriginal heritage

| 82  | Unexpected non-Aboriginal heritage find    | The following safeguards would be applied to manage unexpected non-Aboriginal heritage finds:  
- Should any relics (as defined by the *Heritage Act 1977*) or sites of heritage significance be found, construction would cease immediately in the vicinity of the find and advice sought from the RMS Environment Branch. This would allow as necessary an archaeologist to assess the find and notify the Heritage Branch in accordance with the *Heritage Act 1977*.  
- Steps in the RMS *Standard Management Procedure: Unexpected Archaeological Finds* must be followed.  
- The CEMP would include a procedure for unexpected Aboriginal finds, which would be the implementation of the RMS *Unexpected Archaeological Finds Procedure (2011b)*. | Construction Contractor | Pre-construction and construction |
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>83</td>
<td>Dust from construction activities</td>
<td>An air quality management plan would be prepared before any pre-construction or clearing activities, and would provide guidance on:</td>
<td>Construction contractor</td>
<td>Pre-construction</td>
</tr>
</tbody>
</table>
|     |                                            | • **Dust monitoring.**  
• The use of appropriate dust suppression methods which would include (but are not limited to):                                                                                                       |                                        |                         |
|     |                                            | – Stabilising of areas with the capacity to cause dust, with water spraying, compaction or progressive revegetation.                                                                                                       |                                        |                         |
|     |                                            | – Covering of stockpile and storage areas.  
– Cessation of dust generating activities in high wind situations where dust cannot be controlled.                                                                                                         |                                        |                         |
<p>|     |                                            | – Local residents would be advised of hours of operation and provided with contact details for queries regarding air quality.                                                                                            |                                        |                         |
| 84  | Change in land use                         | Consultation would be undertaken with property owners partially or wholly impacted by the proposal.                                                                                                                      | RMS                                    | Detailed design        |
| 85  | Property acquisition                       | Property acquisition would be managed in accordance with the provisions of the Road and Maritime Services’ <em>Land Acquisition Policy</em> and the <em>Land Acquisition (Just Terms Compensation) Act 1991.</em> | RMS project manager                    | Detailed design        |
| 86  | Property access                            | Property access would be maintained wherever possible. Prior to any unavoidable disruption to access, consultation would be undertaken with the affected property owner.                                          | Contractor                              | Prior and during construction |
| 87  | Commencing construction                     | Local residents would be notified prior to works commencing and would be kept regularly informed of construction activities during the construction process.                                                           | RMS                                    | Pre-construction and construction |
| 88  | Complaints                                 | A complaints-handling procedure and register would be included in the CEMP.                                                                                                                                              | RMS                                    | Pre-                     |</p>
<table>
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<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
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</thead>
<tbody>
<tr>
<td>89</td>
<td>Change of conditions and disruptions</td>
<td>Road users, pedestrians and cyclists would be informed of changed conditions including likely disruptions to access.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>90</td>
<td>Changes to property access</td>
<td>Property access would be maintained wherever possible. Prior to any unavoidable disruption to access, consultation would be undertaken with the affected property owner.</td>
<td>RMS</td>
<td>Construction</td>
</tr>
<tr>
<td>91</td>
<td>Impacts on business</td>
<td>Early and ongoing consultation and communication with local businesses would be undertaken to identify potential impacts on local businesses and appropriate management strategies to avoid or minimise these impacts. This may include measures such as additional signage, provision of alternative access including for delivery vehicles, and communication with local communities about changes to business access.</td>
<td>RMS</td>
<td>Construction</td>
</tr>
<tr>
<td>92</td>
<td>Emergency vehicle access</td>
<td>Access would be maintained for emergency vehicles in the vicinity of construction works. Ongoing consultation would be undertaken with emergency services during construction to ensure that potential impacts are identified and appropriately managed.</td>
<td>RMS</td>
<td>Construction</td>
</tr>
<tr>
<td>93</td>
<td>Interruptions to utility services</td>
<td>Residents would be informed before any interruptions to utility services that may be experienced as a result of utilities relocation.</td>
<td>RMS</td>
<td>Construction</td>
</tr>
<tr>
<td>94</td>
<td>Commencing construction</td>
<td>Prior to construction, RMS would also notify residents that may be in the vicinity of the construction compound sites and work areas.</td>
<td>RMS</td>
<td>Construction</td>
</tr>
<tr>
<td>95</td>
<td>Property acquisition</td>
<td>Property acquisition would be managed in accordance with the provisions of the Road and Maritime Services’ Land Acquisition Policy and the Land Acquisition (Just Terms Compensation) Act 1991.</td>
<td>RMS</td>
<td>Construction</td>
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<tr>
<td></td>
<td>Waste minimisation and management</td>
<td></td>
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<tr>
<td>96</td>
<td>Construction waste</td>
<td>Waste would be managed in accordance with the Waste Avoidance and Resource Recovery (WARR) Act.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>97</td>
<td>Construction waste</td>
<td>Waste generation would be avoided and opportunities for resource recovery taken.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
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<tr>
<td>98</td>
<td>Construction waste</td>
<td>A Waste Management Plan would be completed in accordance with the requirements of the RMS’s QA Specification G36 – Environmental Protection (Management System).</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>99</td>
<td>Construction waste</td>
<td>All waste generated would be disposed of by an appropriately licensed waste disposal contractor at an approved facility. The nearest landfill facility is the Buttonderry Waste Management Facility located 10 kilometres north of the existing intersection.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>100</td>
<td>Construction waste</td>
<td>Housekeeping at the construction site would be addressed on a daily basis following the completion of the day’s activities. This includes sorting of recycling and green waste.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>101</td>
<td>Construction waste</td>
<td>Machinery maintenance would be conducted at a suitable location, ie not adjacent to waterways or stormwater drains and in appropriately bunded areas.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>102</td>
<td>Disposal of asbestos</td>
<td>An Asbestos Management Plan would be developed before construction which would address the known sources of asbestos as well as provide measures to deal with asbestos in the event that unknown sources were located. Asbestos would be managed in accordance with Protection of the Environment (Waste) Regulation 2005 and disposal of asbestos waste would be in accordance with RMS Waste Fact Sheet 5.</td>
<td>Contractor</td>
<td>Pre-construction and construction</td>
</tr>
<tr>
<td>103</td>
<td>Disposal of asbestos</td>
<td>All asbestos material would be managed according to the Asbestos Management Plan.</td>
<td>Contractor</td>
<td>Pre-construction and construction</td>
</tr>
<tr>
<td>104</td>
<td>Disposal of asbestos</td>
<td>All asbestos material would be removed by a licensed contractor.</td>
<td>Contractor</td>
<td>Pre-construction and construction</td>
</tr>
<tr>
<td>105</td>
<td>Disposal of asbestos</td>
<td>All asbestos material would be disposed of at a licensed waste facility.</td>
<td>Contractor</td>
<td>Pre-construction and construction</td>
</tr>
<tr>
<td>106</td>
<td>Waste and litter during operation</td>
<td>Standard road maintenance works would be undertaken during the operation of the intersection. This would include litter removal and response to accidental spills and collisions. The maintenance requirements would be managed by RMS and/or Council, as per their instructions.</td>
<td>RMS</td>
<td>Operation</td>
</tr>
<tr>
<td>No.</td>
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<td>Environmental safeguards</td>
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<td></td>
<td>Cumulative impacts from concurrent developments</td>
<td>The proposed construction staging plans would take into account known future proposed developments in Tuggerah to minimise potential adverse impacts on traffic during construction.</td>
<td>Construction contractor</td>
<td>Pre-construction</td>
</tr>
</tbody>
</table>
5.3 Licensing and approvals

The licences and approvals required for the proposal have been listed in Table 7-2.

Table 5-2 Summary of licensing and approval requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Timing</th>
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<tbody>
<tr>
<td>The proposal may temporarily block fish passage during the construction of culverts and bridges and accordingly, a permit to block fish passage would be required under section 220(1) of the Fisheries Management Act 1994 (FM Act).</td>
<td>Prior to the commencement of works that may block fish passage.</td>
</tr>
<tr>
<td>The proposal is defined as both dredging and reclamation works under Section 198A of the FM Act. As such notification and approval is required by the Minister for NSW Department of Trade and Investment, Regional Infrastructure and Service (Department of Primary Industries) under section 199 of the FM Act. Consideration must be made of any matters that are raised by the Minister within 28 days.</td>
<td>Prior to the commencement of works within waterways, this includes construction of the new rail overbridge which also crosses Tuggerah Creek. Notification is required 28 days prior to works occurring.</td>
</tr>
<tr>
<td>Should the construction contractor have the need to establish bores for the purpose of taking or using of water from the aquifer including for dewatering purposes, a licence would be required under section 112 of the Water Act 1912 from the NSW Office of Water (NOW).</td>
<td>Prior to taking or using any water from the bore.</td>
</tr>
</tbody>
</table>
6 References


Roads and Traffic Authority (RTA) 2011, *Wyong Road Intersection Upgrade Options Report*.


Sinclair Knight Merz (SKM) 2013, *Pacific Highway HW10 and Wyong Road MR335 Intersection and Approaches Upgrade Feasibility and Overshadowing Assessment*. Prepared for the Roads and Maritime Services, St Leonards.


Sinclair Knight Merz (SKM) 2013d, *Pacific Highway and Wyong Road Intersection and Approaches Upgrade Concept Design Report, 100 per cent*. Prepared for the Roads and Maritime Services, St Leonards.