

NSW Roads and Maritime Services

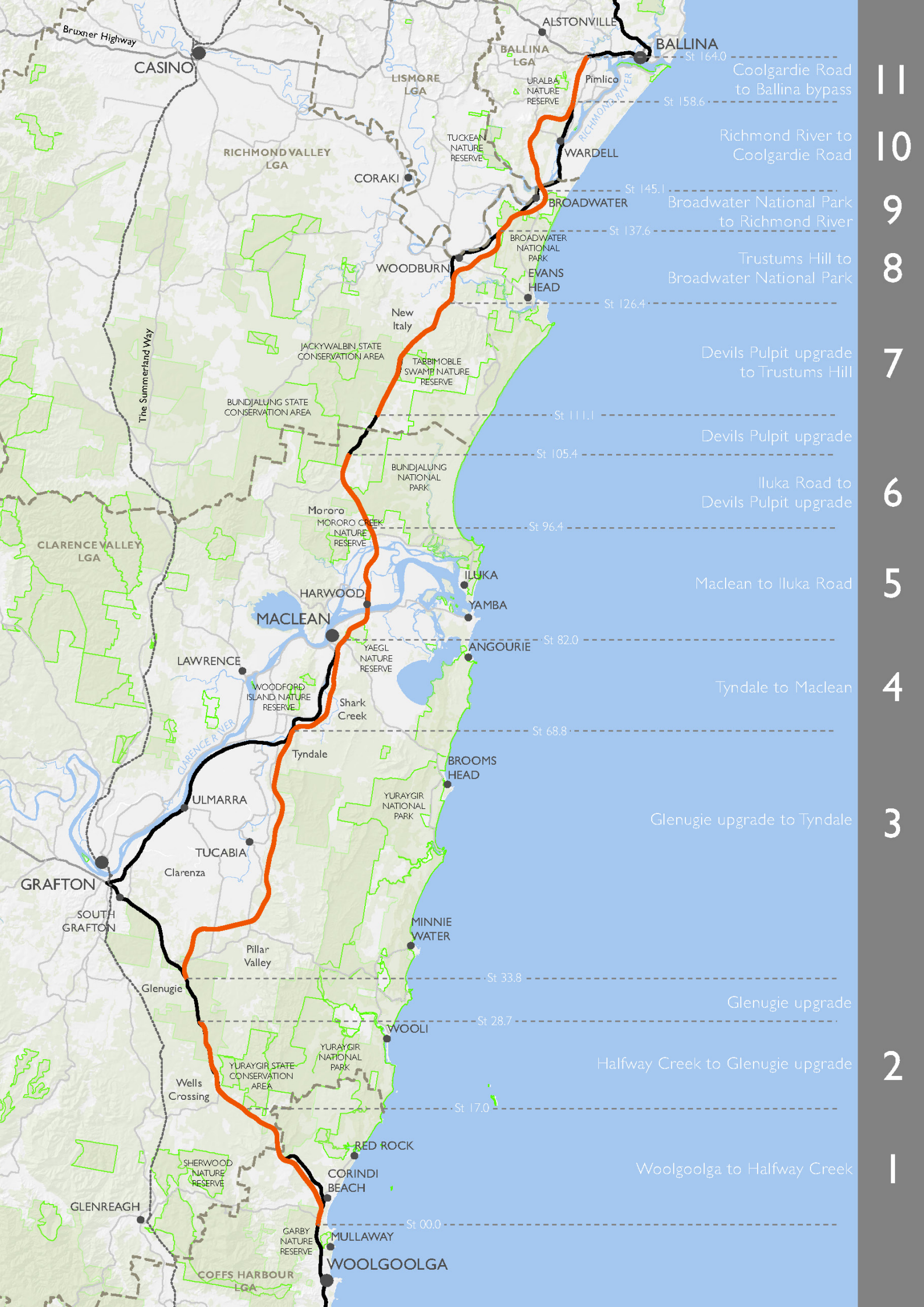
WOOLGOOLGA TO BALLINA | PACIFIC HIGHWAY UPGRADE SUBMISSIONS / PREFERRED INFRASTRUCTURE REPORT

Chapter 2

November 2013

Roads and Maritime 13.299

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CASINO

The Summerland Way

CLARENCE VALLEY LGA

ULMARRA

TUCABIA

Glenugie

Wells Crossing

GLENREAGH

WOOLGOLGA

RICHMOND VALLEY LGA

BUNDJALUNG STATE CONSERVATION AREA

MORORO MORORO CREEK NATURE RESERVE

WOODFORD ISLAND NATURE RESERVE

ULMARRA

TUCABIA

Glenugie

Wells Crossing

GLENREAGH

WOOLGOLGA

LISMORE LGA

CORAKI

WOODBURN

New Italy

JACKY WALBIN STATE CONSERVATION AREA

BUNDJALUNG NATIONAL PARK

HARWOOD

MACLEAN

LAWRENCE

Tyndale

ULMARRA

TUCABIA

Glenugie

Wells Crossing

GLENREAGH

WOOLGOLGA

ALSTONVILLE

BALLINA LGA

CORAKI

WARDDELL

BROADWATER

EVANS HEAD

TABBIMBLE SWAMPI NATURE RESERVE

BUNDJALUNG NATIONAL PARK

ILUKA

YAMBA

ANGOURIE

MACLEAN

LAWRENCE

Tyndale

ULMARRA

TUCABIA

Glenugie

Wells Crossing

GLENREAGH

WOOLGOLGA

WOOLGOLGA

WOOLGOLGA

WOOLGOLGA

WOOLGOLGA

BALLINA

WARDDELL

BROADWATER

EVANS HEAD

ILUKA

YAMBA

ANGOURIE

MACLEAN

LAWRENCE

Tyndale

ULMARRA

TUCABIA

Glenugie

Wells Crossing

GLENREAGH

WOOLGOLGA

WOOLGOLGA

WOOLGOLGA

Coolgardie Road to Ballina bypass
St 164.0

Richmond River to Coolgardie Road
St 158.6

Broadwater National Park to Richmond River
St 145.1
St 137.6

Trustums Hill to Broadwater National Park
St 126.4

Devils Pulpit upgrade to Trustums Hill

Devils Pulpit upgrade
St 111.1
St 105.4

Iluka Road to Devils Pulpit upgrade
St 96.4

Maclean to Iluka Road
St 82.0

Tyndale to Maclean
St 68.8

Glenugie upgrade to Tyndale
St 33.8

Glenugie upgrade
St 28.7

Halfway Creek to Glenugie upgrade
St 17.0

Woolgoolga to Halfway Creek
St 00.0

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2. Response to issues

2.1 Respondents

The NSW Department of Planning and Infrastructure received a total of 145 submissions in response to the exhibition of the environmental impact statement (EIS) between December 2012 and February 2013. The submissions were received from four councils, eight Government agencies and 133 individual submissions from members of the community and interest groups. Of the 145 submissions received, around 20 were received after the exhibition closed on 18 February 2013. These 20 submissions are also considered in this report. The last submission received was on 12 April 2013.

Interest groups that responded to the EIS exhibition included Bicycle NSW, Birdlife Southern NSW, Birdlife Northern NSW, Byron Bird Buddies, Clarence Environment Centre, Climate Change Australia, Clarence Valley Conservation Coalition Inc, Cumberland Bird Observers Club, Inc, Friends of the Koala Inc, Jali Local Aboriginal Land Council, NSW Sugar Milling Co-operative, North Coast Environment Council Inc, Red Rock Preservation Association, Wildlife Tourism Australia Inc, Wildlife SOS, Woodburn Chamber of Commerce and Valley Watch Inc.

Should the project be approved, further consultation would occur in detailed design and, subsequently, during the construction of the project. Acquisition of land from directly affected landholders would also require ongoing consultation between property owners and the Roads and Maritime Services (Roads and Maritime).

Submissions were individually numbered by the Department of Planning and Infrastructure (except Government agencies), and issued electronically to Roads and Maritime. Each respondent was notified via letter of their submission number. These submission numbers are used throughout this chapter to identify where an issue has been raised by the respondent.

A list of respondents, their submission number and the report section where issues are responded to is provided in Appendix A.

2.2 Overview of issues raised

All issues and comments raised during the exhibition of the EIS by the community, Government agencies and interest groups were recorded in a stakeholder database. Submissions received were categorised into issues and sub-issues that relate to the particular comment, concern or question (for example, Biodiversity, coastal emu).

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.

All submissions received have been assigned a submission number. Respondents have been notified of their submission numbers, separately, by letter. The issues raised and Roads and Maritime responses to these issues form the basis of this chapter. Where similar issues have been raised in different submissions, only one response has been provided.

A review of submissions indicated:

- Three per cent of submissions supported the project.
- Fifty two per cent of submissions objected to the project, mainly due to potential biodiversity impacts and route selection from the project sections between Glenugie to Maclean and from Broadwater to Coolgardie.
- Forty five per cent of submissions provided neutral comment on the project.

2.2.1 Government agencies and local councils

Ballina Shire Council

Ballina Shire Council's submissions raised issues related to biodiversity. Issues raised by the Council and where these issues are addressed are included in Table 2-1.

Table 2-1: Issues raised by Ballina Shire Council

| Issue | Where addressed |
|--------------|--|
| Biodiversity | Section 2.12.2, 2.12.6, 2.12.7, 2.12.8, 2.12.9 |

Clarence Valley Council

While the Clarence Valley Council submission supported the upgrading of the highway, local and regional access, biodiversity and hydrology and flooding were raised as issues. Issues raised by the Council and where these issues are addressed are included in Table 2-2.

Table 2-2: Issues raised by Clarence Valley Council

| Issue | Where addressed |
|-------------------------|------------------------|
| The project | Section 2.7.1, 2.7.3 |
| Consultation | Section 2.9.2 |
| Hydrology and flooding | Section 2.10.2 |
| Biodiversity | Section 2.12.4, 2.12.7 |
| Support for the project | Section 2.22.1 |

Coffs Harbour City Council

Coffs Harbour City Council raised issues regarding biodiversity, flooding and impacts to Council assets and social and economic impacts. Issues raised by the Council and where these issues are addressed are included in Table 2-3.

Table 2-3: Issues raised by Coffs Harbour City Council

| Issue | Where addressed |
|-------------------------|---------------------------------|
| The project | Section 2.7.1, 2.7.7, 2.7.8 |
| Hydrology and flooding | Section 2.10.4, 2.10.7, 2.10.11 |
| Biodiversity | Section 2.12.1, 2.12.2, 2.12.7 |
| Aboriginal heritage | Section 2.14.1 |
| Non-Aboriginal heritage | Section 2.15.1 |
| Traffic and transport | Section 2.16.1 |
| Land use and property | Section 2.18.4 |
| Social and economic | Section 2.19.1, 2.19.2 |

Environment Protection Authority / Office of Environment & Heritage

Two submissions were received from EPA / OEH. Issues raised included noise and vibration, Aboriginal heritage and biodiversity. Issues raised by the agencies and where these issues are addressed are included in Table 2-4.

Table 2-4: Issues raised by Environment Protection Authority / Office of Environment & Heritage

| Issue | Where addressed |
|-----------------------------|--|
| EIS content | Section 2.3.1 |
| Assessment process | Section 2.4.1 |
| The project | Section 2.7.5 |
| Construction of the project | Section 2.8.1 |
| Hydrology and flooding | Section 2.10.5 |
| Soils sediment and water | Section 2.11.4 |
| Biodiversity | Section 2.12.2, 2.12.3, 2.12.7, 2.12.8, 2.12.9 |
| Aboriginal heritage | Section 2.14.1 |
| Noise and vibration | Section 2.17.1 |

Forestry Corporation of NSW

The Forestry Corporation of NSW raised maintenance of forestry operations, and appropriate offsets as issues. Issues raised by the Corporation and where these issues are addressed are included in Table 2-5.

Table 2-5: Issues raised by Forestry Corporation of NSW

| Issue | Where addressed |
|-----------------------------|------------------------|
| Assessment process | Section 2.4.1 |
| Construction of the project | Section 2.8.2 |
| Biodiversity | Section 2.12.7 |
| Traffic and transport | Section 2.16.5 |
| Land use and property | Section 2.18.1, 2.18.2 |

Heritage Council of New South Wales

The Heritage Council provided suggested conditions of approval to mitigate impacts to heritage items. Issues raised by the Council and where these issues are addressed are included in Table 2-6.

Table 2-6: Issues raised by Heritage Council of New South Wales

| Issue | Where addressed |
|-------------------------|-----------------|
| Non-Aboriginal heritage | Section 2.15.1 |

NSW Department of Primary Industries (Agriculture, Fisheries and Marine Parks Authority)

Department of Primary Industries raised issues the response provides comments on agricultural land impacts, the proposed Remnant Land Use Strategy, hydrology and flooding, biodiversity, water quality, groundwater and recommended conditions of approval. Issues raised by the Department and where these issues are addressed are included in Table 2-7.

Table 2-7: Issues raised by NSW Department of Primary Industries (Agriculture, Fisheries and Marine Parks Authority)

| Issue | Where addressed |
|--------------------------|--|
| Clarifications | Section 2.3.1 |
| Consultation | Section 2.9 |
| Hydrology and flooding | Section 2.10.1, 2.10.8 |
| Soils sediment and water | Section 2.11.1, 2.11.3, 2.11.4 |
| Biodiversity | Section 2.12.2, 2.12.4, 2.12.8, 2.12.9 |
| Land use and property | Section 2.18.3, 2.18.4, 2.18.6 |

NSW Department of Trade & Investment Crown Lands

Issues raised were about the location of dedicated and combined fauna crossings, and project impacts on two Crown reserves required as flood refuges. Issues raised by the Department and where these issues are addressed are included in Table 2-8.

Table 2-8: Issues raised by NSW Department of Trade & Investment Crown Lands

| Issue | Where addressed |
|-----------------------------|------------------------|
| EIS content | Section 2.3.2 |
| Construction of the project | Section 2.7.7 |
| Consultation | Section 2.9 |
| Land use and property | Section 2.18.3, 2.18.4 |

NSW Department of Trade & Investment Resources and Energy

The Department of Trade & Investment Resources and Energy raised issues regarding the material requirements during construction, and extent of geological information in the EIS. Issues raised by the Department and where these issues are addressed are included in Table 2-9.

Table 2-9: Issues raised by NSW Department of Trade & Investment Resources and Energy

| Issue | Where addressed |
|---|-----------------|
| Assessment process | Section 2.4.1 |
| Alternatives considered and route development | Section 2.6.3 |
| Construction of the project | Section 2.8.2 |
| Soils sediment and water | Section 2.11.2 |
| Non-Aboriginal heritage | Section 2.15.1 |

| Issue | Where addressed |
|-----------------------|-----------------|
| Land use and property | Section 2.18.1 |

Richmond Valley Council

Two submissions were received from Richmond Valley Council. Issues were raised regarding Council owned land and transfer of local sections of the highway to the Council, impacts to New Italy Museum, sourcing extractive resources, and socio-economic impacts from the bypass of Woodburn and Broadwater. Issues raised by the Council and where these issues are addressed are included in Table 2-10.

Table 2-10: Issues raised by Richmond Valley Council

| Issue | Where addressed |
|--|---|
| The project | Section 2.7.1, 2.7.2, 2.7.3, 2.7.7, 2.7.8 |
| Construction of the project | Section 2.8.1, 2.8.2 |
| Soils sediment and water | Section 2.11.2 |
| Visual amenity, urban design and landscaping | Section 2.13.1, 2.13.2 |
| Non-Aboriginal heritage | Section 2.15.1 |
| Traffic and transport | Section 2.16.1 |
| Noise and vibration | Section 2.17.6 |
| Land use and property | Section 2.18.1, 2.18.6 |
| Social and economic | Section 2.19.2 |
| Support for the project | Section 2.22.1 |

Rous Water

Rous Water referred to the extensive consultation between Roads and Maritime and Rous Water, and identifies measures to maintain groundwater quality within the Woodburn Sands aquifer. Issues raised by the agency and where these issues are addressed are included in Table 2-11.

Table 2-11: Issues raised by Rous Water

| Issue | Where addressed |
|--------------------------|-----------------|
| EIS content | Section 2.3.2 |
| The project | Section 2.7.8 |
| Soils sediment and water | Section 2.11.3 |
| Noise and vibration | Section 2.17.6 |
| Land use and property | Section 2.18.2 |
| Support for the project | Section 2.22.1 |

NSW Office of Water

The Office of Water raised concerns about groundwater impacts, monitoring of surface and groundwater, and using best practice methods for restoration and rehabilitation within 40 metres of a waterway. Issues raised by the agency and where these issues are addressed are included in Table 2-12.

Table 2-12: Issues raised by NSW Office of Water

| Issue | Where addressed |
|------------------------------|--|
| Assessment process | Section 2.4.1 |
| Construction of the proposal | Section 2.8.2 |
| Soils sediment and water | Section 2.11.1, 2.11.2, 2.11.3, 2.11.4 |

2.2.2 Community

Community members raised a broad range of issues in their submissions, providing comment on the main aspects of the EIS and the project. Around 20 main issues were raised, which were split into sub-issues.

The main issues raised in the community submissions were:

- Requesting adoption of the “orange route”, and reconsideration of the preferred route from Glenugie to Maclean.
- Biodiversity impacts to flora and fauna including threatened species and the endangered population of coastal emu.
- Maintaining access to individual properties and businesses, including access to and from interchanges. Land use and property impacts, and the acquisition process.
- Hydrology and flooding impacts were also raised as a concern, particularly in light of the 2013 Australia Day floods.
- Construction and operational noise impacts, in particular working hours, noise levels during construction and adequacy of noise mitigation in areas not currently exposed to road traffic noise.

A number of letters and submissions were produced and issued via a template / form letter relating to the biodiversity impacts between Glenugie and Maclean. Forty-two submissions were received using two very similar form letters. A variation of the form letters was also used. In particular, the form letters raised issues opposing the preferred route between Glenugie and Maclean.

Three petitions were also received. One petition was received mainly from Clarence Valley residents with 518 signatures requesting the protection of the coastal emu, and the preservation of their habitat between Glenugie to Maclean. Two further petitions were received from Corindi Beach residents: one requesting low noise pavement for the adjacent section of highway (around 245 signatures), and the other requesting that Eggins Drive be raised to the same level as the Pacific Highway to ensure access during flood events (around 261 signatures).

2.3 EIS content

2.3.1 Clarifications

Submission number(s)

036, 095, 096, Trade & Investment (Crown Lands), Marine Parks Authority, Rous Water, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. Section 10 map does not show Bingal Creek tributaries or planned culverts. Old Bagotville Road has been incorrectly titled Montis Road.
2. Figure 5-114 and Figure 5-115 do not match the figure labelling. Figure 5-39 also identifies Tyndale 2 cane drain as Norleys Lane.
3. Marine Parks Authority note that issues raised in previous correspondence have been addressed in the current EIS.
4. In Chapter 17, Page 71, it states that Section 4 would be upgraded initially to arterial standard, and not motorway standard as indicated in Chapter 5.
5. The Roads Act 1993, in particular Section 175 of the Act, negates the requirement for approvals to be obtained under the *Crown Lands Act 1989*.
6. Rous Water has raised a number of nomenclature statements from the EIS documentation to be noted in future documentation/discussion.
7. Black Flying fox should not be included on page 10-160 as it is no longer listed as a vulnerable species under the TSC Act.
8. On page 10-8 and page 10-20 of the EIS, there are typographical errors.

Response

1. The respondent does not refer to a particular figure, however, it is assumed the figure being referred to is Figure 5-75 of the EIS. This figure is a representation of the project, and is not intended to show all waterways or drainage structures. Bingal Creek and its tributaries are shown in Figure 9-32 of the EIS and Appendix D of the Working paper – Water quality. The list of culverts proposed for the project has not been included in the EIS due to the high number proposed. However, bridge structures (including a viaduct to the north of Old Bagotville Road) have been identified on Figure 5-75.

Figure 5-75 has correctly labelled Montis Road and Old Bagotville Road.

2. Figure 5-114 and Figure 5-115 (Chapter 5 of the EIS) were incorrectly labelled. Figure 5.114 should have been titled 'Rest area and heavy vehicle checking station at Richmond River', while Figure 5.115 should have been titled 'Rest area at Pine Brush'.

Tyndale 2 cane drain (known as Lees Drain) was incorrectly labelled as Norleys Lane in Figure 5-39 of the EIS (Chapter 5).

3. This comment is acknowledged. However, there was an error in management measure SSW30. This relates to temporary sedimentation basins used during construction in Section 1 of the project.

SSW43 should have read “Sizing of sedimentation basins that drain into the Solitary Islands Marine Park would be reviewed to consider the use of 90th percentile sedimentation basins.” This has been rectified in Chapter 5 of this report.

4. Table 17-7 incorrectly states that Section 4 would be upgraded to class A (arterial standard) initially. As stated in Chapter 5 of the EIS (Section 5.2.4), Section 4 would be directly upgraded to a full motorway standard, as the highway would be constructed away from the existing highway (which would form the service road).
5. It is acknowledged approvals under the *Crown Lands Act 1989* are not required for the project. The statement in Chapter 2 of the EIS stating that approval under the *Crown Lands Act 1989* is required is incorrect.
6. These statements are acknowledged. None of these would change the nature or outcomes of the EIS. These would be further considered in future documentation.
7. It is acknowledged that the Black Flying-fox is no longer listed as vulnerable under the TSC Act, and is correctly referenced as such in the Working paper - Biodiversity (Section 3.9.4).
8. Typographical errors are acknowledged.

2.4 Assessment process

2.4.1 Approvals, licenses and permits

Submission number(s)

Trade & Investment Resources and Energy, Forestry Corporation of NSW, NSW Office of Water, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. Section 117 Ministerial Directions regarding extractive industries must be taken into account in the approval process.
2. The Wells Crossing Flora Reserve is set apart under s16 of the *Forestry Act 2012*, and can only be revoked by Act of Parliament or otherwise in accordance with the *Forestry Act 2012*.
3. Relevant licences for water interception, water supply and creek diversions need to be obtained by Roads and Maritime under the *Water Act 1912* or the *Water Management Act 2000*, and meet any relevant access rules under the applicable water sharing plans.
4. An Environmental Protection License (EPL) will be required for the project.

Response

1. This statement is incorrect as Section 117 Ministerial Directions do not apply to a State significant (Part 5.1 of the EP&A Act) project.
2. The need to revoke part of the Wells Crossing Flora Reserve under the *Forestry Act 2012* is acknowledged and detailed in the Working paper - Land use and property (refer to Section 2.1.1).
3. Roads and Maritime would obtain any necessary licences or approvals, including satisfying any water sharing plans water access rules. However, it is noted that Roads and Maritime is not required to gain approval under Part 2 of the *Water Act 1912* for creek diversions.
4. Roads and Maritime acknowledges that the project would require an environmental protection licence under the *Protection of the Environment Operations Act 1997*.

2.5 Need and justification

2.5.1 Ecological sustainability, cost and value for money

Submission number(s)

010, 017, 036, 037, 051, 085, 093, 121, 125.

Issue description

1. Concerned about the extent of environmental damage (including the clearing of a 200 metre corridor and the potential impacts to water quality and aquatic environments) that would occur and question whether the proposal can state that it is managed in an ecologically sustainable way.
2. Ecological Sustainable Development (ESD) was not considered in the EIS.
3. Roads and Maritime has not taken a long term view of the transport needs and has not accounted for lessening oil reserves and the need to reduce greenhouse gases. As such the project does not provide value for money and cannot therefore be justified.
4. The environmental, social and economic costs of the project cannot be justified considering this will be the most expensive part of the highway upgrade with 48 kilometres of new road. In particular, the environment cost of the project between Glenugie and Maclean is unacceptable.
5. The new route between Glenugie and Maclean would not provide value for money as it would be expensive, have large environmental impacts and only achieve several minutes reduced travel time for 30 per cent of existing traffic, largely comprising the heavy transport industry.
6. For better value for money, the project should be designed at a higher flood immunity across Richmond River floodplain

Response

1. The construction of major transport infrastructure of the scale and nature of the project cannot be undertaken without environmental impacts. However, the principles of ecologically sustainable development (precautionary principle, inter-generational equity, conservation of biological diversity and ecological integrity and improved valuation, pricing and incentive mechanisms) have been considered throughout the process of developing the project and assessing its potential impacts and benefits. Potential adverse effects and environmental issues have been afforded equal importance along with economic and engineering issues.

Extensive investigations have been undertaken throughout the development of the project with regard to route selection and concept design to avoid, minimise and mitigate potential environmental impacts.

These investigations and community feedback have provided an understanding of the environmental constraints within the study area. The suitability of these route options were assessed on a broad range of social, environmental and design factors. These factors were further considered through the EIS, and the project has been refined to avoid or minimise any potential impacts, where practicable. In particular, the clearing of vegetation has been minimised where possible in the design, including changing the alignment as well as during the identification of a construction boundary.

This construction boundary (as described in Chapter 6 of the EIS), identifies the clearing footprint of the project. In locations where the upgrade would be limited to new northbound and southbound

carriageways, the project would be up to 150 metres wide. Where interchanges or rest areas are proposed, the project clearing boundary would be about 200 to 400 metres wide. In many instances it would not be necessary to clear that entire area for the construction of the project. Chapter 10 (Biodiversity) of the EIS identifies there would be further opportunities to avoid and minimise clearing of native vegetation and fauna habitat during the detailed design stage (refer to management measure B13 in Chapter 5 of this report).

2. The objectives of the Pacific Highway Upgrade Program require that the principles of ecologically sustainable development be considered in project development (refer to Section 4.2.2 and Section 21.2.7 of the EIS). The project has incorporated these principles, in particular considering biological diversity and ecological integrity in decision making, to the extent possible. The principles of ESD have also been considered in the assessment of the project's benefits and potential adverse effects. Throughout the project, environmental issues have been afforded equal importance along with economic and engineering issues.

ESD has been addressed in the EIS in Chapter 4 (Alternatives considered), Chapter 6 (Construction) and Chapter 21 (Justification and conclusion).

3. The project would balance the needs of road users (eg reduced travel times and increased road safety), financial constraints (ie a design that achieves value for money) and the need to minimise, as far as possible, the impacts on the environment (including the social and natural environment).

The project would also result in a decrease in greenhouse gas emissions. A quantitative assessment of greenhouse gas emissions from the project showed by 2026, there would be a reduction of 15,000 tonnes of carbon dioxide per year. This is compared with the emissions from the existing highway (refer to Section 18.1 of the EIS).

The project needs to be upgraded to cater for future traffic growth in the area in the long term. While Roads and Maritime is aware of the 'peak oil' / reduced oil reserves issues, with the development of biofuels and other forms of oil, it is not anticipated that this would result in a reduction in traffic numbers.

Rather, traffic along the Pacific Highway is forecast to grow by 42 per cent from 2012 to 2036. By 2036, an annual average daily traffic flow of around 14,000 vehicles are expected to use the Pacific Highway between Woolgoolga and Ballina. Currently, on average, a peak of around 9800 vehicles uses the existing Pacific Highway each day. The project has a strong justification for proceeding considering the significant transport efficiency and safety benefits it would provide. The project is a major and essential component of the Pacific Highway Upgrade Program and is consistent with the objectives of this program and of other state and federal infrastructure development policies (as detailed in Chapter 3 of the EIS).

4. The project has a strong justification for proceeding considering the significant transport efficiency and safety benefits it would provide, both intra-regionally and in achieving the overall Pacific Highway Upgrade Program. The project is a major and essential component of the Pacific Highway Upgrade Program and is consistent with the objectives of this program and of other state and federal infrastructure development policies (as detailed in Chapter 3 of the EIS). The reason for why the preferred route was selected, in particular the section between Glenugie and Maclean is described in Section 2.6.

Overall, the Woolgoolga to Ballina upgrade project would meet the project objectives including "provide the best outcomes, taking into account the balance of environmental, social and economic factors". The project would balance the needs of road users (reduced travel times and increased road safety), financial constraints (value for money) and the need to minimise, as far as possible, the impacts on the environment (including the social and natural environment).

5. The cost of the project is proportionate with the task of upgrading one of the most important infrastructure networks in Australia. The costs were considered during project development including Value Management workshops to assist in the route selection. The preferred option was not the most cheapest option considered nor the expensive.

The respondent identifies that 30 per cent of the traffic would use the upgraded highway between Glenugie and Maclean. This traffic split was identified during the Wells Crossing to Iluka Road project route selection process in 2004. An updated traffic assessment was undertaken for the EIS (Working paper – Traffic and transport (SKM, 2012)). This predicted the amount of traffic that would use the upgraded highway through Section 3 is around 57 per cent. This would reduce the volumes of traffic on the existing highway to around 43 per cent of current traffic. The difference in the traffic split numbers is due to updated modelling and more recent traffic counts (refer to response one in section 2.6.1 for further information). It would also improve amenity for residents and businesses in townships along the section, such as Ulmarra.

The project would meet the project objectives and provide benefits for all road users by reducing road crashes and injuries, reducing travel times by 25 minutes along the full length of the project, increasing freight efficiency, and improving accessibility.

The project does provide value for money by balancing the needs of the road users, the environment and functional constraints. The project would reduce travel times by increasing road capacity, bypassing slow-moving traffic within towns, provide a shorter route, provide consistent travelling speeds, reduce risk of incidents delaying traffic and improve access during flooding. These improvements would benefit all users of the highway.

6. The project would result in a substantial improvement in the flood immunity of the Pacific Highway, which has a flood immunity of less than a five year ARI event in a number of locations. The project has been designed with a minimum flood-immunity of 20-year ARI flood event on the Clarence and Richmond River floodplains and 100-year ARI flood event elsewhere. The 20 year event is measured to the edge line of the road pavement and the highway would still be trafficable during these flood events, with no inundation of the travel lanes.

The project would still be operational for flooding events greater than the 20-year ARI with reduced capacity and nuisance flooding. For example on the lower Clarence River floodplain, due to the small difference between the 20 year ARI and 50 year ARI flood levels, the road embankment would not be overtopped in a 50 year ARI flood event. The Lower Richmond River floodplain only has a small difference in the 20 year ARI and the 100 year ARI flood levels. For most parts of this section, the road embankment would not be overtopped in the 100 year ARI flood event. This would improve the ability of people to evacuate when flooding occurs. It would also reduce the risk of flooding related delays on the highway, improve access for local communities and travellers during flood events and improve the reliability of highway journeys.

Constructing the whole highway to a flood immunity of a 100-year ARI flood event is not cost effective and immunity to a 20-year ARI flood event was considered the optimal immunity for the upgrade in major areas of floodplain, as the solution for avoiding all impacts would result in a cost-prohibitive design. However it should be noted that this is the minimal flood immunity through these flood plains and some areas would provide a greater level of immunity. Hydrology and flooding issues are further addressed in Section 2.10 and in Working paper – Hydrology and flooding (SKM, 2012).

2.5.2 Road safety and traffic volumes

Submission number(s)

051, 093, 106, 126.

Issue description

1. The accident rate at Pimlico Road, Coolgardie is much lower than suggested by Roads and Maritime. For this reason, there is not as great a need to upgrade the highway.
2. The project is being constructed for the heavy transport industry to reduce fatalities. B-doubles were introduced on the highway to create a road safety problem to justify the upgrade of the highway.
3. There is talk of introducing B-triples on the highway- but there is no mention in the EIS.
4. The highway upgrade isn't needed as between Woolgoolga and Ballina, there is the lowest traffic volumes of any highway section.
5. Road safety would be better addressed through the construction of a freight rail network that would remove heavy vehicles.

Response

1. The crash data along Section 11 of the project between Coolgardie Road to the Ballina Bypass indicates that 24 crashes were recorded between 2006 and 2010 (one fatal, seven injury, 16 non-casualty tow away). This is equivalent to a crash rate of an average annual 9.2 crashes per 100 million vehicle kilometres travelled. While this crash rate is within the target crash rate for the highway upgrade (15 crashes per 100 million vehicle kilometres travelled), without the project, road crashes on the existing highway would increase through traffic growth and deteriorating road conditions. This section of highway also has a low flood immunity level, which is inconsistent with the objectives of the Pacific Highway Upgrade Program. The existing Pacific Highway requires upgrading to meet the program objectives of reducing travel delays and improved flood immunity.

The upgrading of the Pacific Highway to dual carriageway has brought major improvements to road conditions, road safety, travel times and transport efficiency along the highway. Therefore, to fully realise the benefits, the complete section of highway between Woolgoolga and Ballina needs to be upgraded.

2. The need to duplicate the existing highway was a recommendation made by the NSW coroner following the bus crashes at Kempsey and Grafton in the late 1980s, well before the introduction of B-doubles onto the highway. It is acknowledged that heavy vehicles are involved in around 38 per cent of crashes along the existing Pacific Highway but are only around 25 per cent of total highway traffic. B-doubles were introduced on the highway to improve efficiency of freight

movement. While the highway is being upgraded to improve road safety (targeting a crash rate of 15 crashes per 100 million vehicle kilometres travelled), there are other reasons why the highway is being upgraded. The Pacific Highway Upgrade Program seeks to provide and has started providing major improvements to road conditions, road safety, travel times and transport efficiency along the highway along the east coast of Australia. It is also improving connections between regional areas forecast to experience significant population growth and major tourist destinations. The benefits of the program would not be fully realised until the entire program, including the section between Woolgoolga and Ballina, is completed.

3. While Roads and Maritime is not currently considering designation of the Pacific Highway as a B-triple route, the government and road freight industry are seeking improvements in transport efficiency over the network. Should this be considered in the future for part or all of the Pacific Highway, a decision would involve consultation with both industry and the community and assessment of the geometrics of highway built to earlier standards.
4. The project between Woolgoolga to Ballina is the final section to complete the Pacific Highway Upgrade Program. The project has been designed to meet the Pacific Highway Upgrade program objectives and to realise the overall benefits from the program.

The annual average daily traffic volume between Woolgoolga and Ballina is 9800 vehicles. Peaks of over 11,700 (2011 data) vehicles per day were recorded between Maclean to Iluka Road, Mororo. During holiday periods (Easter, Christmas and school holidays) there is an increase in traffic volumes of up to 40 per cent. This can interrupt traffic flow and result in minor traffic delays.

Traffic numbers are expected to increase by around 42 per cent from 2012 to 2036. By 2036, an annual average daily traffic volume of around 14,000 vehicles is expected between Woolgoolga and Ballina. Increasing the capacity of the highway is essential to deal with the increasing traffic volumes.

The upgrade of the highway would also improve travel times and road safety. Currently the highway between Woolgoolga to Ballina has a crash rate of 20.7 per 100 million kilometres travelled. Along the project, the Glenugie to Tyndale section had the highest number of crashes between 2005 and 2009 with 182 crashes. The project is designed to reduce the crash rate to 15 crashes per 100 million vehicle kilometres travelled (a 29 per cent decrease for the Glenugie to Tyndale section).

5. While rail does play an important role in meeting freight demand, it is important to note only a small proportion of heavy vehicle traffic on the Pacific Highway is exclusively Sydney- Brisbane traffic. A large volume of the traffic (ie around 78 per cent) between Woolgoolga and Ballina originated from or was destined for Grafton.

The Pacific Highway's importance as a freight and passenger route is increasing. From 1996 to 2002 there was a 28 per cent increase in traffic on the highway. In 2004, some 11.5 million tonnes of freight (excluding coal) was moved between Sydney and Brisbane (Ernst and Young, 2006), accounting for about one-third of total east coast inter-capital freight. The Bureau of Infrastructure, Transport and Regional Economics (BITRE) also estimated that freight travelling the full length of the corridor comprises 21 per cent of the non-bulk inter-capital freight and 16 per cent of all non-bulk freight carried on the National Land Transport Network corridors in mainland Australia (BITRE,

2006). It is estimated that about 76 per cent of these freight movements are undertaken by road, most using the Pacific Highway.

Upgrading the Pacific Highway would support the regional centres, cities and towns along its length by improving road conditions for local and regional traffic that use the highway. This cannot be achieved by rail alone. Therefore, even if the North Coast Railway was upgraded, the Pacific Highway would still need to be upgraded to meet the needs of the growing North Coast region.

2.5.3 Project objectives and justification

Submission number(s)

036, 037, 051, 093, 098, 120, 122.

Issue description

1. The highway upgrade objectives would not be achieved by the Woodburn to Ballina section of the project:
 - Reduced road crashes and incidents.
 - Reduced travel times.
 - Reduced freight transport costs.
 - Provide a route that involves the community and considers their interests.
 - Provide a route that supports economic development.
 - Provide best value for money.
 - Achieve a balance between the environmental, social and economic impacts and benefits.
2. The project will not be able to mitigate all environmental impacts.

Response

1. The Woodburn to Ballina section (sections 8-11) of the project would meet the program objectives. In relation to each of the Pacific Highway upgrade objectives identified by the respondent the following is provided:
 - Upgrade of the existing highway may have had reduced head on crashes, through the implementation of a safety upgrade including using wire rope barriers as an interim safety measure. However, it would still result in conflicts between local and through traffic, particularly at local intersections and property accesses. Upgrading to dual carriageways would achieve further safety benefits by reducing the occurrence of head-on crashes, while better sight lines and controlled access points would result in fewer incidents as a result of local traffic trying to merge with fast flowing highway traffic. The project has been designed to meet current Roads and Maritime safety standards, with the motorway standard road being suitable for 110 kilometres per hour. An increase in traffic incidents is not anticipated due to the improved alignment, lane widths and sight lines. The project would provide greater safety benefits than the upgrade of the existing highway.
 - It is acknowledged the project is two kilometres longer between Woodburn and Ballina. The existing highway has a speed limit of up to 100 kilometres per hour, but reduces to 50 kilometres per hour through urban areas (such as Woodburn and Broadwater), and 40 kilometres per hour through school zones (such as through Woodburn). For Woodburn to

Ballina, travel times would reduce by around six minutes from the existing highway (refer to Woodburn to Ballina Preferred Route Report, Roads and Maritime, 2005).

- Freight efficiency and costs would be improved, through the reduction in travel times and the provision of a better quality highway.
 - The route selection process considered community feedback, including a community identified route option. Route options were assessed against a range of factors including environment, heritage, functional, social and noise, and business and economic. The preferred route was chosen through community feedback; a Value Management workshop which was attended by a wide range of stakeholders including community representatives; and further technical investigations (refer to Chapter 4 of the EIS and Section 2.6.2 for further details).
 - The project includes 10 interchanges (three interchanges between Woodburn and Ballina). The interchanges provide access onto and off the highway to urban areas including Woodburn, Broadwater and Wardell. As detailed above, the project would improve travel times and reduce vehicle kilometres travelled. Reductions in travel time and kilometres, and improved road gradients, would lead to reduced fuel consumption.
 - The project provides a balance between environmental, social and economic impacts and benefits. The route sought to minimise social and environmental impacts while providing the best functionality and economic benefits. These were assessed at the Value Management workshop and at the route selection workshop. It is acknowledged that the project would have some adverse biodiversity impacts, however the project alignment between Broadwater and Wardell has sought to minimise the impacts, by passing through cleared areas where possible including traversing around Wardell Heath and Jali land.
 - Management measures including the provision of a Connectivity Strategy and an Offset Strategy would mitigate the impacts of the project on the biodiversity in the area. The alignment would result in improved amenity through Woodburn and Broadwater as the highway would be moved away from the urban centres. Once the project is operational, it would improve productivity due to better mobility and connectivity and a reduction in costs from traffic and congestion (including pollution, noise and vibration).
2. Extensive investigations have been undertaken throughout the development of the project with regard to route selection and concept design to avoid, minimise and mitigate potential environmental impacts. These investigations and community feedback have provided an understanding of the environmental constraints within the study area. The suitability of these route options were assessed on a broad range of social, environmental and design factors. These factors were further considered through the EIS and identification of appropriate environmental management measures to be incorporated into the project (refer to chapter 19 of the EIS).

To lessen impact on biodiversity, the project incorporates a biodiversity management framework that includes a monitoring strategy, a connectivity strategy, and a strategy to offset residual impacts on biodiversity. The offset strategy would be further developed in consultation with the NSW Office of Environment and Heritage, Department of Primary Industries (Fisheries) and the Commonwealth Department of Environment.

The monitoring strategy would monitor specific species and fauna crossing structures to determine their effectiveness and whether additional measures are required to maintain fauna connectivity. The connectivity strategy includes provision for dedicated and combined fauna underpass and overpass structures, outlining design principles for these structures, as well as fauna fencing. Structures are proposed to help wildlife cross above or below the project. In particular, these include four dedicated land bridges, three vegetated widened medians for arboreal mammal crossings and number of dedicated fauna crossings.

The offset strategy would include measures such as provision of compensatory lands to preserve lands from development and offsetting the same type of vegetation and habitat to be removed from the project. The offset strategy would be further developed in consultation with the NSW Office of Environment and Heritage, Department of Primary Industries (Fisheries) and the Commonwealth Department of Environment.

Management measures for soil erosion and control, specifically the protection of water quality (refer to management measures SW59-SW61 in Chapter 5 of this report) through grassed swales and gross pollutant traps have been recommended. Additional management measures have also been identified to avoid or minimise other environmental issues (refer to Chapter 5 of this report).

2.6 Alternatives considered and route development

2.6.1 Route option chosen between Glenugie to Maclean

Submission number(s)

002, 004, 009, 010, 011, 012, 013, 014, 015, 016, 017, 019, 020, 022, 023, 024, 025, 027, 028, 033, 034, 035, 037, 038, 044, 046, 047, 049, 051, 052, 054, 055, 057, 058, 059, 063, 064, 067, 070, 075, 076, 078, 081, 083, 085, 088, 091, 092, 093, 098, 102, 105, 130, 132.

Issue description

1. Challenged the route alignment between Glenugie and Maclean particularly in relation to the environmental impacts, the cost of the preferred route (including floodplain structures with reference to Kempsey Bridge) and the predicted level of traffic likely to use the upgrade in this section. The orange route should have been chosen.
2. Questioned why the highway isn't being upgraded along the Summerland Way to Casino which, if continued through Kyogle, Woodenbong, and Beaudesert, is by far and away the shortest route to Brisbane?
3. The route between Glenugie and Maclean should be located further east to keep the route shorter.

Response

1. A brief overview of the route selection process for the Wells Crossing to Iluka Road project is identified in the following sections. Responses to specific arguments put forward by respondents regarding why the orange route should have been chosen over the current preferred route are also provided below.

Route selection process

A comprehensive route options and selection process was undertaken to identify the preferred route through the Glenugie to Tyndale section. The upgraded highway route for the section from

Glenugie to Tyndale was developed as part of the Wells Crossing to Iluka Road project (incorporating current project sections 3, 4 and 5).

Investigations into the Wells Crossing to Iluka Road project commenced in November 2004 (refer to Section 4.2.4 of the EIS). Investigations were undertaken throughout the development of the project with regard to route selection and concept design to avoid, minimise and mitigate potential environmental impacts. The preferred route was assessed against a range of natural environment, functional and social and local economic criteria.

Possible alignments were identified through preliminary investigations within the study area, mapping of constraints and through the application of the Pacific Highway Upgrade program design standards. These alignments were reviewed in performance against social, environmental and design criteria. Options suggested by the community were also considered. Between Wells Crossing and Harwood Bridge, four short listed route options were identified from the long list of possible route corridors. These were known as the orange (A), purple (B), green (C) and red (D) options (refer to Figure 2-1).

The orange option mainly follows the existing highway with an easterly deviation between Bom Bom State Forest and Swan Creek localities and local bypasses of Grafton, Ulmarra and Tyndale.

The purple option follows the existing highway from Wells Crossing to the northern end of the Glenugie State Forest. It then deviates east, passing to the north of Pillar Valley and to the west of the Pine Brush State Forest, before re-joining the existing highway south of Maclean.

The green option deviates from the existing highway just north of Wells Crossing. It then follows a northerly alignment along the eastern side of the study area to the Clarence River at Harwood Bridge. This option passes through the Pine Brush State Forest and an ecologically significant coastal wetland.

The red option is the most eastern of the short listed options. It deviates from the existing highway just north of Wells Crossing before following a northerly alignment along the eastern side of the study area to the Clarence River at Harwood Bridge. This option passes to the east of Pillar Valley and the Pine Brush State Forest.

More details and comparison of the options including the preferred option are provided in Chapter 4 of the EIS. A comparative assessment of the environmental constraints of the route options of the previous development projects (including Wells Crossing to Iluka Road project) is provided in Appendix I of this report.

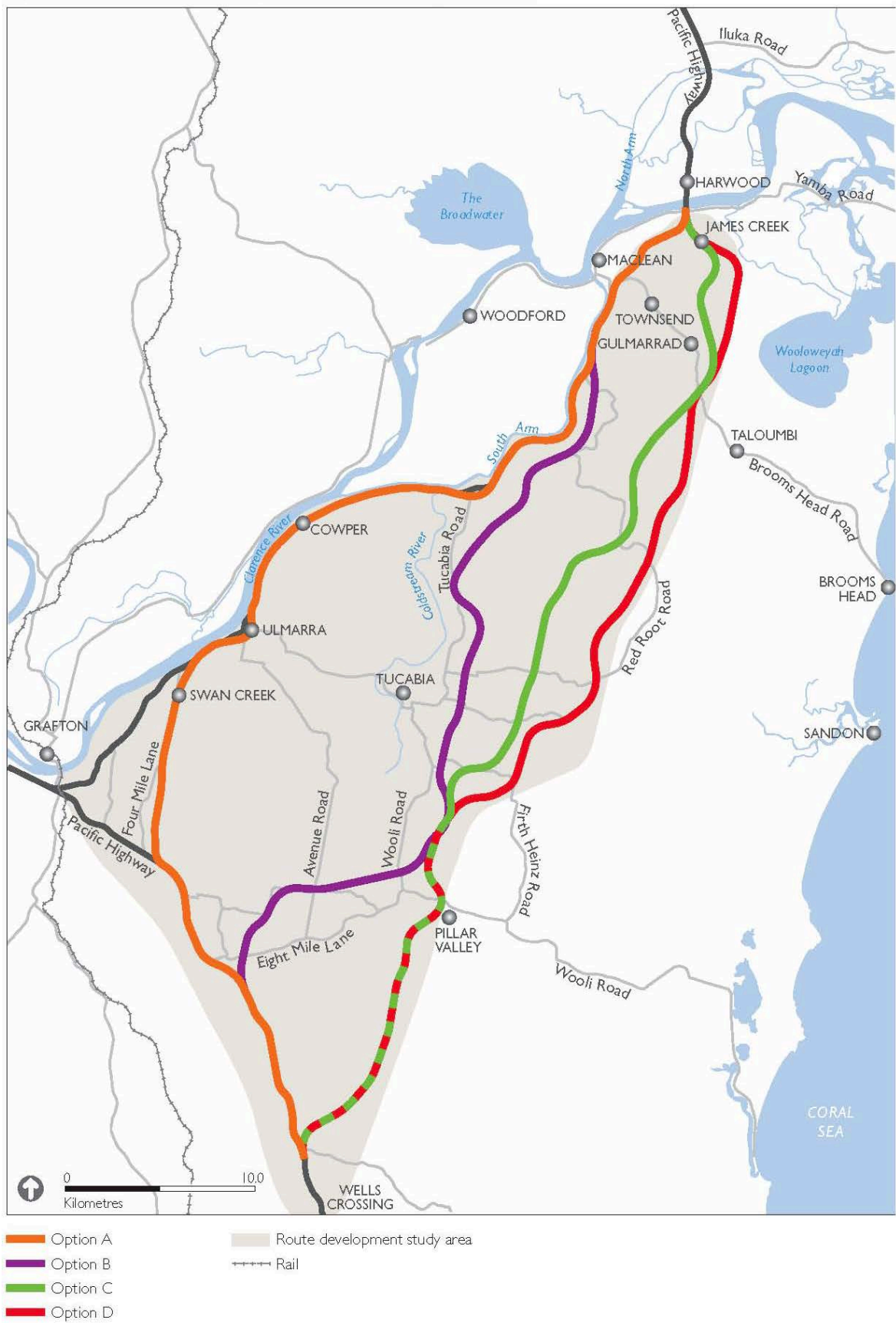


Figure 2-1: Wells Crossing to Iluka Road route options

Roads and Maritime then undertook a combination of desktop and field investigations on the four short listed routes. These route options were also placed on exhibition for community feedback. This feedback identified that there was no clear preference for one route option by the community. Biodiversity was one of the most frequently raised issues.

The Value Management workshop was held in March 2006 and had participants from community stakeholders; the project team and Roads and Maritime. Participants at the Value Management workshop reviewed the outcomes of the investigations and community feedback, and considered the options against agreed performance criteria developed as part of the workshop. The performance criteria were selected by consensus at the workshop based on what factors all participants felt were important in selecting a route. Other than the orange route, the alignments of the other routes were modified at the workshop.

No clear option was identified from this workshop, but the need for further work was recognised before a decision on the preferred route could be made. The workshop did note that modified green option appeared to perform best including strategic cost, on balance with the other options but further work was required to confirm the most appropriate alignment between Glenugie and Pillar Valley. If costs were excluded from the assessment, the modified green and orange options were closely ranked.

These further studies included:

- Further work to determine which alignment was the better option for the southern section.
- Confirmation of the assumptions, decisions, and recommendations made during the workshop.
- Consideration of environmental mitigation and compensation costs associated with each route and the feasibility of mitigation (including Emu impact mitigation, dedicated fauna crossings and fauna exclusion fencing). Also consider the social and economic impact management measures for each route.
- Investigation and consideration of the quarry issues raised (particularly with respect to the Modified Green Option).
- Consideration of the impact of the project on the long term supply of quarry products in the region.
- Exploration of existing highway improvement needs and their associated cost if an eastern option is moved forward as the preferred option.
- Consideration of a potential interchange at/near Tyndale on a Modified Purple Option as an alternative.
- Undertaking a thorough study of impacts on the coastal Emu of the proposed new highway and potential management measures should an eastern option move forward as the preferred option.

Further assessment was undertaken based on workshop recommendations and other studies undertaken. In addition to the list above, further specialist studies included ecological studies (EEC condition assessment, habitat values and movement corridors), heritage studies, geotechnical studies, flooding, noise and development of cost estimates.

Roads and Maritime then held a two-day route selection workshop and considered a range of factors to recommend a preferred option. These included:

- A review of the assumptions, criteria and weightings used in the Value Management workshop (attended by stakeholder and community members).

- Analysis of additional investigations requested at the Value Management Workshop.
- Review and analysis of issues raised by the community and consideration of implications to costs.
- Further assessment and comparison of route options by project team using the same general approach as the Value Management workshop.

The two day route selection workshop developed refined route options (refined purple and refined red options) which were then assessed against the orange option.

The modified green option and the modified red option (from the value management workshop) were very similar, however the refined green option developed at the route selection workshop closely followed the red option. As such, the refined red option was developed and progressed forward, rather than the refined green option.

The refined purple option was developed with an interchange at Tyndale, following the existing highway between Tyndale and Maclean.

As with the value management workshop, the orange option was not refined as it could not be further improved.

The two day route selection workshop found that:

- The orange option performed best in natural environment, but ranked poorly in social and local economics. The cost estimates prepared identified the cost as \$1,713 million (in 2006 dollars).
- The refined purple option performed the best in the functional criteria and ranked second for both social and local economics and natural environment. The cost estimate for the option was \$1288 million (in 2006 dollars). This cost estimate included \$17 million for environmental mitigation.
- The refined red option performed the best in social and local economics, but ranked last in natural environment criteria. The cost estimate for this option was \$1130 million (in 2006 dollars). This included \$24 million for environmental mitigation.

The results of this workshop were used along with other investigations to assist Roads and Maritime in determining the preferred route.

The preferred route

The refined purple option performed best of all options in the functionality criteria due to the addition of other interchanges at Tyndale and Glenugie. The lower performance of the purple option during the Value Management workshop was as there were only two interchanges at Bald Knob Tick Gate Road and south of Harwood bridge. Additional traffic assessment undertaken identified that the refined purple option would attract the majority of traffic between Tyndale and Harwood bridge and a proportion of local and regional traffic between Glenugie and Tyndale. It would achieve the balance of meeting the needs of through traffic by reducing time and distance (around 31.9 kilometres), while attracting local and regional traffic. It would provide benefits to a greater proportion of road users than previously thought.

In comparison, while the orange option would attract the majority of local, regional and through traffic, it would provide fewer benefits to road users due to its longer length (37.6 kilometres). The refined red option would only attract through traffic, with local and regional traffic using the existing highway. Of the refined option, refined purple is the shortest and result in the greatest travel time savings.

The inclusion of the interchanges at Tyndale and Glenugie, improved the performance of the refined purple option on local economy and businesses. This would enable relatively direct access to Grafton and enable access via the existing highway to towns such as Ulmarra. However, the refined purple option would impact on sugar cane farming north of Tyndale and require acquisition of houses along this section.

The refined red option performed best for minimal potential for noise impacts, acquisition of houses and impacts to agricultural land. However, it would result in larger amenity changes to residents in remote areas of the study area that are not subject to impacts from large road infrastructure. It would divert through traffic a large distance from Grafton and would have a greater adverse impact on the local economy.

The orange option would have the greatest potential for social impacts due to the number of houses requiring acquisition, the potential for impacts on agricultural land and the number of people predicted to experience noise impacts. The orange option would also result in the risk of substantial flooding impacts compared to the refined purple and refined red option, which both avoid crossing the Coldstream basin floodplain. The risk of flooding impacts and potential consequences of changes to flooding in rural communities and towns such as Grafton was a significant consideration in the lower ranking awarded to the orange option for social and local economic criteria.

There was a greater differentiation between the options for the natural environment criteria. The orange option had the least potential for impacts on highly sensitive ecological features of the study area as it largely avoids areas of high value habitat, endangered ecological communities and the fauna corridors. It performed best against the natural environment criteria. The refined purple option mostly avoids the areas of greatest ecological value in the study area. It would impact on some areas of high ecological value including crossing Coldstream wetlands and passing through high value habitat south of Tyndale. But it would avoid many areas of greatest ecological value in the east of the study area. The refined red option would have a very high level of impact on the natural environment, fragmenting large areas of high value habitat, severing fauna corridors and impacting on a large area of habitat of the coastal emu sub-population. It would also impact on areas of relatively high quality TEC in the east of the study area.

On balance, at the route selection workshop, the option that best met the objectives of the project was the refined purple option, combined with a package of measures to improve the safety of the existing highway. This option was assessed to perform the best because it avoids key risk areas in terms of both ecology and flooding and balances outcomes in relation to the functional, social and local economic and environmental criteria (Wells Crossing to Iluka Road Preferred Route Report, SKM, 2006). The refined purple option was selected as the preferred route as it:

- Achieves the best balance across a range of issues in relation to the objectives of the Pacific Highway Upgrade Program.
- Provides for staging opportunities including improvements to the existing highway.
- Provides a safer transport corridor and provides for good transport efficiency.
- Supports regional economic development by providing good access to Grafton, Grafton Airport, Maclean, Yamba and the villages of Tyndale and Harwood.
- Uses part of the existing highway corridor, north of Bald Knob Road, and north of Harwood.
- Provides local access with interchanges at Glenugie, Tyndale, Yamba Road and Iluka Road.

- Minimises impact in high risk flood areas through Swan Creek, Ulmarra and Cowper.
- Minimises the acquisition of houses.
- Provides geotechnical advantages by avoiding areas of soft soils and acid sulphate soils across the Coldstream floodplain.
- Retains many areas important to local farmers as flood refuges for livestock.
- Minimises the impact on high value habitat areas.
- Retains important wildlife corridors, with bridge structures providing access to the Coldstream basin.
- Has a minimal impact on Glenugie, Pine Brush and Bom Bom state forests.
- Retains wetlands and conditions that are important to aquatic species, and other plant and animal species.
- Avoids sensitive areas of known Aboriginal and non-Aboriginal (historic) heritage.

After the release of the Wells Crossing to Iluka Road Concept Design Report (RTA, 2009), the sugarcane industry expressed concerns regarding the impact of the preferred route between Tyndale and Maclean on high-yielding cane land. Roads and Maritime worked with local cane growers and affected landowners and developed an alternative alignment to the east of the existing Pacific Highway just north of Tyndale and reconnect with the existing highway near Maclean. In August 2011, the proposed alignment was adopted as the preferred route between Tyndale and Maclean because this route alignment would:

- Impact fewer residences.
- Minimise property severance and impact to farm operations.
- Have a lesser impact on higher quality cane land.
- Provide functional benefits including:
 - Being safer to construct (no construction under traffic).
 - Present fewer sub-surface construction risks (eg settlement).
 - Better cut to fill balance allowing material to be sourced primarily from within the project boundary.
 - Better long-term bank stability.
 - Enable early treatment of areas of soft soils.
- Allow construction as a motorway standard of highway immediately on opening, delivering safety, traffic and transport, and economic benefits.

The revised preferred route is shown in Figure 2-2.

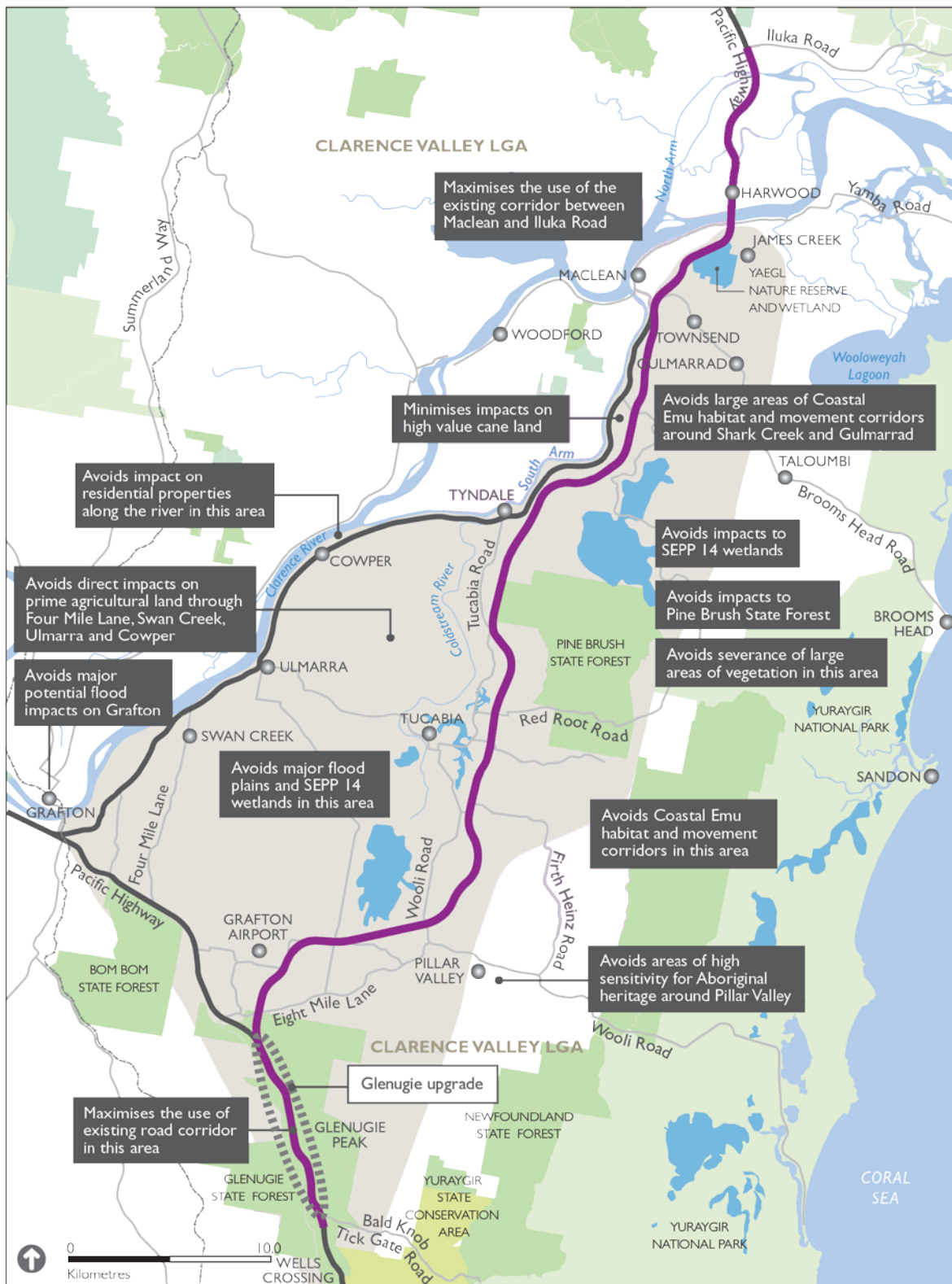


Figure 2-2: Wells Crossing to Iluka Road preferred route

Flooding between South Grafton and Tyndale

The orange route would be located within the Clarence River floodplain for 38 kilometres of its length and require very costly bridging structures. Even so, hydrology modelling at that time indicated there would still be an increase in flood levels inside the South Grafton levee of around 60 millimetres.

In addition, to meet a flood level objective of no greater increase than 50 millimetres, about 20 - 25 floodway bridge structures would be required, some up to hundreds of metres long, as well as ten bridges over creeks out of the floodplain. Numerous culverts would also be required.

Submissions also identified that the Clarence River floodplain could be crossed with a bridge structure similar to that constructed to bridge across the Macleay River (on the Kempsey Bypass, which is now open to traffic). The crossing of the Macleay River floodplain downstream of Kempsey is a very different scenario to that of the Clarence River. This is not a feasible solution for this project as the Macleay River bridge structure is around 3.2 kilometres long, while the orange option needs to cross around 38 kilometres of floodplain (23 kilometres across the Coldstream River floodplain).

Cost of the route

As outlined in Section 4.2 of the EIS, an environmental cost benefit analysis was also undertaken during the preferred route corridor selection process. The preferred option was estimated as less expensive to construct than the orange option. A review of costs was undertaken and identified that the project would cost \$1032 million in 2012 dollars compared to the orange route which would cost \$1588 million in 2012 dollars. The orange option would cost \$556 million (in 2012 dollars) more than the project. The project cost was based on the current project section 3, which is around 1.5 kilometres longer than the start and end points of the orange route (and the refined purple option). Overall, the project (purple route) is six kilometres shorter than the orange route.

This high cost for the orange option was in part due to the high embankments and bridges required across the floodplains (around 40 per cent of the cost for the alignment).

Unjustifiable based on traffic volumes and travel time savings

While the orange route would attract up to 95 per cent of local, regional and through traffic, it would provide less benefits for through traffic because it was about six kilometres longer than other options (with a travel time saving of only nine minutes from Wells Crossing to Harwood Bridge).

The figure of only 30 per cent of traffic that would likely use the upgrade was based on preliminary traffic estimates at the route selection study. More comprehensive modelling with improved data input (including more recent traffic counts) was undertaken for the traffic and transport assessment in the EIS. The modelling incorporated the latest design including Tyndale interchange, which was not included in the traffic modelling of the route selection study. The modelling predicted around 57 per cent of existing traffic would use the upgraded highway, with 43 per cent of traffic remaining on the existing highway. Of this 57 per cent of traffic on the upgraded highway, 20 per cent would be heavy vehicles, with only four per cent remaining on the existing highway. The traffic modelling also shows a trend where the proportion of the corridor traffic using the new highway route has increased over time. This is consistent with the view that highway traffic is growing at a faster rate than local traffic. This is expected to continue over time.

Improvements through the upgrade would result in a decrease in travel time of 12 minutes between Wells Crossing to Harwood Bridge (refer to Wells Crossing to Iluka Road upgrade Traffic and transport working paper, SKM, 2006).

Biodiversity impacts of the preferred route not comparable with the orange option

The principles of ecologically sustainable development (precautionary principle, inter-generational equity, conservation of biological diversity and ecological integrity and improved valuation, pricing and incentive mechanisms) have been considered throughout the process of developing the project and assessing its benefits and potential adverse effects. Throughout this process, environmental issues have been afforded equal importance along with economic and engineering issues.

Roads and Maritime has acknowledged that the route between Glenugie and Tyndale would result in significant biodiversity impacts. Biodiversity impacts as a result of the project are discussed in Chapter 10 of the EIS (of particular concern to this section are impacts to the Coastal emu and *Angophora robur*). The biodiversity assessment also provided a cumulative impact considering impacts from other development and the overall Pacific Highway Upgrade Program (refer to Section 4.5 in the Working paper – Biodiversity).

Measures to mitigate the impacts on biodiversity have been detailed in Chapter 10 of the EIS and includes a biodiversity management framework that includes a monitoring strategy, a connectivity strategy, and a strategy to offset residual impacts on biodiversity. The offset strategy would be further developed in consultation with the NSW Office of Environment and Heritage, Department of Primary Industries (Fisheries), and the Commonwealth Department of Environment.

2. During community feedback through the project development stage, an alternative alignment was presented by a number of community members. This alternative included an inland highway route following the alignment of the Summerland Way between Wells Crossing and Casino. This alternative would be mostly through NSW State forests.

The then Roads and Traffic Authority undertook an analysis of this alternative (RTA, 2006) and found it would not be a viable alternative to upgrading the Pacific Highway because:

- It would not take a large volume of traffic off the Pacific Highway, with less than 25 per cent of Pacific Highway traffic estimated to be attracted to the inland route.
- Given the high volume of traffic remaining on the Pacific Highway, the highway would still require upgrading and ongoing investment to correct deficiencies, improve road safety, address community amenity issues and meet future traffic demands.
- The cost of the route (estimated at \$4.0–4.2 billion in 2006 dollars) would be greater than the cost of the Pacific Highway Upgrade Program (\$3.0–3.2 billion in 2006 dollars) and would not be justified by the predicted traffic use. In addition, it would have to be completed in one stage, diverting funding and delaying required upgrades on the Pacific Highway.
- This alternative would still introduce noise and visual impacts to communities that are not currently exposed to high traffic levels.

The technical study reaffirmed previous investigations undertaken by Roads and Maritime in 1992 on the route. The studies found that building an inland road will not stop the coastal road being

used, nor will it obviate the need for the existing Pacific Highway to be upgraded. There will always be demand for a coastal route from the growing local population, the freight industry and tourist traffic.

3. While the eastern options (being the “green” and “red” options) were shorter than the existing highway, they were not selected due to the potential for adverse biodiversity impacts.

The “red” option was not selected as it would substantially fragment high value habitat areas, impact on areas of high quality endangered ecological communities, involve a greater area of clearing of remnant bushland and would present a much higher risk of restricting access to the important wetland habitats of the floodplain and the habitat of the coastal emu sub-population.

The “green” option also was not selected due to ecological impacts including impacts on the Shark Creek SEPP 14 wetland, impacts to high value habitat and areas of endangered ecological communities. These options did not perform well against the bottom line of natural environment, function and social and local economic criteria.

2.6.2 Woodburn to Ballina route options

Submission number(s)

006, 028, 036, 049, 072, 078, 082, 088, 093, 123, 125, 131.

Issue description

1. What option for the Wardell Road interchange was selected (Option A, B or C)?
2. The preferred route between Broadwater and Coolgardie should not have been selected due to the biodiversity impacts. Submissions identified that the upgrade should follow the existing highway. Other alternative alignments suggested included the previously identified Flood Free Route or a new direct alignment provided as part of a submission.

Response

1. An interchange has not been located at Wardell Road as part of the project. The interchange at Wardell would be located at the northern end of Section 10 of the project at Coolgardie Road (near station 157.5). This interchange would be a full diamond interchange (north-facing and south-facing ramps) and would provide access to the interchange and connections to Coolgardie Road and the township of Wardell. The existing highway north and south of the interchange at Coolgardie Road would be maintained as the service road to provide an alternative local access to the highway. North of Whytes Lane, Pimlico Road would provide alternate access into Ballina.
2. A brief overview of the route selection process and identification of the preferred route for the Woodburn to Ballina project is identified in the following sections. Responses to specific arguments put forward by respondents regarding why the preferred route should not have been selected are provided below.

Route selection process

A comprehensive route options and selection process was undertaken to identify the preferred route between Broadwater and Coolgardie. This section was developed as part of the Woodburn to Ballina route project (incorporating current project sections 8, 9, 10 and 11). Route options identified between Woodburn and Ballina were divided into three sections (Section 1, between

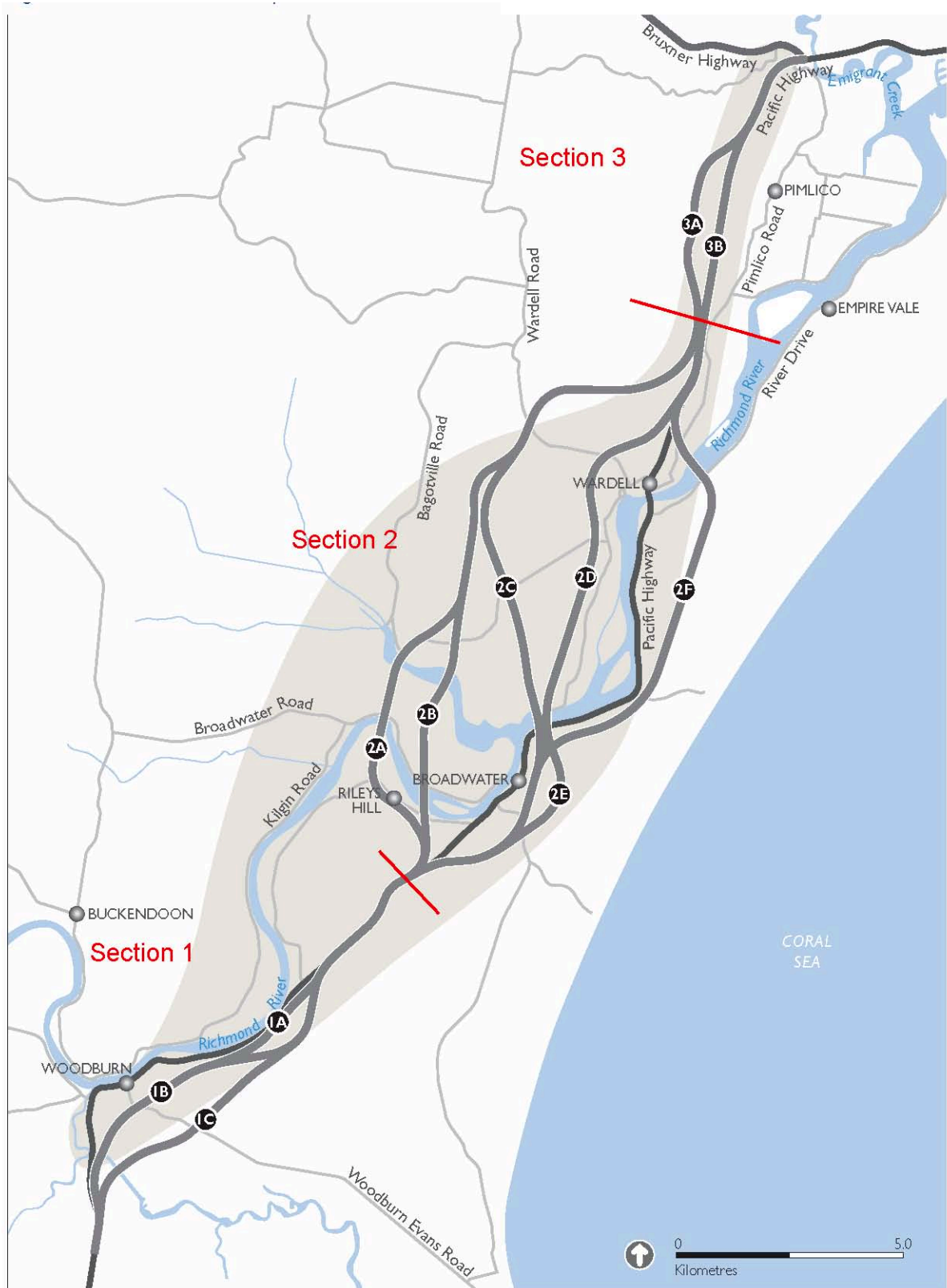
Tuckombil Canal and south of Broadwater; Section 2, between south of Broadwater to north of Wardell; Section 3, between north of Wardell and Ballina bypass).

A range of short listed route options was then identified for each of these three sections (refer to Section 4.2.6 and Figure 2-3 below). The shortlisted route options were put on public display and comments invited from the community. A value management workshop was held in July 2005, to analyse each of the route options against the following five key criteria: environment, heritage, functional, social and noise, and business and economic. The route options were analysed and a number of key issues raised that would need to be addressed in further phases of the project. The key recommendations from the workshop were:

- Support for option 1C as the preferred route for section 1 (subject to further investigations to minimise biodiversity impacts).
- Support for option 3B as the preferred route for section 3 (subject to confirming road, the footprint and impact on sugarcane land).
- For section 2, options 2A and 2B not to be considered further due to their environmental impacts. Options 2C, 2D, 2E and 2F considered to be possibly preferred options, subject to further reduction of impacts on biodiversity and Aboriginal heritage.
- Support for the community alternative route to be further analysed.

Following the value management workshop, further investigations were undertaken to attempt to minimise potential environmental, agricultural and Aboriginal heritage impacts. The study team then re-evaluated the route options against the project objectives. A final assessment of all route options was undertaken using guiding principles of risk reduction, cost, mitigability and intergenerational equity. Following these assessments, a preferred route was identified.

More details and comparison of the options including the preferred option are provided in Chapter 4 of the EIS. A comparative assessment of the environmental constraints of the route options of the previous development projects (including Woodburn to Ballina project) is provided in Appendix I of this report.



- 1B** Route option number
- Route development study area

Figure 2-3: Woodburn to Ballina route options

Preferred route

The preferred route for each section was selected for the following reasons:

Section 1

Option 1C (refined to avoid land subject to a Native Title claim and to reduce agricultural impacts) was selected as the preferred route. Option 1C was selected because it would:

- Have less noise and visual impact on existing and potential future residential areas of Woodburn.
- Provide a good visual and landscape design outcome.
- Have the lowest impact on agricultural lands.
- Have acceptable ecological impacts, for which mitigation can be provided.
- Have the lowest known and potential Aboriginal heritage impact.
- Be the cheapest option to construct, while providing the greatest road user benefits.
- Have the shortest length in flood-affected areas and require the shortest length of bridging for floodwater mitigation.

Section 2

A combination of options 2C and 2E (refined to avoid Jali Local Aboriginal Land Council land and reduce ecological impacts) was selected as the preferred route. Options 2C and 2E were selected because they would:

- Have fewer significant impacts than the other options.
- Have less noise and visual impact on Broadwater and Wardell than options 2D and 2F, resulting in better overall amenity.
- Avoid impact on SEPP 14 wetlands, and have less impact on high quality vegetation than options 2A, 2B and 2D.
- Have less ecological impacts than the displayed option 2C.
- Have less impact on agricultural land (particularly regionally significant agricultural land) than option 2F.
- Not require the acquisition of Jali land.
- Have the shortest length in flood-affected areas.

Section 3

Option 3B (unrefined) was selected as the preferred route. It was preferred to option 3A because it would:

- Have less noise and visual impacts on communities, resulting in better overall amenity (eg at Whytes Lane West).
- Be the cheaper option to construct, while providing the greatest road user benefits.
- Retain the highway on its existing route (using the existing asset which is suitable for upgrading).

Preferred route length and time savings

The project between Woodburn to Ballina is two kilometres longer than the existing highway. However, the increase in the highway length would not result in increased travel times. Through the separation of local and through traffic and higher speed limits that would be implemented from the upgrade to a class M highway, travel times would reduce by around 6 minutes from the existing highway (Woodburn to Ballina Preferred Route Report, Roads and Maritime, 2005).

Biodiversity impacts

The principles of ecologically sustainable development (precautionary principle, inter-generational equity, conservation of biological diversity and ecological integrity and improved valuation, pricing and incentive mechanisms) have been considered throughout the process of developing the project and assessing its benefits and potential adverse effects and environmental issues have been afforded equal importance along with economic and engineering issues.

The route selection and preferred route process has sought to minimise environmental impacts, with the route between Broadwater to Coolgardie traversing through cleared areas where possible. However, Roads and Maritime acknowledges that the route between Broadwater and Coolgardie would still have residual biodiversity impacts.

Although mentioned in a submission, the project does not impact on Bundjalung National Park, however would pass through the Broadwater National Park. The project crosses the national park on the same alignment as the existing Pacific Highway, to minimise any impacts.

Measures to mitigate residual biodiversity impacts are included in Chapter 10 of the EIS. These include a biodiversity management framework that includes a monitoring strategy, a connectivity strategy, and a strategy to offset residual impacts on biodiversity. The offset strategy would be further developed in consultation with the NSW Office of Environment and Heritage and the Commonwealth Department of Environment.

Between Broadwater National Park and Coolgardie, there are three land bridges proposed for dedicated fauna crossing and numerous combined fauna structures are proposed. The connectivity strategy (Appendix A of the Working paper – Biodiversity) also requires the placement of fauna exclusion fencing from station 142.8 to 145.1 and station 146.1 to 159.7 to avoid animals getting access into the road corridor.

Further details on measures to mitigate the biodiversity impacts of the project are included in responses in section 2.12 of this report. In particular impacts and management measures for koalas are identified in section 2.12.4.

Existing highway option

Submissions identified that the highway should be upgraded on the existing alignment. However, this was not possible as the existing highway:

- Is situated alongside the Richmond River on the Richmond River floodplain.
- Passes through the towns of Broadwater and Wardell in which the speed limit would have to be reduced.
- Has a number of residences fronting the highway which would result in many more property acquisitions, resulting in adverse social and amenity impacts.
- In addition, as the area is on the Richmond River floodplain, the existing highway floods under major floods. Large embankments would be required to meet the 20 year ARI flood immunity. This would increase the footprint along the proposed alignment and impact acquisitions. Due to a long continuous ridge running along the river bank, upgrade of the existing highway in this area would result in a significant flooding impact by changing the behaviour of floodwater.

It is important to note the existing Pacific Highway between Broadwater and Coolgardie is also adjacent to significant vegetation and habitat. North of Wardell, vegetation mapping indicates that the threatened ecological community of Lowland Rainforest is present. Other threatened ecological communities along the stretch of highway north of Wardell up to where the project merges back include Subtropical coastal floodplain forest and Coastal cypress pine forest.

In addition, the identification of State and Commonwealth listed species that the project would affect in this area are located adjacent to the existing highway also and could be affected by a duplication of the existing highway. These would include *Syzigium hodgkinsoniae*, *Endiandra muelleri*, *Cryptocarya foetida*, *Archidendron hendersonii* and *Endiandra hayesii*.

Flood Free Route

The community have been involved and have provided feedback throughout the development of the project. The Flood free community alternative option was identified by the community during the route options process and was assessed by the project team (refer to Appendix A of the Woodburn to Ballina Preferred Route Report, (RTA, 2005)).

The route assessed in this report was adjusted by the project team to provide required curves, minimise some of the environmental impacts and minimise the extent of Broadwater National Park within the corridor. These alterations were required to ensure that all route options could be comparatively assessed. However, the route followed the community identified alignment as closely as possible.

The advantages of the route were:

- Engineering advantages over other route options because this route generally follows higher ground and therefore is less flood affected. This reduces the need for:
 - Flood bridges to maintain Richmond River floodplain storage.
 - Soft soil improvements.
 - The importation of large quantities of fill material.
 - About 10 per cent cheaper than the base case.

However, there were a number of disadvantages to the route. These are:

- A 4.2 kilometre length of the route is within the 1:100 year floodplain.
- Need to acquire and provide compensatory habitat for NPWS estate (55.1 hectares), particularly on Broadwater National Park, which is of high importance due to the large number of threatened species that occur within the park boundaries.
- Need to construct an additional six kilometres of new highway corridor instead of re-using the existing highway corridor, which is otherwise satisfactory in terms of geometry.
- Impacts on the ecology within both Broadwater and Bundjalung national parks and other vegetated areas south of the Evans River would be much higher than other route options, as there is a larger area of undisturbed native vegetation.
- Ecology surveys identified endangered ecological communities and numerous threatened species along the route.
- Due to minimal disturbance of the riparian zone surrounding Evans River, the river is considered to be of high biodiversity quality. A crossing over the river would have high impacts on the quality of the river and the important ecological habitats it supports.
- Traverses some areas of high Aboriginal cultural significance around the Evans River. The route passes through more undisturbed land and traverses more landforms of potential

archaeological sensitivity that the base case and thus has more potential to intercept archaeological sites.

Due to the adverse environmental impacts, it was concluded that it should not be included for further assessment.

Alternative direct route

An alternative direct route was provided in a submission as a more direct route to the project. The alignment starts just north of the interchange at Broadwater and follows a direct alignment north, connecting back into the project at the interchange at Coolgardie. While this option may be around four kilometres shorter than the project, it is not considered to be a feasible alignment for the highway due to:

- The number of river crossings required and length within the Richmond River floodplain, resulting in potential flooding and soft soil constraints.
- Social impacts on Wardell.
- Impacts on high yielding sugar cane land.

2.6.3 Options assessment

Submission number(s)

036, 051, 076, 078, 093, Trade & Investment Resources and Energy.

Issue description

1. The route selected was predetermined before any planning was commenced.
2. Initially, the regional environment groups were part of an environmental working group. However, when the route was to be selected, the working group ceased to operate, and these groups were all excluded from any further consultation. As such, the selection of the route was not from broad community consultation.
3. Of the four options for the Wells Crossing to Iluka Road, the orange option was never going to be chosen as Roads and Maritime wanted the highway to have a flood immunity of 1:20 flood event, the other two options to the east had extreme environmental impacts and would never be chosen.
4. If the principle of "avoid impacts on habitat through the planning process" is followed then the orange option should be chosen. Ecological considerations were given less value than social and economic considerations in route selection.
5. Benefits of dropping the motorway proposals include:
 - Existing highway would be upgraded.
 - Ease of access to Grafton.
 - Local ratepayers will not have to maintain more than 100 kilometres of bypassed highway.
 - It would achieve the objective of developing a route considering the community's interest.
 - Reduction of loss of over 200 hectares of agricultural land (Glenugie to Maclean).
 - Reduction in the area of vegetation (including high conservation value habitat, aquatic and riparian habitat) to be cleared.
 - Avoid fragmentation of vegetation, and avoid dissection of the habitat of the endangered coastal emu population.
 - Avoid impacts to threatened flora and fauna.
 - Improved flood evacuation from the upgraded highway.
 - Avoid impacts to habitat for a significant resident Koala population along the Broadwater to Coolgardie section.

- Avoid impacts on numerous nationally significant conservation values of the Wardell wetlands and heathlands, the Blackwall Range and the Tuckean.
6. Alternatives to the project (options) require far better analysis of extractive resources and identification of sensitivity to known/potential resource and their sustainability from route selection.

Response

1. This statement is incorrect, the preferred route was not pre-determined but was selected via four development projects. These development projects identified feasible (short listed) route options, identified potential environmental and social issues within a broad study area (investigation corridor), consulted extensively with the community and stakeholders, and evaluated the route options to identify the preferred route. The options were evaluated against project specific criteria developed by the then RTA, the community and stakeholders, taking into consideration the project objectives. Refer to Chapter 4 of the EIS for further details on the route selection process.
2. The community have been involved and provided feedback throughout the development of the project. The route options were placed on public exhibition to obtain community feedback. Various community and specialist focus groups were held and community stakeholders were invited to a Value Management workshop to determine the way forward for the route options and the project. Community stakeholders involved in the Value Management workshop were selected from the community focus groups established for the project.

It is acknowledged that only a number of community stakeholders were invited to the Value Management workshop, however, the entire community, including community interest groups were all provided with the opportunity to provide comments on the route options. The route options were placed on display for community comment in October 2005.

A value management workshop was held as one part of the route selection process. At the workshop several environmental, engineering, socio-economic, safety and cost issues were used to evaluate each of the options. The outcomes of the workshop included identification of further studies required. Once complete, a project selection workshop was held. This was a workshop between the project team and Roads and Maritime that took into consideration the findings of the Value Management workshop and community feedback and considered a range of factors to determine the preferred option. . These included:

- A review of the assumptions, criteria and weightings used in the Value Management workshop (attended by stakeholder and community members).
- Analysis of additional investigations requested at the Value Management Workshop.
- Review and analysis of issues raised by the community and consideration of implications to costs.

The results of this workshop were used along with other investigations to assist Roads and Maritime in determining the preferred route.

The preferred route was then again placed on public exhibition to enable further community input into the design process.

A comprehensive route options and selection process was undertaken to identify the preferred route. Investigations were undertaken throughout the development of the project with regard to route selection and concept design to avoid, minimise and mitigate potential environmental

impacts. The preferred route was assessed against a triple bottom line of functional, social and local economic and environmental criteria.

3. One of the Pacific Highway Upgrade Program objectives is to reduce travel times. One aim of the project to meet this objective is to provide a level of flood immunity that minimises the risk of delays due to flooding. This flood immunity is 100 year ARI for minor catchments, but 20 year ARI through the large floodplains of the Clarence and Richmond rivers. This will benefit property owners and road users. Further details on the flood immunity and inundation of the project can be found in section 2.5.1, response six.

As well as improving access into the region by improving flood immunity, emergency accesses have been incorporated into the project to improve access during other emergencies. The project also incorporates emergency crossovers to enable traffic to continue should one of the carriageways be closed during a traffic incident.

With regards to the eastern options:

- The “red” option was not selected as it would substantially fragment high value habitat areas, impact on areas of high quality endangered ecological communities, involve a greater area of clearing of remnant bushland and would present a much higher risk of restricting access to the important wetland habitats of the floodplain and the habitat of the coastal emu sub-population.
- The “green” option also was not selected due to ecological impacts including impacts on the Shark Creek SEPP 14 wetland, impacts to high value habitat and areas of endangered ecological communities.

While the orange option would mostly avoid vegetated areas, route options were assessed against a triple bottom line of natural environment, function and social and local economic criteria. Other considerations for the orange option included:

- Flooding between South Grafton and Tyndale: It would be located within the Clarence floodplain for 38 kilometres of the length. Hydrology modelling at that time indicated there would be an increase in flood levels inside the South Grafton levee of around 60 millimetres even with significant bridging structures.
- Wetlands: The route would impact on 700 metres on the Upper Coldstream Nationally Important Wetland.
- Travel time: while it would attract up to 95 per cent of local, regional and through traffic, it would provide less benefits for through traffic because it was about six kilometres longer than other options (with a travel time saving of only eight minutes from Wells Crossing to Harwood Bridge).
- Property: impacts to residential and agricultural properties were high. 175 houses would require acquisition, the potential for impacts on agricultural land (around 465 hectares of prime agricultural land to be acquired) and of the number of people predicted to experience noise impacts (93 residences within 50 metres of the highway).
- Cost: the orange option would be the most expensive option due to the additional length and floodplain bridges required (\$1588M (in 2012 dollars)). It should be noted that around 40 per cent of these costs would be for bridging structures. This would be some \$556M dollars (in 2012 dollars) more than the project route over a comparable length.

4. Ecological considerations were not given less value than social or economic considerations in the selection of the preferred route. The objectives of the Pacific Highway Upgrade Program require that the principles of ecologically sustainable development be considered in the development of projects. The project incorporated these principles, in particular conserving biological diversity and ecological integrity.

The selection of the preferred route considered a triple bottom line of functional, social and economic and natural environment factors. For example, two of the other original options being the “green” and “red” options were both less expensive to build than the preferred route, however, both were not pursued due to ecological impacts (refer to response 3 above). However, it is acknowledged that there would be biodiversity impacts as a result of the project.

Measures to mitigate impacts are included in Chapter 10 of the EIS, including a connectivity strategy and a monitoring strategy. An Offset Strategy has been developed to offset impacts to vegetation (including EECs) in consultation with the Office of Environment and Heritage and the Commonwealth Department of Environment. The aim of the Offset Strategy is to identify a package of offsets to achieve a neutral or net beneficial biodiversity outcome for the region as a result of the project.

The orange option was the most western of the short listed options for the Wells Crossing to Iluka Road project, being mostly a new highway adjacent to the existing highway. This option had an easterly deviation between Bom Bom State Forest and Swan Creek and local bypasses of Grafton, Ulmarra and Tyndale. Based on the triple bottom line, the orange option did not perform best overall (refer to response 3 above).

5. While duplicating the existing highway would avoid areas of high value habitat, EEC and fauna corridors as it would be situated on mostly cleared floodplain. It would have social and land use impacts, particularly where the highway passes through towns and agricultural properties. There are also some areas of intact vegetation alongside the existing highway that would still be impacted by the project, so this option would not avoid all biodiversity impacts. One of the main reasons for not duplicating the existing highway is as the highway is in floodplain and of a sub-standard flood immunity. The duplication would need to rectify this which would add increased cost for flooding structures and additional impacts from large embankments required.

Origin/destination surveys were undertaken and included in the EIS for the Woolgoolga to Ballina project. This updated the percentage of traffic forecast to use the upgraded highway through Section 3 of the project. The assessment predicted around 57 per cent of existing traffic would use the upgraded highway. Forty three per cent of traffic would remain on the existing highway. This reduction in traffic would improve road safety and road travel times along the existing Pacific Highway.

The section of the project between Glenugie and Tyndale would bypass South Grafton, Grafton and Ulmarra. This bypass would remove the bulk of through traffic from these town centres, resulting in improved amenity. The existing Pacific Highway would be retained as a service road, so vehicles can continue to access Grafton via this route.

Roads and Maritime intends to consult with local councils across the project regarding how the existing Pacific Highway would be maintained (refer to section 2.7.8, response one).

The community have been involved and provided feedback throughout the development of the project. The route options were placed on public exhibition to obtain community feedback. Various community and specialist focus groups were held and community stakeholders were invited to a Value Management workshop to determine the way forward for the route options and the project.

It is acknowledged the project would result in adverse biodiversity impacts. Measures to mitigate these impacts are included in Chapter 10 of the EIS, including a connectivity strategy and monitoring strategy. An Offset Strategy has been developed to offset impacts to vegetation (including EECs) in consultation with the Office of Environment and Heritage and the Commonwealth Department of Environment. The aim of the Offset Strategy is to identify a package of offsets to achieve a neutral or net beneficial biodiversity outcome for the region as a result of the project.

The project has sought to minimise impacts on prime agricultural land where possible. Agricultural impacts of the project are detailed in Chapter 16 of the EIS. The level of the existing highway is below the 20 year average recurrence interval (ARI) flood event level in many locations. This means that the highway can be inundated by flood waters during a 20 year ARI flood event. The project has been designed with improved flood immunity, to minimise the likelihood of a road closure. This design feature would provide carriageways that would be flood free for the 20-year ARI flood event on the Clarence and Richmond River floodplains and the 100-year ARI flood event elsewhere. Further details on the flood immunity and inundation of the project can be found in section 2.5.1, response six. This will benefit property owners and road users, and improve flood evacuation.

The project would cross the habitat of the coastal emu through sections 3-5. The project includes a range of measures to mitigate the impacts to emus. In particular, a connectivity strategy and a monitoring program have been proposed. Refer to Section 2.12 for further information

The existing Pacific Highway between Broadwater and Coolgardie has significant vegetation and habitat present. Where possible, the alignment between Broadwater and Coolgardie has sought to pass through cleared or disturbed lands to avoid impacts on vegetated areas. The alignment also traverses around Wardell Heath and Blackwall Range, which contains primary Koala feed trees and a high density of koala recorded near Wardell. The project would result in the fragmentation of koala habitat, with around 375 hectares of habitat critical for the survival of the Koala to be cleared along the entire length of the project. The test of significance undertaken for koalas indicated that the project would have a significant impact on this species.

However, a range of management measures have been identified in Section 10.4 of the EIS to minimise impacts on koalas. These include the provision of a Connectivity Strategy including connectivity structures and fauna fencing; and the preparation of a management plan to guide the review of connectivity structures (a Koala management plan is provided as Appendix K to this report). Between Broadwater and Coolgardie, there are five crossing structures which target koalas. In particular, two land bridges at station 147.6 and 156.5 would facilitate the movement of koalas from the Wardell Heath to the vegetation along Meridian Heights. Refer to response one in section 2.12.2 for further details on koala connectivity structures.

The connectivity strategy (Appendix A of the Working paper – Biodiversity) also requires the placement of fauna exclusion fencing from station 146.1 to station 159.7 to avoid animals getting access into the road corridor.

- Chapter 4 of the EIS provides a summary of the alternatives and options considered through the route development process. Material supply was just one of the considerations in route selection. Further information on different options considered can be found in previous reports, as detailed in Section 4.2.1 of the EIS. Impacts on potential resources from the project are identified in Chapter 6 of the EIS and in Working paper- Land use and property.

2.7 The project

2.7.1 Project route alignment

Submission number(s)

018, Clarence Valley Council, Coffs Harbour City Council, Richmond Valley Council.

Issue description

- The current Pacific Highway should be kept as a local road between the Maclean interchange and Yamba Rd.
- The project should travel along the edges of state forests, national parks and other important reserves.
- An overpass is required at McIntyres Lane, Gulmarrad. There is an opportunity to obtain fill material from further east on McIntyres Lane by the construction contractor.
- Requests further investigation of the extension of Goodwood Street in an easterly direction, connecting to Brooms Head Road in the vicinity of Pine Avenue.
- Eggins Drive reconstruction needs to meet relevant pavement and geometrical design standards for the forecast traffic loadings
- Increasing the grade of Swan Bay-New Italy Road will render the road and intersection unsafe. The southern off ramp and north bound Highway exit arrangement into the Museum car park will be closed.

Response

- As stated in Chapter 4 of the EIS, the route options analysis identified the optimal alignment for the highway between Maclean and Yamba Road would be along the existing Pacific Highway. This route was chosen to be a duplication of the existing highway alignment to minimise impacts to the natural environment, particularly to Townsend and the Yaegl Nature Reserve, and to reuse as much of the existing highway as possible. It also was chosen to tie-in with the preferred alignment for the bridge over the Clarence River, which would be duplicated to the east of the existing bridge. The alternative local route between Maclean and Yamba Road, would be via Cameron Street and River Street as it currently is. This route for the service road through Maclean is considered a suitable and sensible option for the upgrade.
- In almost all cases, the project does travel along the edges of state forests, national parks and other important reserves, and this was a deliberate design decision. In particular, this has been somewhat achieved by duplicating around 68 kilometres of the existing highway. For example, the highway was duplicated along the existing alignment to minimise impacts to the Yaegl Nature Reserve and Broadwater National Park. However, even when maintaining the existing alignment,

the width of the upgrade would affect the edge of many state forest areas, and to a very small extent, to Yaegl Nature Reserve and Broadwater National Park.

3. As a result of consultation with council, an overpass has been included at McIntyres Lane (refer to Chapter 4) as part of the design refinements. The service road connecting the interchange at Maclean to McIntyres Lane would be partly removed. However access from McIntyres Lane would be provided to properties on the east of the upgraded highway. Roads and Maritime would continue to discuss opportunities to win material, however, preliminary earthworks calculations for this project section indicates that there is a surplus of material in this location. As such, there may not be a need for the sourcing of additional material.
4. As part of the design refinements, an alternative access into Townsend and Gulmarrad was considered. This consisted of a revised Jubilee Street access or access along Goodwood Street/Common Road. Consultation was undertaken with the community, including a Community Information Session on the 25 of March 2013. Significant support was received from the community for the revised access into Jubilee Street 'Option 2'. The revised access into Jubilee Street forms part of the Maclean interchange design refinement (refer to Chapter 4).

However, the design of the Maclean Interchange would not preclude the development of the Goodwood Street/Common Road alignment by Council at a later stage.

5. Eggins Drive would be reconstructed to current relevant road design guidelines and construction standards in consideration of traffic loadings. Further consultation with Coffs Harbour City Council regarding the standard of Eggins Drive would inform the detailed design of this local road.
6. The intersection and access arrangements into Swan Bay New Italy Road under the class A upgrade have been refined as part of this Submissions/ Preferred Infrastructure Report. This has provided safer access arrangements into Swan Bay New Italy Road, with less of a change in grade. Access in and out of Swan Bay New Italy Road would be available now north and south of the current intersection (refer to Chapter 4 of this report for further details).

2.7.2 Rest areas and service centres

Submission number(s)

029, 097, Richmond Valley Council.

Issue description

1. No mention of highway service centres in the EIS. Consideration of the provision of suitable service centres for heavy vehicles close to interchanges. Concern over the development of service centres.
2. Council seeks consideration of the provision of a service centre at the Woodburn interchange or within close proximity to the interchange.

Response

1. The Mid North Coast Regional Strategy (DoP, 2009) identifies Woolgoolga and Maclean as two potential highway service centre locations (the locations identified north between Coffs Harbour and Ballina include Arrawarra north of Woolgoolga, Maclean and Ballina). However, highway service centres would not be constructed as part of the project. A brief discussion on potential

environmental impacts has been provided on an area near Maclean that would meet the Strategy identified locations (refer to section 3.11 of this report).

The project would include five rest areas, generally located at about 50 kilometre intervals across the project (for both northbound and southbound traffic), with toilet and picnic amenities to cater for both light and heavy vehicles. Any development of a service centre would be undertaken under a separate planning approval process and most likely by a private developer. That process would provide the opportunity for community review and comment on details of the proposed development, if and when it occurs.

2. Highway service centres would not be constructed as part of the project. The project includes only rest areas with toilet and picnic amenities, to cater for both light and heavy vehicles. The Mid and Far North Coast Regional Strategies (DoP, 2009 and 2006) identify locations of service centres along the Pacific Highway. The locations identified north between Coffs Harbour and Ballina include Arrawarra north of Woolgoolga, Maclean and Ballina. Any service centres at those locations would require separate approvals from the relevant councils. It is expected that a scheduled review of the Far North Coast Regional Strategy by the Department of Planning and Infrastructure will commence shortly. That review will provide an opportunity for Council to propose that Woodburn also be considered as a Highway Service Centre location.

2.7.3 Interchanges

Submission number(s)

018, 026, 073, Clarence Valley Council, Richmond Valley Council.

Issue description

1. There should not be an interchange at Yamba Road, with the Maclean interchange serving the exit for Maclean and Yamba. The respondent also suggests that south bound traffic from Yamba and Harwood should travel along the current Pacific Highway and enter the upgraded highway at the Maclean interchange.
2. Project should include access to highway from Pillar Valley instead of the interchanges at Glenugie or Tyndale?
3. I support the access from Banana Road to the Iluka Road interchange.
4. Access to Yamba Road for southbound highway traffic has potential to create confusion (even if well signposted) as traffic would need to exit the highway at Watts Lane. The possible future southbound off-ramp at Yamba Road should be included in the initial upgrade.
5. The Glenugie interchange should maximise access to the existing Grafton airport and associated future development in the area.
6. An interchange at Swan Bay-New Italy Road could reduce the extent of service road required between New Italy and Iluka Road interchange. This could result in a cost saving to Roads and Maritime.

Response

1. The respondent suggests that there should not be an interchange at Yamba Road. However, the project, with the interchange at Yamba Road maintains existing access and traffic movements onto the highway and caters for the growing coastal areas including Yamba. The project connects Yamba to the employment centres of Maclean and Grafton. Access to the upgraded highway for

motorists travelling south from Yamba Road would be possible through a southbound on-ramp off Yamba Road. Motorists travelling north would be able to access Harwood by exiting the upgraded highway at Yamba Road and continuing across the existing Harwood Bridge. The interchange has been designed to separate local traffic and through traffic, to improve traffic flow and increase safety. For this reason, the respondent's request cannot be accommodated. The interchange at Maclean would provide a full interchange for traffic.

2. Interchanges are designed to be located near existing major node points on the highway (such as Range Road, Tyndale and Glenugie), which could be in proximity to population centres. There are 10 interchanges across the project to provide good access to townships and via the service roads or local roads, to other areas on the North Coast. There is no proposal for the inclusion of an interchange at Pillar Valley as traffic numbers would not justify the inclusion of the interchange.
3. Support for interchange arrangement is acknowledged.
4. The interchange at Yamba Road allows for potential future ramps as part of the project. However, they would not be constructed as part of the initial upgrade as the current design is sufficient to cater for the predicted traffic volumes. However, the project does not preclude the incorporation of the full interchange at Yamba Road, should traffic volumes warrant it in the future. As part of the project, Roads and Maritime would ensure that appropriate signage is provided on the highway to avoid confusion of access to Yamba (refer to management measure SE5).
5. The interchange at Glenugie provides for access onto and off the highway for both northbound and southbound traffic. Northbound traffic would deviate off the highway at around station 34.6 onto the existing highway. Access to the airport would be as per the current access arrangements. For traffic travelling south, access to the airport would be via Eight Mile Lane and Aerodrome Road.
6. An interchange has not been proposed at this location as there is insufficient travel demand to warrant a full interchange. However, the design refinement for a new access at New Italy (refer to Chapter 4) provides opportunities to consider a part interchange sometime in future. A service road is required to provide a continuous alternate access for local traffic and properties requiring highway access.

2.7.4 Bridges

Submission number(s)

018, 069.

Issue description

1. What is the clearance of the Clarence River bridge? Is it fixed or opening?
2. An over bridge in McIntyres Lane is a must to keep the local road link with Gulmarrad and the current Pacific Highway.

Response

1. The bridge crossing of the Clarence River at Harwood would be a fixed structure with a minimum vertical clearance of 30 metres. This is similar to the raised span of the existing Harwood Bridge. The new crossing would be adjacent and to the east of the existing bridge.

2. In response to Council and community feedback, the project has been refined to include an overpass at McIntyres Lane to provide for cross highway movements (refer to Chapter 4 of this report).

2.7.5 Road fencing

Submission number(s)

005, 074, 075, 096, 109, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. The existing fence line between the respondent's property and Roads and Maritime land needs urgent attention.
2. The Tyndale Flood Reserve Trust requests that it be informed about the positioning of fences along the road.
3. The approach to and the overbridge of Byrons Lane, Tyndale should have appropriate fencing to enable stock to be driven over the highway during flood times.
4. It is important that fencing be well maintained especially during floods so it does not become hazardous.
5. What type of vegetation control and clearing would occur on the road reserve side of the fence? Would Roads and Maritime maintain the area up to the fence line (including vegetation management)?
6. The project would result in a fence being installed where there is currently no fence, compensation needs to be provided regarding maintenance of the fence.
7. Fencing should be installed along the project boundary to reduce the likelihood of inadvertent entry onto NPWS land. Exclusion fencing should also be installed (offset from the park boundary and not include any barbed wire).

Response

1. As part of any acquisition process, Roads and Maritime would consult with landowners regarding property infrastructure and fencing.
2. Roads and Maritime is currently in the process of acquisition with the landowner (Crown Lands) and fencing would be considered as part of the property acquisition process. A fencing strategy has been developed to identify potential issues for consideration (refer to Chapter 3 of this report). Roads and Maritime would consult with the Tyndale Flood Reserve Trust regarding cattle movement under or over the highway and the preferred arrangements for fencing in this location during detailed design (refer to management measure LU2 in Chapter 5 of this report).
3. Roads and Maritime would consider the provision of appropriate fencing on the Byrons Lane overbridge and approaches and any other known bridges where there would be stock movements, in detailed design. However, other issues such as flooding impacts on the fencing would need to be considered.
4. This is noted by Roads and Maritime and would be subject to Roads and Maritime' operational management procedures.
The fencing of the project would be considered further as part of the fencing strategy (refer to Chapter 3 of this report). This strategy would consider measures such as the placement of fencing higher up fill embankments, in flood plain areas.

5. As part of the landscape strategy, the area adjacent to the road would be revegetated (See Chapter 11 of the EIS). In this area, the strategy includes the planting of grasses and shrubs. Roads and Maritime would be responsible for the periodic maintenance for roads under their control (such as the upgraded highway), particularly weed management, clearing and trimming of vegetation, to maintain the road reserve (which includes up to the fence line), as part of their operational management procedures.
6. If it is considered necessary by Roads and Maritime and or the landowner that a fence is required, once installed, it would typically become the property and responsibility of the adjoining landowner. The fencing strategy (refer to Chapter 3 of this report) notes that in a few instances fences may not be installed, by agreement with the landowner. As part of any acquisition process, Roads and Maritime would resolve issues regarding property infrastructure and fencing in consultation with the landowner.
7. Roads and Maritime would consult with NPWS regarding fencing requirements for national parks and nature reserves. Exclusion fencing is proposed as part of the Connectivity Strategy in some areas, with these areas to be fenced identified (refer to Appendix A of the Working paper - Biodiversity), including past areas of national parks/nature reserves. Roads and Maritime is developing a fencing strategy to consider fencing issues such as type and location of fencing to minimise further vegetation clearing (refer to Chapter 3 of this report).

2.7.6 Project cost

Submission number(s)

014, 015, 017, 020, 023, 027, 028, 034, 037, 038, 051, 054, 058, 060, 083, 085, 088, 092, 095, 104, 105.

Issue description

1. The acquisition costs of offsets should be part of the overall project budget.
2. Has the project included the cost of the land bridge proposed for Coastal emus if they do not use the underpasses? The cost differential to include it now compared to later would be large. Without this included cost, it cannot be compared with the ecologically less destructive option.
3. Weed removal will be costly along the project.
4. Proposal does not cost impacts to local industry or eco-services.
5. Costing should include impact management measures such as fencing.
6. What is the design cost of the Six Mile Lane deviation and drainage structures?
7. Concerned the true cost of the proposal has not been assessed due to the lack of costing of environmental damage.

Response

1. The costs for offset lands have been incorporated into the \$4.2 billion cost of the overall project.
2. The project cost estimate included sufficient contingencies to include the cost of the potential future land bridge for Coastal emus. Even with the costing of a land bridge factored in, the orange option (section between Glenugie and Maclean) would still be substantially more expensive than the project.

3. Roads and Maritime would be responsible for maintenance of the road reserve, including weed management. This would be undertaken as part of Roads and Maritime' operational management procedures.
4. One of the objectives of the Pacific Highway Upgrade Program is to support State and regional economic development. Numerous government and independent reports highlight the importance of modern, efficient transport links in supporting economic development and local industry. The Pacific Highway is the key north–south corridor on Australia's eastern seaboard. It supports a number of key industries, including the freight industry, agricultural industry and tourism. Upgrading the highway would help to underpin regional, State and national economic growth. A quantification of project impacts on eco-services (benefits derived from ecosystems (Millennium Assessment 2005)) was outside the scope of the EIS.
5. The project cost has included the cost of environmental management measures including fauna fencing and underpass/overpass structures between Glenugie and Maclean, (including sufficient contingencies for a future land bridge for coastal emus between Glenugie and Tyndale).
6. The cost of the deviation of Six Mile Lane, including culverts and the overbridge is around \$3 million (2012 dollars). This cost has been included within the overall project cost.
7. Environmental damages are not normally considered in monetary terms for infrastructure projects. Instead these impacts are addressed and avoided or minimised through the route selection and assessment process. The construction of major transport infrastructure within the NSW North Coast of the scale and nature of the project cannot be undertaken without environmental impacts and require management measures and offsets. However, the principles of ecologically sustainable development (precautionary principle, inter-generational equity, conservation of biological diversity and ecological integrity and improved valuation, pricing and incentive mechanisms) have been considered throughout the process of developing the project and assessing its benefits and potential adverse effects. Environmental issues have been afforded equal importance along with economic and engineering issues.

Investigations have been undertaken throughout the development of the project with regard to route selection and concept design to avoid, minimise and mitigate potential environmental impacts. These investigations and community feedback have provided an understanding of the environmental constraints within the study area. The suitability of these route options were assessed on a broad range of social, environmental and design factors. These factors were further considered through the EIS and identification of appropriate environmental management measures to be incorporated into the project.

2.7.7 Service roads

Submission number(s)

018, 026, 053, 097. Coffs Harbour City Council, Richmond Valley Council. Trade & Investment Crown Lands.

Issue description

1. The highway should traverse along the existing Pacific Highway to Grafton and the lower Clarence.
2. Would the service road between Woodburn and Coolgardie be continuous, as an approved B-double route with the current speed limits and road standards maintained?
3. Suggestions to limit speed of heavy vehicles on the existing Pacific Highway between Tyndale and Glenugie to encourage use of the upgraded highway.
4. What funds will be used to maintain the existing highway? The costs cannot be left to the local Council. Detail on how the existing highway will be maintained needs to be included.
5. How will local roads be maintained?
6. Crown land roads that are upgraded as part of the project will transfer to Roads and Maritime or the relevant local council. Crown public roads that are to be closed or not altered must be restored to existing conditions.

Response

1. The highway between Glenugie and Maclean would be upgraded on a new alignment. The existing highway would be retained as the service road. It would provide an alternative local access for this length, connecting Maclean to Grafton and South Grafton (the lower Clarence).
2. Roads and Maritime has been in ongoing consultation with the cane industry including the Cane Harvesters Co-operative regarding impacts from the project. As part of the consultation process, a cane farm strategy (refer to Chapter 3 of this report) has been prepared to provide a framework for managing cane industry impacts through further discussion with the industry. As part of this framework, Roads and Maritime would consider the importance and need to maintain the current classification of the existing highway between Tyndale and Maclean and Woodburn and Wardell, as a state road. The decision on the speed limit and road standards for section of the existing highway which is bypassed, would be considered during further stages of the project, in consultation with council and if necessary local industry.
3. Some sections of the existing highway would be transferred to the local council, following an assessment and negotiation process. However, some sections of the existing Pacific Highway could remain a state road under Roads and Maritime control. Requirements would be confirmed with councils prior to this transfer taking place, and these requirements would be assessed at that time.
4. Both State and local government local funds would be used to maintain the existing highway. Roads and Maritime would assess and negotiate with Council the conditions for any handover of bypassed sections of the existing highway during the detailed design and construction phase of the project. These negotiations would involve issues such as the status and quality of the roads to be handed over to Council, any funding issues associated with the handover and any work required as part of the handover process. Roads and Maritime would discuss funding, maintenance and ownership of the existing highway with local councils.

5. Local roads are maintained by local councils as roads authorities and are outside the scope of the project. Access for construction activities, including the haulage of earthworks materials, would be within the project boundary, wherever possible. However, there would be stages of construction and sections of the project where continuous access along the new alignment would not be available. In these situations, use of the existing highway or parts of the local road network would be required. During construction, pre-construction road dilapidation reports would be prepared by the relevant contractor for all roads likely to be used by construction traffic (refer to management measure T&T6), as follows:
 - Post-construction road dilapidation reports would be prepared following the completion of construction for all roads assessed before construction.
 - Dilapidation resulting from construction activity would be repaired to maintain an appropriate standard for the required level of service.
 - Copies of road dilapidation reports would be sent to the relevant roads authority.
6. Roads and Maritime would consult with Trade & Investment Crown Lands and relevant local councils regarding the management and ownership of roads, including sections of the existing highway and local roads (including any Crown public roads).

2.7.8 Utilities

Submission number(s)

039, Coffs Harbour City Council, Rous Water, Richmond Valley Council.

Issue description

1. Water supply connection across the old Emigrant Creek Bridge will require relocation.
2. The project would impact on Rous Water infrastructure. Rous Water would assist in the relocation of operational and abandoned pipelines as early as possible to avoid any potential future conflicts. Rous Water are also concerned about adjustments outside that road corridor (ie EIS footprint) that may occur and the management of any environmental approval of these relocations.
3. The project should avoid impacts to the Broadwater Sewerage Scheme (rising pump station) located off Broadwater-Evans Head Road.
4. Any council infrastructure impacted will need to be relocated or protected.

Response

1. The EIS acknowledges that there would need for utility adjustments. Roads and Maritime would minimise any disruption to the water supply during construction. Roads and Maritime would consult with directly affected land owners and Ballina Shire Council regarding the water supply and potential impacts from the project to identify management measures to ensure short and long term supply (refer to management measure LU31 in Chapter 5 of this report).
2. Roads and Maritime would consult with utility providers regarding the relocation of utilities (refer to management measure LU31). Additional approvals that may be required for these relocations would be obtained by Roads and Maritime. Roads and Maritime would further consult with Rous Water and Richmond Valley Council and other utility providers during the detailed design phase.
3. This has been considered in the EIS. A management measure is included in Section 16.4 of the EIS (LU33) requiring Roads and Maritime to consult with Richmond Valley Council during detailed design to confirm the location and timing of the rising pump station.

4. The EIS acknowledges there would be a need for utility adjustments or protection during construction. Roads and Maritime would consult with utility providers including Coffs Harbour City Council, Clarence Valley Council, Richmond Valley Council and Ballina Shire Council regarding any relocation or protection work required (refer to revised management measure LU31).

2.8 Construction of the project

2.8.1 Extended construction hours

Submission number(s)

003, 115, Richmond Valley Council, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. Extended work hours are supported to expedite the delivery of the upgrade and minimise disruptions.
2. Objection to extended working hours.
3. Council supports the savings, both financial and time, which can be made from extending the hours of construction. However, allowances need to be made to avoid utilising these extended hours where there is likely to be an impact.
4. Prior approval is required for out of hours construction in accordance with the Interim Construction Noise Guidelines.

Response

1. Roads and Maritime acknowledges the support for extended working hours. Preliminary feedback received from the community on extended working hours is included in Chapter 3 of this report.
2. Roads and Maritime acknowledges the objection for extended working hours. However due to the advantages of these hours, including the reduction in overall construction timeframe and reducing long term impacts on the highway, Roads and Maritime is still seeking approval for extended working hours. Roads and Maritime would continue to consult with the community. Preliminary community feedback is identified in Chapter 3 of this report.
3. The *Interim Construction Noise Guidelines* (DECC, 2009) have been developed by the Office of Environment and Heritage in consultation with a number of NSW Government agencies to provide guidance on managing noise from construction work in NSW. Section 2.3 of the guidelines provides details on the five categories of work that might be undertaken outside the recommended standard hours. These categories are:
 - The delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads.
 - Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm.
 - Maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours.
 - Public infrastructure work that shorten the length of the project and are supported by the affected community.

- Work where a proponent demonstrates and justifies a need to operate outside the recommended standard hours.

In addition, the guidelines state that, in general, only work undertaken on public infrastructure needs to be undertaken outside the recommended standard hours. This need is typically based on a requirement to sustain the operational integrity of public infrastructure, as work to restore operation of the infrastructure provides a benefit to the greater community (that is, more than just local residents).

Roads and Maritime would continue to consult with the community regarding extended working hours, and avoid extended working where there is an unacceptable community impact (refer to management measure CNV31 in Chapter 5). This relates to the proposed consultation protocol for construction work hours.

4. A discussion on out of hours work is included in Chapter 6 of the EIS. Out of Hours Work activities for the project would be undertaken and managed in accordance with the Out of Hours Work procedures detailed in the project Noise and Vibration Management Sub-Plan, developed as part of the Construction Environmental Management Plan. These procedures would include details of any additional management measures and consultation with relevant stakeholders prior to work being undertaken.

2.8.2 Construction of the project

Submission number(s)

066, 087, 096, Trade & Investment Resources and Energy, Forestry Corporation of NSW, NSW Office of Water, Richmond Valley Council.

Issue description

1. A stockpile site identified in the EIS (site 2 Section 4) is adjacent to watercourse.
2. Concerned about the use of local roads by construction vehicles and the resulting road deterioration and car maintenance required.
3. There is a potential conflict between the extractive materials needs of the project and other requirements in the region. Resource use should also consider cumulative impact on long term supply capacity, any increased transport costs, roadside impacts and net GHG emissions. Sustainability of extractive resources has not been addressed.
4. The cumulative impact of prematurely closing quarries and replacing them with more distance sources potentially causes significant consequential environmental risk such as increased transport costs, roadside impacts and net greenhouse gas emissions. These should be briefly quantified.
5. Ancillary facilities are/were located in cleared areas of state forests for the Glenugie Upgrade and the Devils Pulpit Upgrade. These sites could be used for the project, subject to negotiation with Forestry Corporation of NSW.
6. The proponent must ensure that it has sufficient water supply for the project and obtain all appropriate water licences from the NSW Office of Water prior to work commencing.
7. The EIS has had little regard to sourcing extractive materials from outside the highway investigation zone.
8. Impacts from sourcing materials including hauling extractive resources along Council roads, the damage which may be caused to Council roads and the financial cost to Council to repair, the

inconvenience to residents and the safety of haulage along Council roads have not been covered sufficiently in the EIS.

9. Depletion of local sources of extractive resources has not been covered sufficiently in the EIS.
10. Council is concerned resources may be obtained from quarries which do not have consent to operate or capacity in their consent to supply large contracts.
11. There is a discrepancy in the quarry sites identified in Table 6-14 and Figure 6-44 of the EIS. Quarries and natural resources in the region need to be identified (and mapped) by material type & quality, size of production, total resource, transport distance and market, quarried material (product) and rock-type.

Response

1. It is noted that ancillary facility site 2, Section 4 is adjacent to Tyndale Drain No. 2. One of the criteria for the siting of ancillary facilities is that it is situated away from waterways. This site is large enough to locate stockpiles around 50 metres away from Tyndale Drain No. 2. Appropriate soil and erosion controls would be incorporated through construction (refer to management measure SSW4 in Chapter 5 of this report). Stockpiles would be placed within designated ancillary sites and located so that waterways and drainage lines are not directly impacted (management measure SSW11).

Use of the site would be confirmed by the construction contractor before construction.

2. There would be construction impacts to highway and in some areas local roads due to use by construction traffic. The majority of these roads service very small communities or unpopulated areas and experience very low volumes of traffic movements each day.

During construction, there would be direct access to the majority of ancillary facilities and borrow sites. However, where local roads are used for construction access to the project, ancillary facility and borrow site there is potential to damage the road surface.

Pre-construction road condition survey reports would be prepared for all roads likely to be used by construction traffic. Post-construction road condition survey reports would be prepared following the completion of construction for all roads assessed before construction. Any damage as a result of the construction activities being repaired by Roads and Maritime and their construction contractors (refer to management measure T&T6 in Chapter 5 of this report). Property access during construction would be maintained or provided as otherwise agreed, in consultation with the relevant landowner (refer to management measure T&T7 in Chapter 5 of this report).

3. It is acknowledged that during the construction of the project, there would be an increased demand for resources in the regional area (refer to Section 4.5.2 in Working paper - Land use and property). However, in recognition of this, the project has sought to obtain as much material from the project formation and identified borrow sites within the project corridor. The earthworks balance would be reviewed during detailed design, with the aim of reducing any need for earthworks from outside the road corridor. Impacts on potential resources are identified in Chapter 6 of the EIS and in Working paper- Land use and property. The EIS has also identified where other materials can be sourced.

Impacts on potential resources are identified in Chapter 6 of the EIS and in Working paper- Land use and property. A greenhouse gas assessment was undertaken for the project and assessed the

greenhouse gas emissions from a range of different sources; including the sourcing and transport of material (refer to Chapter 18 of the EIS).

4. Roads and Maritime would not be replacing quarries. Any new quarry developed to meet the demands of the region would need to obtain their own approval by either State or Local Government, considering their own environmental impacts.
5. This comment is acknowledged. Should any proposed ancillary facilities, including those used for Glenugie or Devils Pulpit upgrades, be located within state forest, Roads and Maritime would negotiate with the Forestry Corporation of NSW before their use.
6. Refer to Section 2.4.1, response four for further information around approvals, licenses and permits. Regarding sufficient water supply for the project, Section 6.4.2 of the EIS identifies the uses, indicative requirements and possible water sources.
7. The EIS has been undertaken at a concept design stage, based on only preliminary geotechnical information and an understanding of the materials balance. Some regard to these factors has been provided in the EIS. Further work will be done to investigate these factors during detailed design. It is only at this point in time will Roads and Maritime be able to be more certain on whether extractive materials from outside of the project boundary would be required. Roads and Maritime would consult with Richmond Valley Council on this matter.
8. The project would seek to minimise construction traffic use of local roads to avoid social and traffic impacts, with movements to be predominantly on the existing highway and along the road formation where the project deviates from the highway. However, it is acknowledged that some construction traffic carrying extractive materials from commercial quarries and project borrow sites would use local roads. Local roads that could be used during construction are identified in Table 6-16 of the EIS. This list of local roads is not exhaustive and other local roads within the vicinity of the project area could be required to be used during construction.

Any local roads used for construction access would be upgraded where required (they would be widened and/or have the pavement strengthened) and maintained in serviceable condition. Refer to response two above for further details.

9. The EIS (Working paper - Social and economic) acknowledges that the construction of the project could result in depletion of local sources of extractive resources. However, the project has been designed with the aim of achieving an overall balance of earthworks. This forms part of the sustainability initiatives during construction (refer to Section 6.9 of the EIS) and would reduce the need to import fill from local commercial quarry sources.

The project passes near or through quarries in section 9 and 10 of the project. These quarries would be sterilised by the project, with the closeness of the highway restricting operations, particularly blasting. As such, Roads and Maritime would use these quarries to obtain material required for the project to minimise sterilisation impacts and minimise impacts to other quarry sources and the region.

10. Council's concerns are acknowledged. Roads and Maritime would only source materials from quarries that are licensed. However, it is the responsibility of the quarry owner(s) to ensure that

they comply with the relevant development consent or licence conditions of their business. Current licence conditions would need to be confirmed by the quarry operator before the construction of the project. For further information, refer to Chapter 6 of the EIS.

- Figure 6-44 identifies all known quarries within a wider area, while Table 6-14 narrows down those quarries to those that are operational and that are known to provide materials that are in accordance with Roads and Maritime technical specification standards. The degree of assessment of extractive resources in the region is beyond the scope for a highway upgrade EIS. As the design is finalised during detailed design, further investigations and identification of appropriate sources of material, in consideration of resource limits and travel distances would be considered.

2.9 Consultation

Submission number(s)

001, 017, 021, 049, 071, 083, 085, 094, 096, 101, 103, 117, 119, 126, Department of Primary Industries (Agriculture), Department of Primary Industries (Fisheries), Trade & Investment (Crown Lands), Clarence Valley Council.

Issue description

- The project should not have been rolled into one environmental assessment document and should have been separate projects, making it easier for the public and agencies to consider.
- The EIS should not have been put on public exhibition throughout the Christmas holiday break.
- Concern was raised by the Corindi community group regarding the timing of the EIS community information meetings. The Corindi area did not receive any notice of the public display of the EIS and as such requests an extension to the closing date for public comment.
- Corindi area should have had a flood focus group set up to consider particular local issues.
- All residences in the Richmond River floodplain that would be affected by increased flood levels should be notified.
- Consultation to date has been acceptable but needs to continue through the design and construction phase.
- Another meeting between Roads and Maritime and the property owners at Matilda service centre should occur to finalise property access.
- Consultation should be ongoing with agricultural landholders during construction and the implementation of lands to be rehabilitated back to agricultural land.
- Fisheries NSW should be consulted during the detailed design of culverts.
- All stakeholders of Crown land parcels affected by the project must be appropriately consulted.
- Ongoing consultation should be undertaken with the local aboriginal community to address cultural heritage impacts.

Response

- The Woolgoolga to Ballina section of the highway was previously developed through four projects- Woolgoolga to Wells Crossing, Wells Crossing to Iluka Road, Iluka Road to Woodburn and Woodburn to Ballina. These projects were combined into the Woolgoolga to Ballina Pacific Highway Upgrade to enable the completion of the Pacific Highway Upgrade Program and to realise the benefits of the program sooner.

Consultation with the community, stakeholders and Government agencies has been ongoing from the previous development projects (in some cases from 2004), including through the route options, preferred route and the EIS preparation and exhibition period.

2. Under the *Environmental Planning and Assessment Act 1979*, an EIS needs to be publicly exhibited for a minimum of 30 days. The EIS was exhibited across more than 40 locations for 55 days from 12 December 2012 to 4 February 2013. Due to heavy flooding in the Clarence River area in late January, the Department of Planning and Infrastructure extended exhibition period for the project. The closing date for feedback was extended by two weeks to 18 February. Overall the EIS was on exhibition for a period of 69 days. Nine community information sessions and seven EIS staffed displays were held at 10 different locations across the project study area between 15-19 January and 9-13 February 2013 (refer to Chapter 1 of this report). The first round of staffed displays were planned for school holidays to incorporate holiday makers. The second round of staffed displays were outside school holidays specifically for residents.

As well as the exhibition of the EIS, a community update and a community brochure (which summarised the EIS) was prepared, along with access to the EIS document, the collaborative feedback form and project visualisation videos on the Roads and Maritime website. Further detailed information was available from the working papers supplied as appendices to the EIS.

3. The community information sessions (15-19 January) were deliberately planned for the school holidays to incorporate holiday makers. The EIS staffed displays (9-13 February) were deliberately planned for outside of the school holidays specifically for residents.

In total two community sessions were held in Corindi during the EIS exhibition. There was one scheduled session in January and a second Corindi community session was included in response to community concerns. This extra session was scheduled due to feedback regarding lack of notice. It was held at the Corindi Trust Community Hall on Saturday 9th February 2013. At these sessions project team members were available to answer questions and clarify issues from the community.

While some concerns regarding communication in the Corindi area have been acknowledged; contact with the Corindi community has included: advertisements in a number of local newspapers (refer to Chapter 1 of this report), announcements on local radio, a community brochure and community update being mailed to residents, announcements on the Roads and Maritime website, Ministerial press release, poster at the local post office and two community email updates.

4. Roads and Maritime has established a community focus group for Corindi that includes meetings to discuss flooding within the Corindi and Arrawarra floodplain. Roads and Maritime held the first Corindi, Blackadder and Arrawarra community focus group on the 5 June 2013 to discuss issues with the community, including flooding, noise and property impacts. A second meeting of the Corindi, Blackadder and Arrawarra community was held on the 27 June 2013, and Roads and Maritime presented further information on the flood modelling for the Corindi and Arrawarra catchments and sought feedback from community members. Following this meeting, Roads and Maritime agreed to do further flood surveying and modelling in the Corindi and Arrawarra catchments (for further details, refer to section 3.3.6 of this report). Additionally, to expand on the input of local knowledge and lived experience, one-on-one meetings took place from the 12 August 2013 to 16 August 2013. This community focus group would be ongoing, with further meetings planned to work with the community to address their issues during the detailed design phase of the project.

5. Roads and Maritime would refine the flood modelling during detailed design and will consult further with potentially affected local residents during this phase (refer to management measure HF13 in Chapter 5 of this report).
6. Roads and Maritime is reviewing the ongoing consultation process as the project moves towards detailed design. Residents have raised a range of concerns regarding the upgrade and there will be further consultation. Roads and Maritime would continue to communicate and consult with the local community during the design and construction phases of the project.
7. The issues raised in the submission would be discussed as part of the on-going consultation process between Roads and Maritime and the respondent. In the initial arterial road upgrade, access to the service station would be provided from the Kungala Road intersection (a left-in, left-out and right-in arrangement) via a local access road.

To gain access to the highway, patrons would need to travel back down to Kungala Road. This access was designed based on road safety, current design standards and functional requirements. Roads and Maritime has consulted with the owners regarding this access. In the upgrade to motorway standard, access to the highway from Kungala Road would be closed and access to Kungala Road and the service station would be via the western service road.

8. Roads and Maritime would continue to consult with the community and affected landowners during the detailed design and construction phases of the project. A cane farm strategy (refer to Chapter 3 of this report) has been developed to consider changes to cane farm management and access.
9. Roads and Maritime would include DPI (Fisheries) in discussions regarding the detailed design of waterway crossings; including culverts (refer to revised management measure B16).
10. It is acknowledged that Crown land stakeholders may consist of reserve trust, local council or tenure holders. Roads and Maritime would consult with all stakeholders regarding acquisition.
11. Roads and Maritime has committed to ongoing consultation with Aboriginal stakeholders during the detailed design and construction phases (refer to management measure AH10).

2.10 Hydrology and flooding

2.10.1 Effect on waterways

Submission number(s)

114, Department of Primary Industries (Fisheries).

Issue description

1. What are the flooding impacts on Champions Creek? Would this impact on the flood immunity of Somervale Road?
2. Proposed rock chute and plunge pool identified for the Picaninny Creek diversion pose an obstruction to fish passage and are thus inappropriate for Class 1 to 3 waterways.

Response

1. The impact assessment found that the area upstream of the Champions Creek crossing would experience localised impacts of up to 370 millimetres in the 100 year ARI flood event. This would dissipate to less than 250 millimetres increase within 120 metres upstream of the project boundary and to 150 millimetres impact within 250 metres.

Residents rely upon crossing Somervale Road in local flood events before extended periods of inundation in subsequent Clarence River flood events. The impacts of the project would reduce the time available for access to and from a residence on a private access track on the northern bank of Champions Creek.

This reduction in time would affect the ability of the residents to prepare for any subsequent loss of flood access in long duration Clarence River flood events.

As a result of flood impacts upstream of the bridge over Champions Creek not meeting the flood management objectives for this area, measures have been proposed to be adopted at the detailed design phase. These measures may include lengthening of the bridge over Champions Creek. The area where Somervale Road crosses Champions Creek, around 460 metres upstream of the project boundary, would experience impacts of about 90 millimetres in the 100 year ARI flood event (and 70 millimetres impact in the 20 year ARI flood event).

If necessary, Somervale Road and the private access track on the northern bank of the creek would also be raised to mitigate impacts on flood access and evacuation – assuming lengthening of the bridge over Champions Creek would not be a viable option to mitigate these impacts (refer to management measure HF13 in Chapter 5 of this report).

2. A management measure was provided in the EIS in recognition of the fact that the detailed design of creek realignments is needed (refer to management measure HF7 in Chapter 5). This management measure has been revised to include consultation with DPI (Fisheries) on the final design for creek realignments including any features such as plunge pools and rock chutes.

2.10.2 Operational flooding impacts - velocity

Submission number(s)

021, 081, Clarence Valley Council.

Issue description

1. A 20 per cent increase in velocity from Cassons Creek will increase scouring and result in floodwaters moving equipment and vegetation. The EIS states this would be contained in the creek- this is incorrect.
2. Concern about whether floodwater flow, volume and velocity have been underestimated around Harwood Bridge where recent floods have resulting in severe erosion.
3. Section 6.11.3 of the EIS identifies that an impact of the project will be a decrease in the "flood immunity" of the Maclean levee from an estimated overtopping of 1 in 36 years to 1 in 35 years.
4. Has the hydrology working paper assessed the required openings under approach roads (overpasses and interchanges)? If not, the capacity of openings under approach roads should be assessed in detailed design.

Response

1. The EIS or the Working paper – Hydrology and flooding does not state that the flows / water would be contained within Cassons Creek.

Figure 6-2 in Chapter 6 of the Working paper – Hydrology and flooding shows that the predicted increases to velocities are localised to the areas immediately upstream and downstream of the project. Hence, these velocity changes are not likely to impact livestock and native wildlife downstream (or upstream) of the upgrade.

2. A preliminary geomorphological assessment was undertaken as part of the Working paper – Hydrology of the predicted changes to bed and bank velocities for a range of flood events including common flood events (either two year ARI or five year ARI) and rarer flood events (20 year and 100 year ARI events). A detailed geomorphological assessment would be undertaken during the detailed design phase for all waterways with an aim to minimise changes to natural stream flow and velocity.

The assessment would include an investigation of scour protection at all waterway crossings, particularly banks adjacent to bridges and inlets and outlets of culverts. To avoid erosion and scouring of embankments as a result of flooding, all disturbed areas across the project would be stabilised and revegetated progressively. Drainage channels would be lined to avoid localised erosion and scouring control would be provided at the entrance to drainage structures.

The design of bridge piers in waterways would be in accordance with the NSW Office of Water guidelines for instream work and watercourse crossings to minimise the impacts to the stability and hydrology of the water course. Measures to mitigate potential downstream impacts may include energy dissipating structures to restrict stream velocities, rock armouring or increasing culvert or bridge size, and revegetation to reduce the potential for scour and erosion (refer to management measure HF6 in Chapter 5 of this report).

3. This statement is correct. The flood immunity of the levee at Maclean would reduce from overtopping of 1 in 36 years to 1 in 35 years.
4. The design that was assessed in the hydrology and flooding modelling (Working paper - Hydrology and flooding) included the culvert and flood relief structures required for all overpass roads, service roads and embankments for interchanges.

However, further hydrology modelling would be undertaken during the detailed design phase to review the design.

2.10.3 Operational flooding impacts – afflux and inundation

Submission number(s)

021, 030, 049, 081, 087, 088, 100, 105, 110, 117, 127, 131.

Issue description

1. The project would result in an increase of flooding of 33 millimetres which would overtop the levee on our property (Plenkovich Road, Broadwater), inundating the property and affect our farming business in the event of a 1 in 20 year or 1 in 50 year flood.

2. The project in the Richmond Valley would result in large flood events cutting off the highway, longer flood inundation, greater flood depth, increased inundation of properties and houses resulting in increased damages cost to structures and highway maintenance.
3. The project could dam the floodplain immediately east of the existing highway between Ferry Park, Maclean and south to McIntyres Lane. For the flood slots under the highway to spread the floodwater further uphill, the level of the Clarence River needs to rise substantially and would result in increased velocity and volume of flood waters in the South Arm and Shark Creek areas. This would affect townships downstream such as Maclean, Harwood, Palmers Island.
4. The project would act as a dam and change direction of water through bridges which are inadequate for water volumes flowing in Corindi area.
5. Would there be an increase in flood levels on the respondent's property.
6. The recent upgrade of the "Clover Leaf" section on the southern side of Harwood Bridge resulted in floodwaters taking longer to run off. As such raising the highway near Yamba Road would cause a damming effect. It is imperative drainage pipes allow flood waters to take their natural flow and eliminate the damming effect.

Response

1. The levee near this property is located at about 2.9 metres AHD. The existing flood levels at this location for the 50 year ARI flood (during which the impact of 33 millimetres is experienced) is about 3.4 metres AHD. Therefore, the levee would be overtopped during the 50 year ARI flood regardless of the project.

However, it is possible that the immunity of this levee may be reduced as a result of the project, as the probability of a 25 year ARI flood overtopping the levee has increased.

Flood modelling results at this location show that the levee currently overtops at a flood probability between the 20 year ARI (2.7 metres AHD) and 50 year ARI (3.4 metres AHD) events. Based on flood levels at this location, and the height of the levee, it is estimated that the levee has an existing immunity of around the 26 year ARI, corresponding to an annual exceedance probability of 3.8 per cent (ie there is currently around a 3.8 per cent chance of the levee overtopping in any given year).

As a result of the project, it is estimated (based on the levee height and modelled results of the 20 and 50 and 100 year ARI flood events) that the flood immunity of the levee would be reduced from the 26 year ARI to around the 25 year ARI. This corresponds to an annual exceedance probability of 3.9 per cent (ie there would then be a 3.9 per cent chance of the levee overtopping in any given year with the project in operation).

This represents an increase of 0.1 per cent or 1 in 1000 chance of the levee overtopping in any given year, as a result of the project. Or to put it another way, the chance of the project being the difference between the levee being overtopped or not being overtopped in any given year is around 1 in 1000.

Further flood modelling would be undertaken during the detailed design phase of the project to review the assessment assumptions and this potential impact and identify any appropriate management measures.

2. The project aims to retain / mimic the existing flooding / hydrology behaviour where possible. The highway does pass through the mid Richmond River and the Lower Richmond River floodplains. The highway has been designed to be above the 20 year ARI flood event. This has included, where required, that the road be constructed on embankments. The embankments have been designed with appropriate culvert and bridge structures to enable the passage of floodwaters under the highway. These culvert and bridges would also aim to minimise any increase in flood depths. Flood impacts on these floodplains are detailed in Section 16.6 and 16.7 of the Working paper – Hydrology and flooding.

While the project would still be operational for flooding events greater than the 20-year ARI with reduced capacity and nuisance flooding, some floods larger than the 20 year ARI flood could still cut off the highway. However, this would be in fewer places and overall, the project would flood less often. The project would reduce the probability of the highway being cut off in any given year from more than 18 per cent to less than five per cent.

The period of inundation will vary for different locations in the floodplain, however the flood management objectives for the project state that the period of inundation would not be increased by more than five per cent. Increases in inundation period can be seen for different locations along the project boundary in the flood level plots presented in Appendix G of the Working paper – Hydrology and flooding. Any increase in peak flood height would be within the stated flood management objectives. These objectives would be used for any design modifications during the detailed design phase.

Houses within the area of flood impact (ie increase in peak flood levels) would experience an unavoidable but minor reduction in flood immunity as a result of the project. This means that for any given property that experiences an increase in peak flood levels as a result of the project, there would be a slightly greater probability of the specific flood event occurring which causes water to enter the house. However, the increase in this probability is very small.

The increase in the cost of damages as a result of this decrease in immunity has been assessed for affected areas on the Clarence River and Richmond River floodplains. The assessment shows that for all affected areas, the vast majority of houses would experience an increase in average annual flood damages of up to \$50 (refer to figures 6-49 and 6-50 in Working paper – Hydrology and flooding).

3. The hydrology and flooding study has assessed the impacts of the highway on the Clarence River and impacts to surrounding areas such as Shark Creek, Maclean, Harwood and Palmers Island (refer to Section 6.11 of the Working paper – Hydrology and flooding).

The project aims to retain the existing hydrology behaviour where possible. The impact of the embankment across the floodplain to the east of the existing Pacific Highway at Ferry Park, Maclean and south to McIntyres Lane has been found to limit increases in peak flood levels to the west of the highway to no more than 25 millimetres in design flood levels of up to the 100 year ARI flood event which is within the flood management objectives. The Clarence River model showed that there would be no change to the direction of watercourses or the direction of flood flows except for constriction into and expansion out of discrete openings (culverts and bridges) and construction diversions. As such there would be limited change to flood flows and velocities as a result of the project.

Details on the flood model used to simulate the Clarence River floodplain can be found in Section 4.9.1 of the Working paper – Hydrology and flooding. The Clarence River flood model adopted accepted techniques of numerical flood modelling to generate these results. The Clarence River flood model was calibrated and verified against the flood events occurring in March 2001, May 1996 and May 1980. An independent review of flood modelling was undertaken in July 2012 (WMAwater, 2012) and found that the modelling approach taken was appropriate (refer to Section 2.2.6 on page 33 of the Working paper – Hydrology and flooding).

Hydrology and flood modelling undertaken as part of the project identified that the current Goodwood Street underpass is an important floodwater flow path and that with the new interchange at this location, sufficient culverts and drainage structures would be required to facilitate the movement of floodwaters. Banks of eight cell culverts cross the interchange to enable the west-east movement of floodwaters from the Clarence River South Arm to enter the Chaselings Basin to the east.

Chapter 4 of this report includes a design refinement for the interchange at Maclean, to avoid lower ground and an area of soft soils. This design refinement has maintained the drainage structures as were identified in the EIS to enable floodwaters to enter the Chaselings Basin.

4. The proposed location of culverts (approximate station 4.4 and 4.7) and bridges (approximate station 4.0 to 4.3) would minimise changes in flow direction and flood behaviour.

An analysis was carried out to determine the sensitivity of the flood impacts to assumptions of culvert and bridge blockage during the 100 year ARI flood event. Along the floodplain between the Corindi River and Cassons Creek, flood levels upstream of the project embankment would experience an increase in impact of less than 25 millimetres. This increase in impact is contained within an area of around 8.4 hectares. Upstream of the Cassons Creek crossing, flood levels would experience an increase in impact of less than 20 millimetres. Upstream of the Corindi River crossing, increases in impact are less than 10 millimetres. This decreases to zero impact within around 125 metres of the project boundary. Downstream of the Corindi River, flood levels would decrease in all flood events. Further hydrological and flooding assessment is provided in Section 3.3 of this report.

Management measures for waterway diversions (HF7 and HF8) and to meet flood management objectives (HF23) are included in the EIS (refer to Chapter 8 of the EIS).

5. Flood model results at this property show that under existing conditions, the 100 year ARI peak flood results in half of this property being inundated.

As a result of the project, peak flood levels in the 100 year ARI flood are expected to increase by less than 15 millimetres. Depending on the gradient of the terrain on the property, this could marginally increase the extent of inundation of the property.

Design of the project crossing at Halfway Creek is being revised as part of the detailed design phase. Updated flood modelling results due to design changes are not yet available. However, any flood impacts would be maintained below the flood management objectives for the project. Information on the flood management objectives can be found in Section 2.1 of the Working paper – Hydrology and flooding. Consultation regarding any changes undertaken as part of detailed design would occur with the affected communities.

6. The project would not cause a damming effect. Currently, the design south of Harwood Bridge features two culverts to enable the passage of flood waters from west to east across the project. This would be bunded to the west to separate the freshwater of the cane drainage system and the brackish water to the east. Further assessment of the drainage under the highway would occur during detailed design in consultation with the community.

Additional hydrology work was undertaken to identify opportunities to provide additional flood flow capacity and improve recession of flood water to the drainage system for James Creek floodplain. This has been an issue raised by the cane industry and is captured in the Cane farm Strategy (refer to Chapter 3 of this report).

2.10.4 Operational flooding impacts - duration

Submission number(s)

079.

Issue description

1. Concerns that the project would increase flood duration for areas surrounding Woodburn, particularly from Bungawalbyn Creek.

Response

1. The areas surrounding Woodburn are currently affected by backwater flooding of Bungawalbin Creek overflow during 20 year ARI events.

Impacts to peak flood levels in these areas as a result of the project are minimal - less than five millimetres in the 50 year and 100 year ARI flood events (refer to Appendix G of the Working paper – Hydrology and flooding). This impact is experienced specifically during peak flooding.

It is understood that duration of flooding is a particular issue for these areas. However, there would not be any change to the duration of flooding in these areas as a result of the project and rate of recession would remain unchanged from current conditions. Flood flow recession of all major drainage paths would not be affected.

2.10.5 Flooding and hydrology assessment method

Submission number(s)

021, 050, 061, 081, 088, 104, 110, 131, Coffs Harbour City Council.

Issue description

1. A residence has been missed from flood risk assessment, upstream of the Corindi River crossing.
2. Respondent's house is a low set dwelling and has previously flooded. No low set dwellings have been shown in the EIS along this part of the project.
3. Does not agree with flood modelling for Duck Creek to be part of the Richmond River flood model.
4. Suggests a survey be undertaken east of the highway (around Duck Creek) to direct water in a northerly direction.
5. Maclean is affected by tidal influence in the damming of flood water, this is a major consideration as barometric low pressure areas and high tides should go hand in hand.
6. The project needs to ensure floodwaters recede as quickly as possible, particularly floodwater from Tuckombil Canal into Evans River. The additional barriers in the Richmond River, existing and during flood, will inhibit floodwater escaping. Appropriate consideration to these barriers must be included in flood models.
7. The 1974 flood, a record flood for the Shark Creek area, does not appear to have been taken into consideration in the models.
8. The use of the 1 in 100 year flood level as the height to build the highway between Tuckombil Canal and Lang Hill, rather than the 1 in 20 year flood level.
9. Landfill across the Ballina floodplain has locked up Fishery and Emigrant Creek floodwater (including the Ballina bypass, Tintenbar to Ewingsdale upgrade project and other development).
10. The highway design fails the flood impact objectives for the Corindi River catchment for flood increases upstream, soffit levels and flood immunity. The proposed management measures include:
 - Station 4.0: bridge over Corindi River floodplain to be revised to reduce impacts upstream to within flood management objectives.
 - Station 4.7: bridge over Cassons creek raised to meet 1:100 year flood immunity and debris clearance.
11. What storm durations were modelled and how were the durations determined?
12. Hydrology modelling should include an increased rainfall intensities under climate change of 20 per cent, not the 10 per cent used in the EIS.
13. Minor catchments were not included in the EIS working paper and would be assessed as part of the detailed design.

Response

1. There is a residence located upstream of the existing highway crossing of Corindi Creek. However, based on aerial photography (2010), no residence has been identified on the floodplain upstream of where the project would cross Corindi Creek and within the impacted area. However, there would be further flood modelling during detailed design to confirm this.
2. Table 4-8 of Section 4.15.3 in the Working paper – Hydrology and flooding classifies fully detached residential dwellings as 'Single storey', 'High-set' or 'Double storey'. 'High-set' refers to dwellings that are set at a height sufficient for use of the area below the house as a utility space (laundry, workspace, garage, storage, etc). All other dwellings (either single storey or double storey) are assumed to be low-set.

The assertion that a house in this area has experienced flooding above the floor is consistent with Table 4-8, which shows that 73 'single story' (ie low set) dwellings in the area of flood impact would experience flooding above the floor level in a 20 year ARI magnitude flood, and 194 single storey dwellings would experience flooding above the floor (187 less than 0.5 metres and 7 more than 0.5 metres) in a 100 year ARI magnitude flood in existing flooding conditions.

The project is expected to increase peak flood levels in this location of up to 25 millimetres in a 100 year ARI magnitude flood.

3. Modelling of flooding around Ballina, including Duck and Emigrant creeks, was undertaken in the 'Lower Richmond River' flood model - a separate model to the rest of the Richmond River floodplain. This model assessed local catchment flooding (which has a much shorter duration) of Duck, Emigrant, Chilcotts, Maguires and Sandy Flat creeks in combination with regional Richmond River flooding. For example, the 100 year ARI event was assessed by running 100 year ARI local catchment flooding in combination with the 10 year ARI regional Richmond River flood and also the 100 year ARI regional Richmond River flood in combination with 10 year ARI local catchment flooding.

This approach is common when assessing local catchment flooding in combination with regional events, and is consistent with the respondent's assertion Duck Creek has experienced severe floods when flooding on the Richmond River and Emigrant Creek was much less severe. Reported flood levels and impacts in the EIS represent the highest levels and impacts for the 100 year ARI flood in either local catchment flooding or regional Richmond River flooding (whichever is greatest) in any given location.

4. The objective of drainage design in this area is to replicate as much as possible the existing drainage system, as improving drainage in one area can adversely affect flooding in neighbouring properties. In line with this, the objective is for floodwaters to drain as per the current condition when the existing highway is overtopped.
5. Maclean is affected by tidal influence. All flood events modelled include a preceding storm surge corresponding to an equivalent probability with the flood event assessed. This is consistent with observed and expected flooding behaviour during major flood events. As a result, the flood impacts assessed for the Clarence River account for increased water levels from tidal influence, including storm surge.
6. The highway would act as a minor impediment to flow on the Richmond River floodplain to the east of Woodburn.

In some locations, (including the floodplain between Tuckombil Canal and Broadwater National Park) the project would have impacts on peak flood levels upstream, as the solution for avoiding all impacts would result in a cost-prohibitive design. The flood management objectives were designed to minimise flood impacts to within a targeted limit that, in most cases, would be acceptable to the community, given the benefit of the project. More information on the flood management objectives can be found in Section 2.1 of the Working paper – Hydrology and flooding.

The project in this location causes attenuation of peak flooding, resulting in increases in flood peak levels to the west of the project and reductions in flood peak levels to the east of the project. The increases in peak flood levels to the west of the project are within the flood management objectives of the project.

The bathymetry (terrain) of the Richmond River and floodplain used in the model to simulate existing conditions has been calibrated and verified against the flood events occurring in May 2009, January 2008, March 1974 and February 1954. The independent review of flood modelling in July 2012 (WMAwater, 2012) concluded "the flood model is deemed suitable for the assessment herein" and also that "the flood impacts are found to be reasonable and satisfy the established afflux criteria".

Flooding under existing conditions is representative of existing barriers in the Richmond River, including bridges and sand bars. The model results for conditions during project operation were tested for sensitivity to flood barriers during flooding, such as debris build-up on bridge piers. The analysis assumed a doubling of pier area on the new bridge over Tuckombil Canal to represent the effect of debris wrapped around piers. The sensitivity analysis found the impacts were insensitive to blockage with less than 10 millimetres of increase in impacts upstream. The project bridge is expected to have a much lower potential for blockage, with spans at least 15 metres longer than the existing bridge.

Details of the sensitivity analysis carried out for the bridge over Tuckombil Canal and additional blockage sensitivity analyses carried out for culverts and bridges across the Richmond River floodplain are provided in Section 6.16.3 of the Working paper – Hydrology and flooding.

7. The flood model was calibrated and verified against six (6) flood events ranging from 1890 to 2001, with the highest recorded flood event in March 2001. This level of calibration is considered appropriate. The 1974 flood, as mentioned in the submission is not the biggest flood in the Shark Creek area.
8. The minimum level of flood immunity for this project is 20 year ARI and the target immunity, if feasible, is 100 year ARI. The project, apart from areas crossing the Richmond and Clarence river floodplains, would have 100 year ARI flood immunity (further details on the flood immunity and inundation of the project can be found in section 2.5.1, response six). The level of the existing highway across these floodplains is generally well below the proposed immunity levels. Based on cost considerations, the design flood immunity adopted for the M class roads crossing the Richmond and Clarence river floodplains is the 20 year ARI. This is measured from the edge of the road pavement and the highway would still be trafficable during these flood events, with no inundation of the travel lanes. The project would still be operational for flooding events greater than the 20-year ARI with reduced capacity and nuisance flooding. The project would provide a better flood immunity level than currently exists.
9. The EIS has considered the cumulative flooding impact of the Woolgoolga to Ballina Pacific Highway Upgrade in conjunction with Ballina bypass. Assessment results are discussed in Section 6.17.3 of the Working paper – Hydrology and flooding. The assessment found the design would meet all stated flood management objectives for the area.

Assessment of flooding impacts from other developments such as urbanisation and the Tintenbar to Ewingsdale upgrade is not within the scope of the EIS. However Roads and Maritime provides for flood drainage on all of its Pacific Highway Projects, including Tintenbar to Ewingsdale and the Ballina Bypass. Management of non-Roads and Maritime development with respect to flood risk management of the Richmond River floodplain is the responsibility of the relevant Local Government authority.

10. Further hydrology modelling for the detailed design at Corindi and Cassons creeks identified that the flood management objectives were not able to be met without significant cost (for flood afflux). Alternative management measures would be considered by Roads and Maritime prior to construction and in consultation with the community.
11. The critical storm duration was used to generate the hydrological inputs to the hydraulic model for each catchment. The critical duration was estimated through hydrological modelling a range of storm events (for Corindi, 9 events between 1 hour and 24 hours) to determine the event duration which generates the greatest peak flow rate.
 - For the Corindi River at the location of the project, the critical storm duration was estimated to be 6 hours.
 - It is recognised that different durations of flooding for floods of equivalent probability may result in different patterns of flood behaviour. This can occur in floodplains with large storage volumes. However, the flood storage in the Corindi River floodplain is not large and is not an influential factor in long duration flooding. This is because the available storage does not represent a significant fraction of the flood volume. As a result, the pattern of flooding is generally expected to be maintained across floods of varying duration in this catchment.
12. Further hydrology modelling undertaken for the detailed design for the Woolgoolga to Glenugie section used a higher rainfall intensity of 15 per cent for climate change, in recognition of this issue raised by Coffs Harbour City Council.
13. Further hydrology modelling undertaken for the detailed design for the Woolgoolga to Glenugie section assessed the impacts to minor catchments. Roads and Maritime would further consult with Coffs Harbour City Council regarding these results.

2.10.6 Surface water drainage

Submission number(s)

005, 048, 066, 091, 108, 118, 128, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. My concerns relate to stormwater drainage management of downstream flows through our land (Lot 21 DP230180 and Lot 911 DP1145226, around station 80.6 to 82.8). My question is how Roads and Maritime will deal with flows from the western side of the highway.
2. Previous acquisition and road construction resulted in concentrated surface water flows creating a stormwater erosion canal (Lot 21 DP230180 and Lot 911 DP1145226).
3. The current drainage at Hillside Lane from the borrow site will be altered and may cause future flooding impacts on the pastures and creeks on and nearby our property.

4. Drainage near Shark Creek is a major concern for us as this can have a severe impact on the viability of our farming venture- the existing drainage system should at least be maintained. This needs to be included in the highway design as it is essential the integrity of this levee/drainage system be maintained.
5. There will be on-going drainage issues with this home (Lot 1 DP751372) because of the location of the highway.
6. Culverts proposed as part of the project need to be retro-fitted under the existing highway to allow water to escape.
7. The respondent is concerned about the flooding impacts on their property at Pimlico.
8. Concern raised about the normal flow of water from the respondents Woodburn property. The water from my property flows out to the north and should not be blocked by the highway upgrade. Proper drainage facilities at the southern side of the highway should be included in the plan.
9. The design and installation of drainage structures adjacent to Yaegl Nature Reserve and Mororo Creek Nature Reserve need to maintain existing sheet flow and avoid creating concentrated flows.

Response

1. Drainage across the project near Lot 21 DP230180 and Lot 911 DP1145226 has been designed to accommodate the design flow for the local catchment area to the west of the project. This means the project's flood immunity at this location is designed to cater for a 20 year ARI flood event. Within the design, there are multiple culverts located at station 80.6 north of the interchange's western and eastern roundabouts to direct cross drainage under the highway.
2. Impacts from previous road construction are not within the scope of this project. However, it should be noted that the upgrade would be constructed to current drainage design standards. These standards include improved environmental and drainage outcomes (such as the use of scour protection at culvert exits to avoid scour and erosion).
3. The current drainage would be altered as a result of the project and the use of the borrow site. Drainage across the project near Wardell Road has been designed to accommodate design flow for the local catchment area. Flood impacts associated with local catchments was not undertaken during the concept design because of the number of local (small) catchments along the project. The detailed design phase of the project would provide an opportunity for local flooding issues to be addressed. Detailed flood modelling would be undertaken during the detailed design phase. Roads and Maritime would consult with any affected landowners identified regarding the potential drainage and flooding impacts on private properties to formulate appropriate management measures.
4. Roads and Maritime acknowledges the importance of maintaining the current performance of the drainage system in the Shark Creek basin. The revised drainage system associated with the upgrade would be agreed through consultation with local land owners in this area. Roads and Maritime agrees to maintain integrity of the levee system by continuing through the project corridor.

Further review of Shark Creek drainage has been undertaken (refer to Chapter 3 of this report) and would be further investigated during detailed design in line with the Cane farm Strategy (refer to Chapter 3 of this report).

5. It is uncertain whether the respondent is referring to the natural drainage of the land or the impact of surface runoff from the highway. However, the project is not anticipated to affect natural drainage of surface water across the property.
6. At this location, the existing highway would be substantially altered. Station 87.6 to 88.1 of the project would consist of the raised interchange at Watts Lane. The existing highway would remain the service road, however no work is proposed to retro-fit culverts under the highway. This falls outside the scope of this project.
7. The objective of drainage design in this area is to replicate as much as possible the existing drainage system, as improving drainage in one area can adversely affect flooding in neighbouring properties.

The project is not expected to have any adverse effects on the flood flow of the existing drain, however, further assessment would be undertaken at the detailed design phase. There are no plans at this time to move the drain 50 metres west or to any other location.

8. Hydrology and flooding impacts from the project were assessed and documented in the Working paper – Hydrology and flooding (SKM, 2012). This assessment identified the location and sizing of drainage structures under the highway. The project has been designed with the objective of maintaining existing surface flows and flooding behaviour, including along the alignment near Woodburn.

The project includes a number of waterway opening and crossing structures (such as bridges and culverts) to convey flows safely under the road embankment. At this location (approximate station 133.3), there is a bank of 20 culverts (3.3m x 1.2m). Hydraulic modelling would be undertaken during detailed design to review the design.

9. The project would avoid concentrated flows and maintain, as far as feasible and reasonable, the existing hydrological regime. The project would not affect the day-to-day drainage and hydrological regime of the nature reserve. Further assessment would be undertaken during detailed design to consider this issue in greater depth.

2.10.7 Climate change and hydrology

Submission number(s)

061.

Issue description

1. With the large predicted sea level rises culverts must be placed deeper and the bund (7.6) would turn our property into a lake (220 acres at Uralba, Lot 1 DP501685, Lot 1 DP530628, Lot 25 DP712026, Lot 308 DP755745, Lot 356 DP755745, Lot 367 DP755745, Lot 400 DP 755718).

Response

1. The objective of drainage design in this area is to replicate as much as possible the existing drainage system, as improving drainage in one area can adversely affect flooding in neighbouring properties.

In line with this objective, the bunds to be incorporated as part of the project would be constructed to act as an impediment to flow during small events in the same manner as the existing situation but would overflow during large floods. As such any impacts experienced from climate change would not be as a result of the project (ie they would be experienced regardless of the project). Mitigating the effects of climate change (as opposed to assessing the effect of the project under climate change conditions) is not within the scope of the EIS.

2.10.8 Flood management

Submission number(s)

018, 060, 061, 065, 084, 087, 088, 088, 101, 104, 105, 131, Department of Primary Industries (Fisheries), Coffs Harbour City Council.

Issue description

1. Great care must be exercised in mitigating the effect of flooding between Whytes Lane and the Bruxner Highway.
2. Drainage structures near Tyndale 1 cane drain need to be reconsidered.
3. Underpass north of Eight Mile Lane too small for flood volumes.
4. A culvert north of Woodburn Evans Head Road would be placed on an existing dam. Respondent requests further consideration of property drainage to join the highway culvert.
5. The Richmond River bridge would partially block water from Tuckean Swamp and Broadwater Channel, overflowing the Bagotville Barrage.
6. The number of bridges between Woodburn and Wardell is a barrier to water movement.
7. The Corindi River floodplain bridge has been reduced from 400 metres and would cause flooding impacts. Flood management measures need to be extended to all fencing-safety barriers in the flood zones. Temporary fencing should consider flooding issues.
8. To allow adequate passage of floodwaters, at least 880 metres of viaduct is required across the lower Richmond River floodplain, plus the bridge across Tuckombil Canal or moved east to the flood free route.
9. Floodwaters across the basin must be interrupted to avoid impacts through the Clarence Valley. As such, land bridges should cross the floodplains between Tyndale Hill and Green Hill, Green Hill to Maclean interchange, Harwood Bridge to Mororo Bridge and across Harwood and Chatsworth islands.
10. Suggests floodgates be removed on canal near Duck Creek.
11. Suggests the levee is incorporated into the highway design to maintain integrity of levee/drainage system. Drainage provided must be at least the equivalent to the current standard.
12. Concerned that bridge span at share farming site is not wide enough and soil erosion would occur as flooding subsides.
13. Requests the use of adequate size and number of culverts and viaducts.
14. There needs to be sufficient clearance under the Shark Creek bridge to maintain the natural flow of floodwaters.
15. Proposed drainage structures affecting OPP habitat need further assessment and review to reduce expected velocities
16. Eggins Drive will need to be reconstructed at least to the 1 in 100 year flood level for flood free access to Corindi/Red Rock residential areas

Response

1. The objective of drainage design in this area would be to replicate as closely as possible the existing drainage system. During detailed design, further consultation with affected land owners would be undertaken.
2. Roads and Maritime is consulting with private land holders in the Shark Creek basin to address drainage issues in the area. Consultation and further preliminary investigations indicate a potential alternative drainage system should be considered. This would be investigated further during detailed design. Longitudinal drainage is also required to convey drainage into the Tyndale No. 1 cane drain. The drainage structures in the Shark Creek basin are under review and consultation with property owners would continue through detailed design in line with the Cane farm Strategy (refer to Chapter 3 of this report).
3. Drainage across the project near Lot 7 DP793765 has been designed to accommodate peak flow in a 100 year ARI event for the local catchment area (about 2.5 square kilometres) to the south-east of the project. The capacity of drainage at this location has been designed in combination with fauna crossing structures.

This drainage structure is 3 metres wide by 1.2 metres high. However, the structure is a multicell culvert consisting of 11 cells. This is a total flow area of 39.6 square metres.

Based on preliminary design calculations, the size of this structure appears adequate for a catchment of this size. However, culvert design for local catchments will be refined during the detailed design phase.

4. The concept design adjacent to the respondent's property includes a multicell culvert of 20 cells, each measuring 3.3 metres wide by 1.2 metres high. During construction, dams or weirs in the drain located at the project crossing would be removed and replaced with the design drainage structures.

The size and number of culverts in the concept design have been simulated in a 20, 50 and 100 year ARI design flood event using a hydraulic model, and has been found to be adequate to meet the flood impact design objectives of the project. These objectives can be found in Section 2.1 of the Working paper – Hydrology and flooding.

However, the flood modelling undertaken for the EIS has indicated that there is scope to review the location of these culverts. The exact locations of the culverts would be confirmed during detailed design. Roads and Maritime would consult with any affected landowners identified regarding the potential drainage and flooding impacts on private properties to formulate appropriate management measures.

5. Impacts to flood levels around Bagotville Barrage as a result of the new bridge over the Richmond River are in the order of 32 millimetres during the 50 year ARI event and 27 millimetres during the 100 year ARI event. These impacts would be experienced around peak flooding, or maximum flow through this area of the Richmond River catchment. There is not expected to be any impacts on the recession of flood waters in this area as a result of the project.

Peak flood velocities upstream of, and in particular, over Bagotville Barrage are expected to remain unchanged in the 100 year ARI flood as a result of the project.

This is due to flood level impacts of the project being experienced both upstream and downstream of the barrage and hence having a slight dampening effect, if any, on the hydraulic gradient over the barrage.

6. Flooding under existing conditions is representative of existing barriers in the Richmond River, including the existing bridge at Woodburn. Identification of flooding impacts from existing bridges are not within the scope of the environmental impact assessment of this project. However the flood modelling for the project has incorporated all existing structures.

Flood impacts as a result of the new bridge north of Broadwater, proposed as part of this project, is within the scope of the EIS. The upstream flood impacts as a result of this bridge are discussed in Section 6.16.3 (page 293) of the Working paper – Hydrology and flooding and presented in Figures 6-43, 6-44 and 6-45 for the 20, 50 and 100 year ARI flood events respectively. All increases in peak flood levels as a result of the bridge are within the flood level impact objective of 50 millimetres for houses, commercial premises, urban areas and cane farms.

The model results for conditions during project operation were tested for sensitivity to flood barriers during flooding, such as debris build-up on bridge piers. The analysis assumed a doubling of pier area on the new bridge over the Richmond River north of Broadwater to represent the effect of debris wrapped around piers. The sensitivity analysis found that the impacts were insensitive to blockage with less than 10 millimetres of increase in impacts upstream.

7. The project includes a 90 metre bridge over the Corindi River and a 300 metre bridge over the Corindi River floodplain. The flood assessment undertaken for the project shows that there would be no increase to flood levels downstream of the river crossing. The result of the flood level increases upstream of the upgrade is a minor flow attenuation, which enables more storage of floodwaters on the floodplain). River flood levels are increased in the Corindi River upstream of the upgrade due to the constriction at the 90 metre bridge. The levels do not increase due to any increase in flow in the river.

The length of the bridge has reduced from 400 metres to 300 metres due to more accurate flood modelling undertaken for the EIS. The project would also cross Cassons Creek via a 75 metre bridge; this was previously to be crossed by culverts.

Roads and Maritime are currently undertaking further hydrology survey and modelling in the area to calibrate the flood model for the area to recent flood events. The model outputs will be used by Roads and Maritime to determine whether any changes to the project design in the Corindi and Arrawarra catchments for the Pacific Highway upgrade would be warranted (for further details, refer to section 3.3.6 of this report). The community would be involved in and informed throughout this process through the Corindi, Blackadder and Arrawarra community focus group.

The flood model was tested for sensitivity to flood barriers including debris build-up on bridge piers. An analysis considered the potential for blockage of the proposed bridge over the Richmond River during the 100 year ARI flood event. The analysis was based on doubling the assumed bridge pier area to account for debris wrapped around piers. With the doubled pier area, impacts upstream of the bridge increased by less than 10 millimetres. As such, the model was found to be insensitive to assumptions regarding blockage.

It is acknowledged fencing could become dislodged during flood events. This issue has been raised in the fencing strategy and measures to reduce the potential of fencing being washed away would be considered further as part of this strategy.

Drainage and fencing design in this area would be subject to further consultation with landholders and detailed design. During construction, the use and location of temporary fencing would be considered in relation to potential flooding impacts.

8. The project would provide greater flood immunity than currently on the highway. The existing highway between Tuckombil Canal and Lang Hill has a 5 to 10 year ARI flood immunity. The project would improve this to a flood-immunity of 20-year ARI flood event (further details on the flood immunity and inundation of the project in section 2.5.1, response six). The flood immunity is measured from the edge of the road pavement and the highway would still be trafficable during these flood events, with no inundation of the travel lanes. The project would still be operational for flooding events greater than the 20-year ARI with reduced capacity and nuisance flooding. The hydrology assessment has reviewed the hydrology of the area and appropriately sized culverts and bridges have been proposed as part of the project to ensure that there is minimal disruption to existing flooding behaviour. The project has had to balance a number of factors including meeting the project flood management objectives and cost. However, the assessment of the mid-Richmond River found that there would not be any change to flood peak levels. However, during a 100 year ARI flood events, there would be an increase in flood levels to the west of the highway, no greater than 25 millimetres.
9. The flood impacts at Maclean and downstream villages from the project are less than 50 millimetres in all areas outside the project boundary. This excludes an area of 0.6 hectares to the north-west of the interchange at Watts Lane, Harwood. A management measure has been identified to consider the reduction of the impact in this area (management measure HF24). These impacts would be experienced during a 100 year ARI flood event. These impacts would be expected to be very close to, if not, the greatest impacts experienced in any flood event. This is because the road embankment would be overtopped during a flood event greater than a 100 year ARI flood event. The flow of water over the road is a more efficient form of floodwater conveyance than flows being constricted through the waterway opening.

The solution for avoiding all impacts, such as a land bridge (viaduct) across large areas, would result in a cost-prohibitive design. The project would minimise flood impacts to within a targeted limit. More information on the flood management objectives can be found in Section 2.1 of the Working paper – Hydrology and flooding. A discussion on why the flood free route was not selected is provided in Section 4 of the EIS

10. Unfortunately, Roads and Maritime is not able to remove these floodgates. This issue has been raised with Roads and Maritime in previous consultation, with residents either wanting them kept or wanting them removed. Roads and Maritime approached Richmond County Council regarding the issue and was informed that unless all owners agree to remove the floodgates, they should remain in place. Roads and Maritime is not intending to remove the floodgates. Culverts to be extended would be fitted with similar floodgates to replicate the existing scenario.

11. Roads and Maritime is undertaking ongoing consultation with private land holders in the Shark Creek basin to address drainage issues in the area. Preliminary review of the drainage structures in the area indicates that these structures will be removed from the design, in line with the Cane farm Strategy (refer to Chapter 3 of this report).
12. Around 40 per cent of the respondent's property would be directly affected by the twin bridge crossing of Shark Creek and the realigned highway. The project would potentially create erosion and sedimentation impacts, and change flood behaviour at the site.

Shark Creek is the only watercourse crossed by the project in Section 4 with natural bed and banks and was therefore assessed in terms of bed and bank stability. Shark Creek peak flood velocities occur when increasing flood levels from Clarence River flood events flow into the Shark Creek flood plain. The project would increase velocities at the peak of the flood from about 0.2 metres per second to about 0.5 metres per second. These are low velocities and likely to be lower than the velocities experienced on a daily basis from tidal inflows and outflows. Hence, the changes to the velocities at the peak of the flood are unlikely to result in any change to the form of the creek bed and bank, and are not likely to cause erosion and sedimentation impacts.

Flooding issues and the length of the bridge crossing would be further considered as part of the property acquisition and detailed design process.

The design of drainage structures across the Shark Creek floodplain would be further reviewed during detailed design to enable the most appropriate and cost-effective structures to be installed to meet the design flood objectives in this location of less than 50 millimetres increase in peak flood levels for cane lands.

13. Roads and Maritime acknowledges the importance of maintaining the current performance of the drainage system between Tuckombil Canal and Lang Hill. The revised drainage system associated with the upgrade would be informed through consultation with local landholders in this area. Drainage would be subject to further detailed design.

The refinement in the length of drainage structures has arisen due to more accurate modelling that has been undertaken through the use of updated models (such as the Richmond Valley Council flood model) and calibrating the model to recent flood events.

14. This assessment identified the location and sizing of drainage structures under the highway. The project has therefore been designed with the objective of maintaining the existing surface flows and hydrological regimes. The bridge across Shark Creek is 448 metres long and is sized to convey floodwaters and minimise flood behaviour as much as possible.
15. A management measure (HF9) was identified in the EIS that required further assessment in detailed design to consider appropriate velocities of flood flows through watercourses and floodplain structures (ie bridges and culverts) in areas identified as potential habitat for the Oxleyan Pygmy Perch and the Purple-spotted Gudgeon. This has been incorporated into the threatened fish management plan (refer to Appendix K).
16. Roads and Maritime is currently in discussions with Coffs Harbour City Council and the local community about the level of flood immunity of Eggins Drive and is undertaking further hydrology modelling as part of the detailed design.

2.10.9 Flood management objectives

Submission number(s)

026, 056, 088, 104, 126, 131.

Issue description

1. The highway should be flood-free, an immunity of 1:20 would have seen the highway inundated four times in the past five years.
2. The project should not worsen flooding impacts, including for smaller flood events less than 1:20 or 1:100.
3. Instead of providing a 1:20 year flood immunity, why not flood-proof the motorway entirely by increasing embankments.

Response

1. The minimum level of flood immunity for the project carriageways is 20 year ARI and the target immunity, if feasible, is 100 year ARI. The project, apart from areas crossing the Richmond and Clarence river floodplains, would have at least 100 year ARI flood immunity (refer to Figure 8-1 of the EIS). The flood immunity is measured from the edge of the road pavement and the highway would still be trafficable during these flood events, with no inundation of the travel lanes. The project would still be operational for flooding events greater than the 20-year ARI with reduced capacity and nuisance flooding (for further details on the flood immunity and inundation of the project, refer to section 2.5.1, response six).

The severity of recent flood events is acknowledged, however, designing the overall highway to be flood free in any flood event is not feasible. The project has been designed to respond to potential future floods by improving the Pacific Highway's flood immunity. The area south of Shark Creek is cut off during a 1 in 3 to 4 year (ARI) flood event. However, the project would result in a substantial improvement in the flood immunity of the Pacific Highway. Any further refinements during detailed design to proposed culvert or bridge structures would be made to at least meet this level of flood immunity.

2. Designing the overall highway to be flood free in any flood event is not feasible. The project has identified flood management objectives that set allowable flood impacts for the relevant land uses for any assessed flood event (up to 100-year ARI event). However, the project aims to retain the existing hydrology behaviour where possible, Hydrology modelling undertaken for this area (Woodburn) indicates that it would change flooding behaviour in the following ways:
 - During the 20 year ARI flood event, increase flood levels between 5 and 25 millimetres.
 - During the 50 year ARI flood event, increase flood levels between 5 and 25 millimetres.
 - During the 100 year ARI flood event, could increase by up to 5 millimetres.

The project would minimise changes to flow direction and flood behaviour, particularly at this property (refer to Section 6.10.3 and Figure 6-18 of the Working paper – Hydrology and flooding). Further assessment of the drainage under the highway would occur during detailed design in consultation with the community.

3. To totally flood proof the highway (assuming 100 year ARI flood level immunity) would require a large number of bridge structures and soft soil treatments, which would not be economical to construct. In addition, to increase the level of fill would also result in a widening of the road/project

corridor and additional vegetation clearing would be required. Along the existing highway this would result in increased impacts to prime agricultural land, residences and towns (Ulmarra and Tyndale) and greater impacts on the Coldstream wetlands.

The increase of fill to flood proof the alignment of the project would result in additional impacts to biodiversity including Commonwealth listed threatened flora and fauna species, and would require extra material which is scarce.

Further details on the flood immunity and inundation of the project is detailed in section 2.5.1 response six

2.10.10 Flood evacuation and access

Submission number(s)

001, 051, 088, 093, 107, 116, 126.

Issue description

1. The project would not improve flood evacuation as some residents would need to use flood prone local roads or the existing highway and the new highway would still flood in large flood events.
2. Project would result in increased flooding on the respondent's property and could cut the flood evacuation route near Cassons Creek. The respondent requests all weather access to Eggins Drive.

Response

1. The project will improve the upgraded sections of the Pacific Highway from existing levels of immunity (in some places less than 5 year ARI immunity) to at least 20 year immunity for the entirety of the project, the existing Pacific Highway would retain its current flood immunity. This is a substantial reduction in the likelihood of these sections of the highway being cut by floodwaters in any given year. As a result, this would generally improve the ability of people to evacuate when flooding occurs, particularly communities near areas that are a duplication of the existing highway. In some areas, people would need to use either the flood-prone existing highway (which would become a service road) or other local roads to access the highway. However, the project, in general, would not worsen the ability to evacuate in those areas. Management measures have been developed to address the rare and specific circumstances where the ability to evacuate would be worsened as a result of the project. These measures are presented in Section 8.1.8 of the Working paper – Hydrology and flooding.
2. Roads and Maritime has sought to identify and consider where the ability of residents to evacuate is worsened as a result of the project. However, it is possible that some private property owners may have individual circumstances for evacuation which may be impacted by the project which have not yet been identified. Roads and Maritime would continue consultation with property owners to identify flood evacuation issues (refer to management measure HF13 in Chapter 5 of this report).

The greatest impacts are likely to be experienced during the 100 year ARI flood event. Hydraulic modelling of the 100 year ARI flood in the Corindi River floodplain show that there are no impacts (ie, less than 1 millimetre increase) at this property, as it is more than a kilometre upstream of the project and well outside the area of flood level impact (ie where peak flood levels are raised by at

least 5 millimetres as a result of the project). The project would therefore not result in the inundation of the house in any flood event where inundation does not currently occur. An appropriate flood management approach will be proposed in consultation with the private land owners. The aim of this approach would be to mitigate the increased flood hazard presented to residents on this property due to their evacuation route being cut by the project. This issue is being considered and has been flagged for further consideration at the detailed design phase.

2.10.11 Blackadder Creek safety works

Submission number(s)

018, 021, 071, 100, 101, 117, 119, 126, Coffs Harbour City Council.

Issue description

1. Following road work in 2011, the existing Pacific Highway now acts as a dam. Inadequate drainage was placed under the raised highway section. The flood affected Corindi Beach, particularly Corindi Park Drive (Australia Day 2012). The Corindi River flood model is incorrect and did not encompass Corindi Park Drive.
2. By not having a flood focus group at Corindi, the effects of a rain event at Corindi Park Drive has not been considered in the planning of the project. Concerned that the redesign of Corindi Bridge would require increased culverts and landfills to be used increasing risk to residents of Corindi Park Drive.
3. The Blackadder Creek safety work changes have increased the level of water more than 100 ml as our homes were flooded on Corindi Park Drive.
4. Planning for bridges and embankments over the Corindi River floodplain, Blackadder and Cassons Creeks need to take this serious situation into consideration to ensure this does not affect the flooding either upstream or downstream.
5. The cumulative impacts of the upgrade and the recent work to the existing highway at Blackadder Creek should be assessed and included as part of the project detailed design.

Response

1. It should be noted this refers to the Roads and Maritime Blackadder Creek safety work project and not part of the Woolgoolga to Ballina project.

Roads and Maritime has initiated a community consultation process (separate to this project) with community members and Coffs Harbour City Council to address a range of flooding issues at this location.

The flood model has considered the cumulative impact of the project and the Blackadder Creek safety work to include Corindi Park Drive (refer to Chapter 3 of this report).

A Corindi, Blackadder, Arrawarra community focus group has been established for the Woolgoolga to Ballina Pacific Highway Upgrade to provide feedback to the community on a range of project issues, including the cumulative assessment undertaken. Roads and Maritime has undertaken further hydrology survey in the area that included inputs from various community members on their flood experiences. The extent of the flood models have also been revised and would now incorporate Corindi Park Drive. The model outputs will be used by Roads and Maritime to determine whether any changes to the project design in the Corindi and Arrawarra catchments for the Pacific Highway upgrade would be warranted (for further details, refer to section 3.3.6 of this

report). The community would be involved in and informed throughout this process through the Corindi, Blackadder and Arwarra community focus group.

2. An independent assessment of flood modelling was completed in 2012. Further assessment of the drainage through the upgraded highway is planned during detailed design in consultation with the community. In addition, a Corindi, Blackadder, Arwarra community focus group has been established for the Woolgoolga to Ballina Pacific Highway Upgrade to provide feedback to the community on a range of project issues including the cumulative assessment undertaken.

Further information regarding this issue is provided in Section 2.10.10 above.

3. The SMEC report does identify the 2011 highway work raised flood levels over the upstream side of the existing Pacific Highway.
4. A cumulative assessment has considered the Blackadder Creek safety work (not part of the project) and the Woolgoolga to Ballina Pacific Highway Upgrade (the project), which includes bridges crossings of Corindi River, its floodplain and Cassons Creek. This combined assessment indicates a reduction in flood levels between 5 and 50 millimetres for most properties on Corindi Park Drive.
5. Flood modelling includes consideration of the existing situation without the project, and then consideration of the effect of the project on flood behaviour in the future. Cumulative impacts of all existing structures are part of establishing the existing flooding situation. The Pacific Highway Blackadder Creek safety work is part of the existing structures considered in the assessment, being a raised embankment across the floodplain. A reassessment has been undertaken to consider the cumulative impact of the Blackadder Creek safety work and the project. The assessment of impacts of the project, with the Blackadder Creek safety work (and all other structures), indicates that reductions in flood levels would be between five and 50 millimetres for most properties along Corindi Park Drive (refer to Chapter 3 and Appendix C of this Submissions/ Preferred Infrastructure Report for details of predicted impacts). As part of the Corindi, Blackadder, Arwarra community focus group, Roads and Maritime has agreed to undertake further hydrology surveying and modelling work (for further details, refer to section 3.3.6 of this report).

2.11 Soils sediment and water

2.11.1 Construction impacts

Submission number(s)

036, 039, 105, Department of Primary Industries (Fisheries), NSW Office of Water, Trade & Investment, Resources and Energy.

Issue description

1. Concerns regarding environmental impacts and cost of importing large volumes of fill to construct the project across flood prone areas.
2. Considerable earthworks would be required for the Emigrant Creek bridge construction due to unstable soil (in relation to possible structural damage to property).
3. Bridge maintenance would be expensive because of acid sulfate and soft soils.

4. Fisheries NSW should be consulted during the preparation of the Construction Environmental Management Plan which should include a Soil and Water Management Plan, a Construction Flora and Fauna Management Plan and erosion and sediment control measures.
5. All work should be undertaken to minimise impacts on nationally important and SEPP wetlands and be undertaken with the objectives of minimal impact on these wetlands and consistency with the NSW Wetlands Management Policy 2010.
6. All work within 40 metres of a water course is to be undertaken in accordance with industry best practice and the requirements outlined in the NSW Office of Water 'Guidelines for Controlled Actions'.
7. All disturbed areas within 40 metres of a watercourse are to be revegetated and rehabilitated immediately after work is completed.
8. The EIS inadequately deals with geology and extractive resources and lacks detail on the importance of the Clarence Morton basin and its importance in controlling or influencing landscapes and quarry resources.

Response

1. The location of the project through the floodplains was considered as one of the constraints during route selection. The EIS identifies the embankments to be constructed across floodplains. Sedimentation and erosion controls would be implemented to manage potential impacts. It is expected with appropriate controls in place, impacts can be minimised. Once restoration and rehabilitation of the project is completed, further erosion and sedimentation is not expected.
2. Considerable earthworks would be required for the bridge across Emigrant Creek, both to consolidate soft soils and to form the bridge structure embankments. Appropriate consolidation and construction methodology would be used to address soft soils. The detailed design would be developed considering soft soil locations to enable an adequate design and construction methodology is used. All work would be completed in line with a Construction Environmental Management Plan, to minimise environmental impacts and the potential for disturbance of residential amenity.
3. The EIS identifies that south of the Richmond River crossing, there is a high probability of acid sulfate soils occurring within 1-3 metres of the ground surface and a high possibility of acid sulfate soils occurring in the bottom sediments in the Richmond River.

As acid sulfate soils are a known issue for the project, all structures including bridges would be designed in consideration of the soil conditions, and designed using acid resistant materials as per Roads and Maritime's *Guidelines for the Management of Acid Sulfate Materials* (refer to management measure SSW25 in Chapter 5 of this report). Roads and Maritime has undertaken more detailed geotechnical investigation to confirm soil conditions to enable further design to manage these conditions.

Roads and Maritime has built other sections of the Pacific Highway on soft soils (eg Ballina bypass) and is aware of the conditions and treatments available. The project would be constructed by first treating the soft soil to consolidate this ground (through methods such as surcharge with wick drains or stone columns). This would avoid excessive movement of the ground once the highway is built and minimises pavement damage and future maintenance.

4. Management measures addressing these issues have been identified in the EIS.

- A soils and water management plan and a flora and fauna management plan would be prepared (refer to management measures SSW3 and B10 respectively).
- Erosion and sediment control measures would be developed in an erosion and sediment control plan (refer to management measure SSW4). This would be in accordance with current Roads and Maritime guidelines and *Managing Urban Stormwater Volumes 2A and 2D Main Road Construction*.

Roads and Maritime will continue to consult with DPI (Fisheries) through the development of the project, including on these plans. However, given the large quantities of crossings in the project, a more streamlined approach of consultation should be agreed to the benefit of all parties. RMS would consult with agencies regarding this approach.

5. SEPP 14 and Nationally Important Wetlands have been identified as sensitive receiving environments and will be afforded the level of protection required in the Blue Book. This includes 85 percentile sedimentation basins. However, as discussed within the Working paper – Water quality, consideration would be given during detailed design to the use of 90 percentile sedimentation basins for high risk sensitive receiving environments. Work would be undertaken in consideration of the NSW Wetlands Management Policy 2010 (refer to new management measure SSW9).
6. All work within 40 metres of a waterway would be undertaken in accordance with best practice, and appropriate NSW Office of Water guidelines (including Guidelines for Controlled Actions) (refer to new management measure HF19).
7. Revegetation and rehabilitation of all disturbed areas, including within 40 metres of waterways will occur progressively as work is completed. This may include measures such as temporary cover crops.
8. Geology was assessed for the EIS based on available information and as it influences or is affected by the project. Further geotechnical investigations have been undertaken and would ensure that the design of the project is adequate for the geological conditions to be experienced on the alignment. Extractive resources have been investigated as part of the EIS; including those identified as potential material sources (refer to Chapter 6 of the EIS). Extracting resources from temporary borrow sites across the project are also discussed in Chapter 4 of this report (refer to borrow site at Mororo Road, Mororo, and west of Wardell Road, Wardell).

2.11.2 Pollution of waterways

Submission number(s)

079, 086, NSW Office of Water, Trade & Investment Resources and Energy, Richmond Valley Council.

Issue description

1. Project impacts on acid sulfate soils could contaminate waterways, wetlands and groundwater from project impacts on acid sulfate soils.
2. Accidental spills of fuels and chemicals from motor accidents and contaminated runoff from the overflow of water control ponds could impact on swamp lands and floodplain.
3. Council does not support resumption of the Broadwater landfill for the service road alone. Roads and Maritime should resume the entire site and decontaminate the land before changing its use. Council will not accept the road dedicated back to Council.

Response

1. The project passes through areas of high potential of acid sulfate soils, (refer to Chapter 9 of the EIS) and could disturb acid sulfate soils. These soils are typically encountered during previous upgrades of the Pacific Highway and control methods and management during construction is well developed. The potential impact would be managed and mitigated through the implementation of the relevant measures and procedures set out in the *Acid Sulfate Soil Manual* (Stone et al., 1998) and *Acid Sulfate Soils Assessment Guides* (Ahern et al. 1998).

Measures for management of acid sulfate soil would be identified in the Soils and Water management plan (refer to management measure SSW3 in Chapter 5 of this report). This includes the use of acid-resistant construction materials as per Roads and Maritime's *Guidelines for the Management of Acid Sulfate Materials* and development of an acid sulfate soils management plan (refer to management measure SSW25 in Chapter 5 of this report), and neutralisation of acid caused by disturbance of acid sulfate soils in accordance with applicable guidelines.

2. The project includes measures to avoid accidental spills of petroleum, chemicals and hazardous materials from vehicle leaks or road traffic incidents. This includes installing water quality ponds that contain accidental fuel and chemical spills along the highway. Specifically, to prevent any spills during operation from reaching drinking water supplies, basins would be designed to accommodate spills up to 40,000 litres in size (refer to management measure SSW59 in Chapter 5 of this report). Where required, temporary sedimentation basins would be retained during operation.
3. Roads and Maritime would only acquire the land that is required to build the project and not the entire property. Once acquired, Roads and Maritime would undertake a contamination assessment and decontaminate the part of the site disturbed by the project (refer to management measures SSW17 to SSW21). Roads and Maritime would manage construction to avoid further impacts on the site.

2.11.3 Groundwater impacts

Submission number(s)

051, 079, 093, Department of Primary Industries (Fisheries), NSW Office of Water, Rous Water.

Issue description

1. Construction and operation of the project could impact the quality of groundwater sources including drinking water from infiltration of sediments, particulates and soluble pollutants.
2. There is a lack of data for the Harwood to Woodburn section and Glenugie to Grafton section. This data is important to identify groundwater impacts and mitigation.
3. An Acid Sulfate Soils Management Strategy should be developed to identify management measures for the potential oxidisation of ASS due to a drop in groundwater levels.
4. Any groundwater work where water is extracted or supplementary groundwater collected, and is subsequently used for the purpose of water supply requires a licence under the Water Act 1912, or in accordance with the appropriate Water Sharing Plan under the Water Management Act 2000.
5. A monitoring program must be implemented to monitor impacts of the development on surface water resources, groundwater resources and wetlands. A minimum monitoring period of three years following construction or until the waterways are certified by an independent expert as being rehabilitated to an equal or better condition should be undertaken. NSW Office of Water should be consulted about these plans.

6. Rous Water has requested that there are a number of different issues that need to be considered as part of detailed design for the Woodburn bore field. This includes salinity, 'short-circuiting' of the clay layer, the development of a wellhead protection zone and consideration of the 12 elements of the Australian Drinking Water Guidelines Management Framework.
7. Field investigation to determine ground water recharge and flow behaviour in the area of the Woodburn Water Supply local ground water management area should be undertaken followed by a review of management measures.

Response

1. The EIS acknowledges potential impacts to groundwater. However, by implementing management measures adverse impacts on water quality are unlikely. Management measures include soil and erosion controls (refer to management measure SSW26 in Chapter 5 of this report) and using sedimentation basins to capture runoff before discharge into the surface and groundwater environment. Basins in the Rous Water bore field would be lined to avoid infiltration to groundwater. Water quality and groundwater monitoring would occur during construction (refer to the draft water quality monitoring protocols in Chapter 3 of this report).

During operation, water quality basins would be installed to capture runoff from the road surface. Use of lined swales would also be considered during detailed design, and specified within the construction contract where required.

2. Additional geotechnical investigations were undertaken during the preparation and exhibition period of the EIS. These investigations included the installation of over 100 piezometers along the alignment. This additional information was reviewed as part of the additional investigations (refer to Chapter 3 of this Submissions/ Preferred Infrastructure Report) and enabled better categorisation of cuttings and identification of management measures through this area. The review of groundwater levels identified 31 cuttings along the project that were reclassified. Between Harwood and Woodburn, 18 cuttings were revised (16 cuttings being revised to a type A cutting and two revised to a type B cutting).

In Section 3 (Glenugie to Tyndale), three cuttings were revised to type B cuttings. The revision in cutting types enables the appropriate level of management (as identified in the EIS) for each cutting type.

3. Management measure SSW3 identifies that a soils and water management plan would be developed that would address acid sulfate soil issues. This management measure has been revised to include specific reference to oxidisation of acid sulfate soils due to reduction in groundwater levels. Refer to Chapter 5 of this report.
4. Roads and Maritime would obtain any necessary licences or approvals for the use of groundwater.
5. Roads and Maritime has developed three interim Water quality management protocols, which address both surface water and groundwater including relevant items noted in this submission. A summary of these protocols is provided in Chapter 3 of this report. Roads and Maritime has consulted with relevant Government agencies including NSW Office of Water regarding the development of these protocols, which would be consolidated into one overall Water Quality Management Program, as detailed in Working paper – Water quality.

6. Roads and Maritime would continue to work with Rous Water to identify and manage impacts as a result of the project. The potential for ingress of seawater has been addressed in Section 3.2 and Chapter 6 of the Working paper – Groundwater. Salinity was also addressed in the working paper, identifying that there are no known occurrences of natural salinisation in the area. As part of identified management measures for cutting type A, presence of or potential for salinisation would be considered before construction.

In addition, the water quality monitoring protocols would monitor for sodium in groundwater samples (refer to Chapter 3).

The potential for ‘short-circuiting’ in the clay layer and development of a wellhead protection zone to identify the distance between the project and operational bores are acknowledged. A management measure was identified in the EIS (refer to Chapter 5 – SSW57) requiring consultation with Rous Water to define the appropriate buffer zones between the project and the bores.

The 12 elements of the Australian Drinking Water Guidelines Management Framework would be considered in consultation with Rous Water during detailed design and development of water quality management measures (refer to new management measure SSW 58).

7. Roads and Maritime is currently consulting with Rous Water regarding a study to determine the recharge and flow behaviour of the Woodburn borefields. Roads and Maritime would continue to consult with Rous Water regarding mitigating impacts to the Woodburn borefields. This would include consideration of the similar treatment as identified in the Tintenbar to Ewingsdale upgrade (refer to management measure SSW56) or potential relocation of a bore. However, other methods with the same or better environmental outcome would also be considered.

2.11.4 Water quality controls

Submission number(s)

086, 096, Department of Primary Industries (Fisheries), NSW Office of Water, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. Request for careful planning regarding the construction and location of water control ponds adjoining the respondent's property.
2. Dispersal of runoff caught in water ponds would require careful coordination with cane drainage and no adverse impact on adjacent farming operations.
3. All sediment basins should be constructed above the water table or lined with impermeable material.
4. The project requires the installation of temporary and permanent sedimentation basins and litter traps to intercept any runoff from construction site and the final road pavement into sensitive areas such as Mororo Creek Nature Reserve and Yaegl Nature Reserve.

Response

1. The design and location of temporary sedimentation basins and permanent water quality ponds have been included in the EIS, but would be further considered during detailed design. Basins and

ponds would be located to provide the optimal collection of surface runoff. Should land be acquired for permanent or temporary basins, this would be undertaken as part of the property acquisition process. However, for temporary sedimentation basins, Roads and Maritime may lease land for the duration of the construction following consultation with individual landowners.

2. It is noted that the drainage structures for the highway would need to be coordinated with the cane drains to avoid adverse impacts. This would form part of the cane farm strategy identified for the project (refer to Chapter 3 of this EIS).
3. Sedimentation basins would be designed in accordance with the guidelines of the 'Blue Books' (Landcom, 2004 and DECC, 2008a), and Roads and Maritime' Technical Guideline – Temporary Stormwater Drainage for Main Road Construction (Roads and Maritime, 2010b). (refer to management measure SSW26 in Chapter 5).
4. The EIS identified these areas as sensitive receiving environments. Along the project, the risk of adverse impacts from erosion and sedimentation can be reduced to minimal levels with the application of the proposed impact mitigation and management measures, including standard soil erosion and sediment controls and other construction site management procedures. With the implementation of the proposed measures during construction, adverse impacts on water quality and sensitive receiving environments would be unlikely.

Management measures would include the use of sedimentation basins to capture runoff from the work before discharge into surface water (and groundwater). During operation, permanent water quality basins and grassed swales would be installed to avoid impacts of surface water run-off, sediment and erosion. Litter would be managed as part of Roads and Maritime' operational management system.

2.12 Biodiversity

2.12.1 Loss of vegetation

Submission number(s)

010, 014, 015, 017, 020, 023, 027, 028, 033, 034, 036, 037, 038, 040, 041, 044, 045, 046, 051, 052, 054, 057, 058, 059, 061, 070, 076, 078, 083, 085, 092, 093, 098, 111, 120, 123, 125, 126, 129, 130, Coffs Harbour City Council

Issue description

1. The project will result in the clearing of 948 hectares of vegetation comprising 337 hectares of Threatened Ecological Communities (TECs), including the Nationally listed Lowland Rainforest of Subtropical Australia. Areas of particular concern were through the Glenugie to Maclean areas and the Broadwater to Coolgardie areas.
2. The heavy vehicle checking stations and rest areas between Woodburn and Ballina would destroy vegetation if not located in cleared areas.
3. The soil micro-organism structure may change due to imported materials and changes in drainage patterns. This could be a risk to vegetation communities.
4. The loss of native vegetation on the respondents property, a treed strip between the cane farm and the project, will impact on wildlife.
5. Extensive clearing of Lowland Rainforest will result in fragmentation and loss of ecological connectivity.

6. The EIS does not show how much vegetation or community types would be removed from the Coffs harbour LGA.

Response

1. Impacts to biodiversity were taken into account during the route options phase. Extensive investigations were undertaken throughout the development of the project with regard to route selection and concept design to avoid or minimise impacts on high value habitat and Threatened Ecological Communities (TECs).

As outlined in Chapter 10 of the EIS there would be impacts to State and Commonwealth listed species, populations and communities as a result of the project. The sections of the project that deviate from the existing highway alignment have the potential for greater biodiversity impacts, particularly where it passes through areas of native vegetation. This includes the section between Glenugie and Tyndale and the section between Broadwater and Coolgardie. The project has sought, where possible, to pass through cleared areas. However, there would be some residual impacts.

Supplementary biodiversity surveys undertaken and design refinements proposed as part of the Submissions/ Preferred Infrastructure Report has revised this amount to around 932 hectares of vegetation to be cleared and 262 hectares of TEC, which is a reduction from the EIS (947 hectares and 337.7 hectares respectively). Refer to Appendix J of this report for the Supplementary Biodiversity Assessment for further details.

In particular, design refinements have been proposed at the interchange at Wardell that reduces the impact on Lowland rainforest communities. This would impact 4.2 hectares of the community (2.0 hectares being the Commonwealth listed Lowland Rainforest of Subtropical Australia). This is a decrease from the EIS design, where 10.3 hectares of Lowland Rainforest communities would be impacted (5.8 hectares being Commonwealth listed).

The principles of avoiding and / or minimising loss of native vegetation would continue to be applied to any further design refinements undertaken during detailed design, and during construction.

In addition to these management measures, Roads and Maritime will implement a Biodiversity Offset Strategy (detailed in Appendix C of the Working paper – Biodiversity). This strategy would be further developed, in consultation with relevant state and Commonwealth agencies, and would address the aims of the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012) and OEH Principles for the use of biodiversity offsets in NSW.

Roads and Maritime is currently investigating offsets for high priority Commonwealth listed species, including surveys of potential offset properties. Preliminary findings have been included as part of the Supplementary Biodiversity Assessment (refer to Appendix J).

Further details of the Biodiversity Management Framework are in Section 2.12.2 (response one).

2. In keeping with the *Strategy for Major Heavy Vehicle Rest Areas on Key Rural Freight Routes in Rural NSW* (Roads and Maritime 2010) on the Pacific Highway, rest areas for the project need to be:

- Located around 50 kilometres apart.
- Situated on or near a crest.

This enables travellers' adequate opportunities to stop along their journey. Where possible, rest areas are located within cleared areas, however, the location of rest areas must balance these design constraints with the environmental and social constraints found within the corridor. Further details on the rest area strategy and the review of options considered for the rest areas at Pine Brush and north of the Richmond River are provided in section 3.10 of this report.

Roads and Maritime has further minimised vegetation loss by proposing two rest area design refinements. The rest area at Pine Brush would be relocated south to an area between Bostock Road and Somervale Road. The rest area north of the Richmond River has been relocated further north, with the northbound rest area relocated around 200 metres north, and the southbound rest area moved north of Old Bagotville Road.

The design refinement to the rest area at Pine Brush would result in a reduction of vegetation to be removed by around three hectares. Impacts to threatened ecological communities would be reduced by about 1.2 hectares (refer to Table 4-12 in this report) and there would be a reduced impact to the threatened species *Angophora robur* by around 408 individuals. This also provides a net beneficial outcome to known threatened fauna species habitat.

The design refinement of the rest area north of Richmond River has targeted areas of disturbed or partially cleared vegetation, resulting in a reduction in vegetation removal by around six hectares. The heavy vehicle checking station proposed at this location has been removed to reduce the footprint of the facility. The design refinement has also allowed the inclusion of an additional fauna landbridge at station 147.6 and the upsizing of a culvert to 3m x 3m to provide a combined fauna crossing structure. This provides substantial improvements to terrestrial fauna connectivity in this section.

Assessment of these design refinements are provided in Chapter 4 of this report.

3. Construction of the project would be undertaken in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011). These guidelines include the need to consider the physical and chemical properties of the existing soils and their organic profile. Soil in areas to be revegetated should match surrounding soil conditions as closely as possible unless adjacent areas are weed infested or contaminated. In addition, the project aims to retain the existing hydrology behaviour where possible; this includes cross drainage through the upgrade between tracts of native vegetation.
4. The strip of treed land mentioned in the submission is along the property boundary, adjacent to the existing Pacific Highway. The vegetation is identified as swamp forest and would provide habitat to common fauna species. However, this strip has not been identified as a fauna movement corridor or contributing to a continuous area of vegetation. Management measure UD3 also specified the project's urban design and landscaping strategy would be further developed into detailed landscape design in line with the Landscape Guidelines (RTA, 2008), to minimise landscape impacts from vegetation loss.
5. A design refinement has been proposed (refer to chapter 4) at the interchange of Wardell which would reduce the impact on Lowland Rainforest. The project would impact around 4.2 hectares of

Lowland Subtropical Rainforest (NSW listed) in Section 10. Only 2.0 hectares of this has been identified as meeting the criteria for listing under Commonwealth legislation. The impacts to the Commonwealth listed vegetation is still considered to be significant, due in part to the heavily clearing of the community (with an estimated twenty five per cent remaining). The residual impacts on this EEC have been assessed in accordance with the TSC Act and EPBC Act requirements in both the EIS and in the Supplementary Biodiversity Assessment (refer to Appendix J).

6. Council comments are acknowledged. The assessment of biodiversity has not been broken into specific LGA areas as the project covers four LGAs. Roads and Maritime is happy to discuss specific impacts in the Coffs Harbour LGA with council during detailed design.

2.12.2 Fauna connectivity

Submission number(s)

005, 010, 028, 031, 035, 047, 054, 057, 059, 064, 087, 090, 102, 112, 123, 125, Department of Primary Industries (Fisheries), Trade and Investment (Crown Lands), Coffs Harbour City Council, Ballina Shire Council, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. Concerns about the inadequate number of fauna connectivity structures across the alignment, with resulting severance of important wildlife corridors affecting the long-term viability of many species. In particular, Glenugie to Maclean, Broadwater to Coolgardie, and threatened mammal populations between the Clarence River north arm to Oakey Creek.
2. Concerns that the use of fauna crossing structures by fauna is unproven and have not been tested and they will not work for all species, in particular the Coastal Emu population.
3. Offset areas will not be able to compensate for the loss of wildlife corridors between Glenugie and Maclean.
4. No fauna crossings have been provided for the Pretty Faced Wallabies near the respondent's property, where a resident mob is established.
5. All Class 1 waterways (with known or potential Oxleyan Pygmy Perch (OPP) or other threatened species habitat) should have appropriate structures to cross the waterway, such as a bridge or arch. Of particular note is the crossing at station 134.6, where a culvert is proposed.
6. Widened medians should be retained in any future upgrade.
7. A rope or timber pole crossing (for arboreal fauna) at station 17.0 is adjacent to a highly modified area and should be relocated, similarly a rope or timber pole crossing at station 140.6 terminates on its western side on Crown land reserved for a rubbish depot that could be used as such in the future. This structure should also be relocated. A culvert at station 143.8 terminates in close proximity to Broadwater Quarry, which may dissuade fauna from using the crossing.
8. Dedicated and combined fauna crossings should not be co-located with roads (eg the crossings associated with Somervale Road underpass and Minyumai Road overpass).
9. Key Habitats and Corridors' (Scotts 2003) should be used as a guide for the location of fauna overpasses/underpasses in the Arrawarra/Corindi sections of the project.
10. The connectivity strategy needs to consider habitat enhancement/reconstruction leading into and away for connectivity structures as far as possible.
11. The connectivity structures proposed in EIS don't match with those proposed in route selection process, eg 4 bridges, 2 major and 6 minor structures were proposed in route selection, but EIS relies on culverts for fauna movement.

12. EPA recommends connectivity goals are updated for Rufous bettong, brush tailed phascogale, long nose potoroo, common planigale to also include facilitation of dispersal and maintain habitat connectivity.
13. EPA recommends additional column in connectivity structures table to highlight whether the proposed structure meet the design principles.
14. Grays Road overpass at station 15.7, recommends making dual use due to known species and adjacent reservations. Could replace the structure proposed further north.
15. Fencing for fauna and culverts should be installed in vicinity Mororo Creek Nature Reserve, along interface of Bundjalung National Park and Devils Pulpit Forest between stations 104 to 109.
16. The connectivity goals for threatened frog species should include "prevent and minimise road kill" as well as maintaining access to important habitat.

Response

1. The biodiversity management framework for the project includes a connectivity strategy (Section 10.4.2 of the EIS). The strategy aims to provide connectivity structures to enable wildlife to cross under or over the highway, which will to some extent reduce the barrier effect of the project. The goal of the strategy is to maintain connectivity within the landscape, and where feasible and reasonable, enhance connectivity.

The project design has included around 112 connectivity structures across the project consisting of watercourse bridges, canopy bridges, glider poles, land bridges, and underpasses. Widened medians, fauna fencing, landscaping and revegetation would also form part of the connectivity strategy. Around 35 connectivity structures would be located between Glenugie and Tyndale (Section 3 of the project). Fauna exclusion fencing would be provided through areas of vegetation and known movement corridors. Fauna fencing would restrict animals accessing the road corridor and directing them to locations where crossing through structures is available.

The project has considered the impact on populations of threatened mammals (eg Koala and the Long-nosed Potoroo). The Working paper - Biodiversity identifies that the likely presence of all threatened species across the upgrade and key locations for wildlife movement corridors. Koalas were identified as a target species within sections 7, 9 and 10 of the project. As such, the EIS proposed four dedicated land bridges (connectivity structures) within sections 7, 9, and 10 of the project. In addition, around 10 combined connectivity structures (culverts and viaducts) for small to medium mammals such as Koalas and Long Nosed Potoroos were proposed in the EIS within Section 10 of the project.

As part of the Submissions/ Preferred Infrastructure Report, further field surveys and review of crossing structures were undertaken (refer to Chapter 3 of this report). The field surveys confirmed important resident koalas and Long Nosed Potoroo populations in sections 9 and 10. The assessment also made recommendations for the augmentation of or additional culvert structures to facilitate further connectivity. As such, the design refinement for the rest area north of the Richmond River includes a new fauna land bridge at station 147.6 and upsized culverts at stations 148.6 and 146.6 to provide combined fauna connectivity structure.

During detailed design, Roads and Maritime would consider opportunities for further connectivity structures at the following locations in consideration of project functional constraints:

- Station: 144.2 south of the Richmond River.
- Station: 144.7 south of the Richmond River.

- Station: 156.9 south of Coolgardie Road, Pimlico.

The EIS (Section 10.4.2) notes that fauna crossing structures are particularly effective when used with fauna exclusion fencing that direct fauna away from the road and towards the structure. Fauna exclusion fencing is also included as part of the fauna connectivity strategy at these locations.

Brush-tailed Phascogales were identified as a target species within sections 1-2, 6 and 7 of the project. Widened medians and aerial rope crossings were provided to accommodate arboreal mammals including Brush-tailed Phascogales. Several combined structures were also provided across the project for mammals particularly in sections 1-2, 6 and 7 including bridge underpasses, box culverts and pipes.

In addition, around two combined connectivity structures (culverts) for small to medium mammals would also be located north of the land bridge within Section 7 of the project. Fauna exclusion fencing associated with the connectivity structures has been proposed between station 111.6 to station 128.4 (Section 7 of the project). Squirrel Gliders were identified as a target species within sections 1-2, 7 and 9 of the project. As such, around two connectivity structures (rope or timber poles for gliders and possums) have been proposed within Section 7 and around one connectivity structure (rope or timber poles for gliders and possums) have been proposed within Section 9 of the project. Fauna exclusion fencing associated with the connectivity structures has been proposed between station 137.8 to station 141.0 (Section 9 of the project).

In project sections 6 and 7 between the Clarence River north arm and Oakey Creek the project is to be constructed almost entirely as a duplication of the existing Pacific Highway alignment. The existing highway and grade line would be retained in many locations. So while the new carriageway would be on a higher elevation, fauna crossing structures would be constrained by the existing structures under the existing highway. However, Roads and Maritime recognises the importance of this area for fauna movement. As such, the design included the provision of a land bridge just south of Minyumai Road, Tabbimoble.

2. Roads and Maritime is committed to the ongoing monitoring and adaptive management of the coastal emu to further mitigate the impacts and ensure emu connectivity across the project. Roads and Maritime has been working with the EPA to identify principles around connectivity, particularly for the coastal emu, including the use of arch or bridge structure with a clearance of no less than 3.6 metres. A number of combined emu structures are proposed in Sections 3 and 4 with a clearance of at least 4.5 metres.

The connectivity strategy and structures are not intended to compensate for habitat loss, but rather provide fauna connectivity for habitat that has become fragmented as a result of the project. The effectiveness and suitability of the types of fauna connectivity structures have been reviewed based on previous studies and investigations both in Australia and internationally. Recent fauna connectivity monitoring from the Glenugie upgrade also provided encouraging outcomes and learnings.

In Australia, there are several published studies also providing measurable evidence for the effectiveness of purpose built fauna crossing structures. This includes arboreal mammals (Goldingay et al 2011), small to medium sized terrestrial mammals and amphibians and reptiles

(SMEC, 2007). Among these are several threatened fauna species such as Koala, Spotted-tailed Quoll, Squirrel Glider and possibly the Long-nosed Potoroo and Black Bittern. Land bridges are known to provide passage for macropods (Bond and Jones, 2007), particularly when fencing is used to funnel fauna and especially when land bridges contain attractive palatable grass. These structures have also been reported as important for small birds which are sensitive to fragmentation (Bond and Jones, 2007).

In NSW, Roads and Maritime has commissioned several long-term studies involving radio-tracking of Koalas pre-, during and post-construction to investigate the effectiveness of underpasses, overpasses and exclusion fencing incorporated into the Pacific Highway Upgrade. These studies have demonstrated the effectiveness of overpasses and underpasses (minimum 2.4 x 2.4 metres) for Koalas crossing the highway. Fauna crossing structures are particularly effective when used with fauna exclusion fencing that direct fauna away from the road and towards the structure. Table 10-30 of the EIS (Section 10.4.2) provides a list of common and threatened fauna species that have been reported using fauna crossing structures. Additional information on the effectiveness of structures on the project has been provided in chapter 7 of the Supplementary Biodiversity Assessment (Appendix J of this report) and threatened species management plans (Appendix K of this report).

The emu crossing structures would be monitored throughout construction and into operation to ascertain whether emus would use the structures. Further discussion on the effectiveness of emu crossing structures is provided in Section 2.7.3 of this report.

Connectivity structures would be reviewed in the detailed design phase and any changes would be made in consultation with the Office of Environment and Heritage and Department of Primary Industries (Fisheries). The project would involve the monitoring of targeted species and would determine the suitability of structures. Monitoring of the structures could extend up to five years. The results of the monitoring would assist in determining the effectiveness of these design measures, and whether any future management actions are required.

3. A range of dedicated and combined fauna crossing structures have been developed into the design to maintain fauna connectivity (refer to Appendix A of Working paper - Biodiversity). The project would also include an offset strategy, which will offset key fauna habitat lost from the project. This would include known corridors for fauna movement. Roads and Maritime would develop and implement a Biodiversity Offset Strategy (detailed in Appendix C of the Working paper – Biodiversity), as described previously in Section 2.12.1.
4. As stated in Working paper - Biodiversity, the Whiptail Wallaby (Pretty Faced Wallaby) are endangered under the TSC Act. This species was identified in the assessment as known to occur between Glenugie and Harwood (refer Appendix H of the Working paper - Biodiversity). There are no fauna connectivity structures in this area as the area in question at Tyndale has not been identified as an important movement corridor for mammal species. The preferred and natural habitat for wallabies is east of the project and the provision of a fauna underpass at this location was determined to be not required.
5. Roads and Maritime has been working closely with DPI (Fisheries) regarding aquatic habitat connectivity, in particular crossing structures for the Oxleyan Pygmy Perch. This process is ongoing and is informed by new data gathered during the assessment, during detailed design or

during construction. Roads and Maritime agrees with the principle that waterways defined as Class 1 should have structures crossing over the waterway that are appropriate for the habitat type and quality.

As noted in the Working paper - Biodiversity, there are two Class 1 waterways where culvert structures have been provided. The need to review the connectivity structure at station 134.6 was noted in the EIS, with Roads and Maritime to review the structure during detailed design. (Note that the crossing at station 134.6 is quoted in the EIS as 134.7). However, aquatic surveys undertaken in the Redbank Creek area has determined that Redbank Creek and its tributaries are not Class 1 waterways, but rather class 2 and class 3 waterways respectively. Further aquatic surveys of a number of waterways in project sections 6 to 10 were undertaken in August and September 2013, in consultation with DPI (Fisheries). During detailed design (refer to management measure B15), further Oxleyan Pygmy Perch surveys would be undertaken in consultation with DPI (Fisheries) to confirm the Class of the waterway and the design will be reviewed to include appropriate crossing structures for the following waterways:

- Unnamed waterway station 114.0.
- Oaky Creek station 122.5.
- Nortons Gully station 123.6.
- Unnamed waterway station 133.4.
- Unnamed waterway at station 134.7.
- Tributary of Macdonalds Creek at station 135.5.
- Montis Gully station 141.0.
- Eversons Creek station 143.6.

Roads and Maritime would continue to consult with DPI (Fisheries) regarding the design of waterway crossings.

6. There are three areas of widened medians proposed for the project to provide opportunities for glider crossing across the upgrade. Initially, when the project is constructed, the widened medians would be between 50 to 70 metres in width. The widened medians have been designed to be wide enough so that a minimum of 25 metres in the median would be retained in the ultimate upgrade to six lanes, should a future approval be sought by Roads and Maritime.
7. The location at station 17.0 has been selected as it would connect fauna connectivity corridors eg the Dirty Creek Range, to Newfoundland State Forest and Yuraygir State Conservation Area.

The location at station 140.6 has been selected as it would connect vegetation either side of the Broadwater National Park.

However, the exact location of the connectivity structures would be determined during detailed design and take into consideration this comment on the appropriateness of this structure location. Roads and Maritime agrees that land use (current and future) adjoining structure location is an important consideration in the effectiveness of these structures.

8. It should be noted that the Sommervale Road underpass is identified as an incidental emu crossing (refer to Appendix A of the Working paper - Biodiversity) only. Emus are known to use the local road network as a wayfinder for navigation, including Sommervale Road.

A dedicated land bridge is proposed at Minyumai Road. While in close proximity to the local road to the east of the highway, it would not co-locate traffic and fauna movement. Evidence of threatened fauna crossing the highway at this location was found in the biodiversity assessments, suggesting the crossing is required at this location. To locate the crossing elsewhere would have resulted in impact and land acquisition to the Tabbimoble Swamp Nature Reserve.

Ongoing development of the Connectivity Strategy during detailed design would consider the placement of the structures. The Connectivity Strategy would be further developed in consultation with Office of Environment and Heritage.

9. The Working paper -Biodiversity identified key habitat and corridors based on the Key Habitats and Corridors project (DEC 2003) and Climate Change Corridors project (DECC 2007). These areas were specifically targeted for connectivity structures based on the types of fauna that use that corridor.
10. The Biodiversity Connectivity Strategy (Appendix A of the Working paper - Biodiversity) identifies principles around vegetation and habitat around connectivity structures. Connectivity structures have been sited based on threatened species records and local and regional wildlife corridors.

While it is agreed that landscape linkages should be used to increase fauna connectivity, Roads and Maritime cannot commit to re-vegetating areas that are not owned or managed by Roads and Maritime.

However, a review of combined and fauna connectivity structures (refer to the Supplementary Biodiversity Assessment) has identified that the majority of connectivity structures (82 per cent) are in locations that are vegetated, are on Roads and Maritime land that can be revegetated or are not required to be vegetated (ie structures target Oxleyan Pygmy Perch or the coastal emu). The remaining 18 per cent would require strategic re-vegetation within the road reserve to improve their effectiveness.

11. Between Richmond River bridge and the Coolgardie Road interchange (including changes made by the design refinements), there are two dedicated connectivity structures (land bridges), 12 combined connectivity structures and numerous drainage structures that could facilitate incidental fauna movement. The connectivity structures were built upon from the preferred route assessment. The larger structures identified in the Connectivity Strategy (Appendix B of Working paper - Biodiversity) through this area have the same naming convention (eg Wardell Viaduct 2) as the previous development project.

However, Roads and Maritime would re-consider the need for fauna connectivity in this location during detailed design and through preparation of management plans. As part of design refinements and the Supplementary Biodiversity Assessment, a review of connectivity structures targeting koalas through this area was undertaken, refer to response one above for further details.

12. This comment is acknowledged and would be incorporated into the Connectivity Strategy as it is developed through the detailed design phase of the project.

13. This comment is acknowledged. As the Connectivity Strategy is further developed, the Connectivity Structures table would be updated and would include an additional column to check off compliance with the design principles.
14. The structure at Grays Road provides a local road overpass. This is located in a section of the highway that is already upgraded to an arterial standard – the Halfway Creek upgrade. The overpass referred to is to only be constructed once there is a need to upgrade this section to a motorway standard. That time would be determined by a range of factors but it is likely to be many years from now. There is no justification for constructing the overpass early, based on the very low numbers of traffic using this local road. However, Roads and Maritime recognises the importance of this area for fauna movement.
15. While a crossing structure for the area around Mororo Nature Reserve has been considered, as the project follows the existing Pacific Highway at this location, there is little opportunity to raise the highway to incorporate a sufficiently large crossing structure. In response to this, an additional landbridge was located to connect Tabbimoble Swamp Reserve to Double Duke State Forest.

However, Roads and Maritime would continue to develop the connectivity strategy in consultation with EPA and consider alternative connectivity opportunities.

Fauna fencing along this length of highway includes from between stations 97.9 to 101.9.

With regards to the provision of connectivity structures between stations 104 and 109, this is outside of the project scope but falls within the Devils Pulpit upgrade project. Roads and Maritime has separately consulted with EPA regarding connectivity structures and fencing through that project.

16. A threatened frog management plan has been developed (refer to Appendix K), that includes the main mitigation goals for the species. This includes “No mortality of threatened frogs from vehicle strike adjacent to known habitat areas.”

2.12.3 Impacts to coastal emu

Submission number(s)

002, 008, 011, 012, 013, 014, 015, 016, 017, 019, 020,023, 024, 025, 027, 028, 033, 034, 035, 037, 038, 040, 041, 044, 045, 046, 047, 051, 054, 055, 057, 058, 059, 063, 064, 067, 070, 075, 076, 083, 085, 087, 092, 093, 095, 098, 113, 120, 126, 129, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. Numerous submissions raised concerns about impacts to the coastal emu. Concerns were about impacts to habitat and population; need for additional genetic sampling and baseline monitoring and the type, location, number, effectiveness and safety of connectivity structures.
2. The landscape plan suggests food plants such as soybean, oats or rye could be used as ground cover to attract emus to a crossing zone. These plants are not part of the native diet of the Coastal Emu.
3. The EIS (Table 7.3) suggests Roads and Maritime plans to actually isolate Emus from one of their known foraging and nesting sites in a large tract of land between the new and existing highways at Shark Creek.

4. Before the recent flood there was a large emu population in the area of Byrons Lane their only escape is towards the high ground of the river bank. The proposed highway and fencing could cut off this escape.
5. The project between Tabbimoble to Woodburn would provide a barrier to fauna including the Coastal emu, and could become a trap during wildfires.
6. Further information is required on the commitment to fence the entire known emu section between station 35.0 and 80.2. Similarly, flexibility in structure design and fencing placement and the statement there will be no additional structures other than a proposed land bridge should be explained. Fauna fencing should be extended beyond habitat edges away from the road, and into cleared paddocks to avoid funnelling fauna onto the road and should not be a vegetated fence.
7. The connectivity goals for coastal emu should include goal "maintain connectivity to other subgroups for breeding opportunities'.
8. Maintaining open landscape and planting grasses under bridges for emu connectivity including approaches to 40 metres is supported.
9. EPA recommends a precautionary approach to mitigation and offsetting for coastal emu.
10. EPA recommends that the Department of Planning and Infrastructure convenes further meetings with Roads and Maritime and EPA to discuss opportunities to further enhance connectivity options for coastal emu.
11. Priority emu crossing zone starts station 46.1 Pillar Valley Creek to station 59.3. Specific comments on structures:
 - Mitchell Road overpass should have an increase clearance.
 - Bridges located at stations 47.6, 47.9 and 49.3 are high priority crossing structures.
 - Consider an increase in height of Chaffin Creek bridge at station 52.4.
 - Chaffin Creek bridge at station 54.7 is subject to inundation and would have limited effectiveness.
 - What is the height of the structure north of Champions Creek at station 58.6, the Somervale Road overpass at station 56.9 and the structure at Champions Creek at station 57.0?
 - Consider dual use of Bostock Road and Firth Heinz Road.
 - What is the height of the access bridge at station 61.0? Could this be combined with the 5.5 metre arch at station 60.8?
 - A site where an overbridge could be included is at station 53.7 because it links Chaffin Hill and Chaffin Swamp.
 - The current proposed location of an overbridge is not suitable, arch structures and combined crossings at stations 63.6, 64.5 and 66.2 are unlikely to be effective.

Response

1. The project would cross the habitat of the coastal emu through sections 3-5. Construction of the highway in these sections has the potential to create a barrier for emus accessing important habitat in pre- and post-breeding life-cycle activities associated with wetland and floodplain habitat.

Roads and Maritime has undertaken a number of studies as part of the project to better understand emu movement patterns. During the route option and preferred route stages of the project (2005-2006), studies on the coastal emu population were undertaken (for the Wells Crossing to Iluka Road project). These previous studies provided an understanding of emu movements and habitats and recognised that there would need to provide connectivity structures to maintain emu movements across the project. Data from the NSW Atlas of Wildlife was analysed

for road kills of emu that have occurred since 1980. This analysis in 2012 was used to understand the factors that contribute to road kills of emu, in the hope these instances can be reduced in the highway upgrade. This road kill data provided an indication of movement patterns of the coastal emu.

Another study undertaken in 2012 included the collection of emu DNA samples from the area to help identify emu movements and diet. A monitoring pilot study of emus using GPS tracking devices was undertaken late 2012. That study was stopped by Roads and Maritime due to the potential harm caused. However, the study showed that captive emus can be safely anaesthetised and handled with minimal stress and provided insight into the movements and survivorship of captive reared emus. As stated in Section 5.2.3 of the Working paper - Biodiversity, further baseline monitoring would be undertaken to finalise the Coastal Emu Management Plan developed for the project (refer to Appendix K). Further research and baseline monitoring to be undertaken into the coastal emu would be discussed with the Office of Environment and Heritage.

As part of the project, a total of around 22 dedicated, combined and incidental connectivity structures (arches, bridges and local road under / overpasses) are proposed between Glenugie and Tyndale (Section 3 and 4 of the project).

The location and design of emu connectivity structures were developed in consultation with the Office of Environment and Heritage and through consultation with property owners on emu movements. Comments on the structures, including change in sizing and alternate locations have been received by OEH during the EIS display. OEH has indicated that priority emu crossing zones are south of the Pine Brush State Forest. Roads and Maritime would continue to develop the connectivity strategy with OEH on the design and location for emu connectivity structures, in accordance with the guiding principles and the connectivity goals for the emu as described in Appendix A of the Working paper- Biodiversity.

Emu connectivity structures have assumed that only bridges or arches with a minimum clearance of 3.6 metres and up to 5.5 metres would present the minimum underpass design for emus. Those emu crossing structures that are bridges range from 45 to 448 metres (Shark Creek bridge) in length. Some of these structures are designed for waterway crossings that also meet the needs for emu connectivity as emus are known to follow creeks and drainage lines. As stated in the Connectivity Strategy, a minimum of four metres is required under the bridge between the waterway and embankment to facilitate emu movement. This minimum passage of four metres is exceeded in several bridges. Due to the length and openness of these structures, they would not be likely to create an ambush point for emus.

A number of road bridges are identified as 'incidental'. This refers to the fact that structures have not been designed for specific fauna movement (such as road overpasses). However, these structures could be used for fauna movement (particularly in areas where emus are regularly seen on those roads currently). Monitoring of the bridge structures would determine if emus are using these structures to cross the highway. If this is found to be the case, a number of these overbridge structures have the potential to be widened in future to accommodate both fauna and vehicle traffic on a separated bridge.

Fauna crossing structures are particularly effective when used with fauna exclusion fencing that directs fauna away from the road and towards the structure. During field surveys for the emu, they

were observed negotiating three and four strand property fences and passing easily through and under fences. As such the fauna exclusion fencing associated with the connectivity structures proposed between stations 35.0 to 80.2 (Section 3 and 4 of the project) are designed to prevent passage of emu onto the road corridor. In addition, in many of these areas large floods pose a risk of damage to fauna fencing. Alternative design solutions such as the placement of fencing closer to the highway formation (ie higher up the embankments) are included in the Connectivity Strategy for further consideration in detailed design. Roads and Maritime is currently looking at opportunities in key emu movement areas for early establishment of fencing on the proposed boundary. There would be gaps where bridge structures are proposed, to enable emus to become accustomed to using the gaps before construction. These gaps would be monitored to determine if emus are using them before construction. Fence type and plantings to attract emus may also be trialled to determine the effectiveness of different techniques.

Roads and Maritime is committed to the ongoing monitoring of impacts to the coastal emu to ensure connectivity goals set out for the species are achieved. Part of this commitment includes the development of an ecological monitoring program and a specific coastal emu management plan (refer to Appendix K). These would review and monitor the performance of emu connectivity structures. Monitoring results would be provided to EPA, and the results of the monitoring would determine if the management measures are appropriate or if additional measures or offsets are required. As part of this process, the need to construct a land bridge would be considered. The Connectivity Strategy has an adaptive approach to maintain connectivity for threatened species including the coastal emu.

2. While it is acknowledged that soybean, oats or rye are not part of the native diet of the coastal emu, the landscape plan to include soybean, oats or rye plants has been developed based on local knowledge of emu feeding habitats and in consultation with the Office of Environment and Heritage. These plants would only be considered as a cover crop while the native vegetation is established at the site. The intention is to encourage use of the structures by emus, particularly when first constructed. The ecological monitoring program would monitor connectivity structures as well as landscape plantings to determine their effectiveness at attracting emus to connectivity structures.
3. Between Tyndale and Maclean, Emu connectivity would be possible at the Tyndale Cane drain 1 (Crackers drain) and 2 (Lees drain), Byrons Lane and Shark Creek bridge which is 448 metres in length. The EIS notes that it may be better for the survivability for the coastal emu population if east west movements between Tyndale and Maclean were not possible. There is only a relatively small area of habitat available west of the upgrade alignment and there is the possibility that emu could become trapped in times of flood or confused about pathways leading back to the east. The detailed design will consider the issue of fencing and fauna connectivity at this location further in consultation with key stakeholders including OEH.
4. This has been identified as a potential risk as discussed above. Roads and Maritime is committed to review the need for east west movements between Tyndale and Maclean in consultation with key stakeholders including OEH. However, an overpass would be placed to provide cross highway access along Byrons Lane. This could provide for incidental emu movement across the highway. However, there is also higher ground to the west that could be used to escape floods.

5. Between Tabbimoble and Woodburn, the highway travels along the alignment of the existing highway which forms a barrier to fauna movement although not as great as the project because of its greater width. The project design would provide small mammal underpasses through this area and a land bridge would be constructed adjacent to Minyumai Road, Tabbimoble to facilitate fauna movement across the highway. The coastal emu are no longer known to occur in the region north of Iluka Road.
6. The connectivity strategy has indicatively identified that fauna fencing would be provided from station 35.0 to 80.2 to avoid fauna, including emus gaining access to highway corridor through project section 3. Other factors including vegetation and topography would be considered when the final extent of fencing is determined. As part of this process, extending the fencing into cleared areas would be considered. Fauna fencing would be designed in accordance with the design principles in the Connectivity Strategy (Appendix A of the Working paper – Biodiversity) including "Fencing should be continuous and at their ends have a 'return area' to guide animals back into habitat rather than onto the road."

However, it should be noted that openings would be required for emu crossing structures as well as property access requirements. This would still mean that access to the highway corridor by emus would not be possible, under normal operation. Fauna exclusion fencing and emu connectivity would be considered as part of the fencing strategy (refer to Chapter 3 of this report).

Roads and Maritime would continue to consult with OEH regarding type and location fauna exclusion fencing and the optimal location and type of emu crossing structures.

7. To maintain connectivity to these other Coastal Emu subgroups, Roads and Maritime would need to augment connectivity far beyond the highway corridor. This is not within the scope of this project. The project crosses the habitat of the largest emu sub-population that is centred on Yuraygir National Park and surrounds on the southern side of the Clarence River. The remaining sub-populations occur north of the river centred on Bundjalung National Park and Bungawalbin Nature Reserve (Main Camp). These sub-populations would not be impacted by the project nor would the project cut connectivity between these groups. However, the project does allow for movement within the Yuraygir population sub-groups.
8. This comment is acknowledged and has been included in the coastal emu management plan (refer to Appendix K). The landscaping strategy would also be prepared in consideration of the requirements from the Working paper –Biodiversity (refer to management measure UD3).
9. A precautionary approach has been taken in regards to the management measures for the coastal emu. Many of the structures have been increased in height so to achieve the minimum height of 3.6 metres as agreed as reasonable with OEH. However, there are four structures that have a greater height of between four and 5.5 metres. It is not a reasonable expenditure of public funds for Roads and Maritime to design and construct major structures significantly greater in height than this where there is no evidence of emus being deterred from using 3.6 metre structures.

A coastal emu management plan has been prepared (refer to Appendix K) to direct management measures including monitoring and the performance review of emu connectivity structures. The review of emu connectivity structures would be undertaken through monitoring consistent with

DECC (2004) survey guidelines. The success of the structures would be assessed based on the complete passage of a species. Monitoring would extend for up to five years.

In consultation with the Office of Environment and Heritage, the results of the monitoring would determine if the management measures are adequate, require modification or if additional measures or offsets are required. As part of this process, the need to construct a landbridge would be considered.

10. As part of the further development of the Connectivity Strategy, Roads and Maritime would consult with OEH regarding connectivity for all fauna (refer to management measure B2). In addition, Roads and Maritime would finalise the coastal emu management plan (refer to Appendix K) (refer to management measure B11) in consultation with OEH.
11. This comment is noted. Roads and Maritimes held a workshop with OEH on the 17 September 2013 to address the issue of emu connectivity. Outcomes of the workshop in relation to OEH's submission are detailed below. Emu crossing structures would be further developed in detailed design.
 - Mitchell Road overpass already has a clearance of 4.6 metres.
 - The bridge at station 47.6 has been identified as a combined emu crossing with the clearance of the bridge to be increased to at least 3.6 metres. The bridge structure at station 49.3 has been designed as a combined emu crossing structure, with the bridge structure raised to provide at least 3.6 metres clearance for emu movement. This structure would provide four metres either side of the waterway for emu passage.
 - The Chaffin Creek bridge structure is 75 metres long and has been designed as a combined emu crossing structure. This structure would provide four metres either side of the waterway for emu passage. The bridge has been specifically raised to provide at least 3.6 metres clearance.
 - Most structures would be subject to inundation during flood events. Structures crossing waterways have been designed with a minimum passage of four metres from bridge abutment to edge of waterway to maintain fauna movement for as much of the time as possible.
 - The clearance under the structure north of Champions Creek at station 58.6 is around five metres and with a length of 75 metres. Champions Creek bridge has been designed as a combined emu crossing structure with a five metre clearance. The clearance under the Somervale road underpass (station 56.9) structure is around five metres. The actual height of the bridge over Champions Creek (station 57.0) structure is around five metres of clearance and 88 metres in length.
 - In the Connectivity Strategy, it identifies further consideration should be given for Bostock Road (and Somervale Road) to become future dual uses for fauna movement. A design refinement (refer to Chapter 4 of this report) has placed the rest area just to the north of this location. However, this is not anticipated to affect the potential of Bostock Road to become a future dual use, but noted it could affect the effectiveness of the structure.
 - The height of this combined emu and property access structure at station 61.0 is about six metres. The details of the structure would also need to take into consideration the requirements of the landowners property acquisition and access requirements.
 - At station 53.7, a 3.6 metre x 3.6 metre culvert is proposed as part of the project. Roads and Maritime would further consider the type of structure to be used at this location and could include change to an arch or bridge structure.

- The comment is noted. Roads and Maritime would continue to discuss optimal locations for emu crossing structures during detailed design. It should be noted that the structure located at station 63.6 is only identified as an incidental emu crossing structure.

2.12.4 Impacts to fauna and habitat

Submission number(s)

002, 004, 008, 010, 011, 012, 013, 014, 015, 016, 017, 019, 020, 022, 023, 024, 025, 027, 028, 031, 033, 034, 035, 036, 040, 041, 044, 045, 046, 047, 051, 052, 054, 057, 058, 059, 063, 067, 072, 076, 078, 082, 083, 085, 087, 090, 092, 093, 102, 104, 105, 111, 114, 120, 123, 125, 126, 129, 130, 132, Department of Primary Industries (Fisheries), Clarence Valley Council

Issue description

1. The removal of old growth forest will impact on the birds that rely on holes in trees for nesting.
2. Some bird species will not relocate to another area successfully (Bennet, 2012).
3. Monitoring of all fauna is required in the area and in the offset area to ensure that no fauna will be lost.
4. When the road is constructed, fauna will still want to use their corridors which will include the road, leading to unacceptable levels of road kill.
5. The wetlands and rainforests near Wardell support threatened fauna and flora species including EECs. Additional fragmentation will result in a decline in local fauna populations including the local Koala.
6. The project will adversely impact on the Endangered Black-necked (Satin) Stork habitat.
7. The proposed route of the Broadwater to Coolgardie section of the Pacific Highway upgrade will result in the destruction of extensive areas of habitat for numerous threatened species listed on the EPBC Act. Of particular concern are significant impacts that will be generated on the Long-nosed Potoroo (*Potorous tridactylus*) and the Koala (*Phascolarctos cinereus*).
8. Construction of the project could result in lime and alkaline runoff contaminating waterways and raising the pH of receiving waters.
9. The list of OPP high risk areas should be expanded to cover all OPP habitat from Section 6 to 9.
10. The EIS states that concrete batch plants 50 metres away from OPP habitat pose an unacceptable risk. Provide a more comprehensive suite of protection measures for OPP.
11. Detailed design should eliminate or minimise any impact on endangered communities and take into account management measures as recommended by Government agencies.

Response

1. A very small area of old growth forest is impacted in sections 2 and 8 of the project. However, the loss of hollow bearing trees would be greatest where the project would deviate from the existing Pacific Highway alignment in Section 3, Section 9 and Section 10. To mitigate impacts, pre-clearing surveys would be undertaken by an experienced ecologist to identify the location and extent of important habitats in the construction footprint to be salvaged for reuse/relocation, such as bushrock, hollow trees and woody debris. If possible, the hollows would be permanently relocated in adjacent areas or artificial hollows installed in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a). Artificial hollows (nest boxes) installed as part of a nest box management strategy. This strategy would determine the number and type of nest boxes required, with the majority of these structures being installed before any clearing of vegetation.
2. The project does not include the relocation or reintroduction of bird species. The impacts of the project on bird species are associated with the loss of habitat. This loss of habitat has been considered in the assessment of significance for bird species. The project does include an offset strategy to compensate for the loss of habitat (Appendix C of the Working paper - Biodiversity). Refer to Section 2.12.1 for further details.

3. Field surveys for fauna to inform the biodiversity assessment has been undertaken since 2004, covering a range of season and climate patterns, to provide a comprehensive assessment of fauna in the study area. A supplementary biodiversity assessment was conducted since the EIS display and is attached to this report (Appendix J). Further surveys would be undertaken during the detailed design and construction phase and as part of management and monitoring plans to be implemented during construction and operation.
4. The project includes a mix of fauna crossings including dedicated underpasses, widened medians, land bridges and arboreal crossings to enable wildlife to cross under or across the highway. In addition, fauna exclusion fencing would be erected along the project at appropriate locations shown in Table A-5 in the Working paper - Biodiversity to direct fauna movement towards fauna-crossing structures. This would be subject to routine monitoring to check for damage. The section from Glenugie to Maclean would be fenced. Fauna underpass structures would provide safe passage for ground-dwelling fauna. Underpasses would be designed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity. The project monitoring program would monitor the performance of fauna crossings and determine whether any modifications or additional structures are required.
5. As outlined in Chapter 10 of the EIS there would be impacts to State and Commonwealth listed species, populations and communities as a result of the project. The sections of the project that deviate from the existing highway alignment have the potential for greater biodiversity impacts, particularly where it passes through areas of native vegetation. This includes the section between Richmond River and Coolgardie Road (Section 10 of the project). Where possible, the alignment between Broadwater and Coolgardie passes through cleared or disturbed lands to avoiding impacts on vegetated areas. The alignment also passes around the Wardell Heath, which contains primary koala feed trees and a high density koala population recorded near Wardell.

The project would result in the fragmentation of koala habitat, with around 375 hectares of habitat critical to the survival of koala to be cleared along the entire length. The test of significance undertaken for koalas indicated that the project would have a significant impact on this species. In section 10, two landbridges are proposed (one as a result of a design refinement in chapter 4) to facilitate the movement of koalas from the Wardell Heath to the vegetation along Meridian Heights and the Blackwall Range. These landbridges are located: north of the Richmond River at station 147.6 and to the west of Wardell, at station 156.5. The connectivity strategy (Appendix A of the Working paper – Biodiversity) also requires the placement of fauna exclusion fencing from station 146.1 to station 159.7 to avoid animals getting access into the road corridor. Section 10.4 details the measures to be implemented to minimise impacts on threatened species which include the provision of connectivity structures and preparation of a number of different threatened species management plans to guide the review of connectivity structures and other measures.

6. The Director-General's requirements for the EIS required Roads and Maritime to assess the impacts on the Black-necked stork. The Black-necked stork was confirmed (ie has been identified through field investigations undertaken for the project) in project sections 1-5. During field surveys, the nest sites mentioned by the respondent were not detected in the project boundary. Table 4-16 of the Working paper – Biodiversity identifies impacts of the project to the species, including the Black-necked stork such as: "Potential impacts (to species including the Black-necked stork) include relatively small loss of habitat for foraging and breeding. Potential longer-term changes to hydrology or water quality conditions affecting the density of prey species and foraging resources.

This includes expected clearing of riparian zones and potential changes to local flood patterns. Black-necked stork is known to nest in the study area associated with the Coldstream wetlands in the Pillar Valley to Tyndale area (Section 3) where nests are in disturbed wetland habitat situated on agricultural land (Clancy 2010). There are no known nest sites within the direct project boundary." A significance assessment for wetland birds including the Black-necked stork was undertaken and found that the project would not result in a significant impact on this species. A review of this assessment of significance still found that the project would not result in a significant impact on this species (refer to chapter 6 of the Supplementary Biodiversity Assessment).

Management measures to be implemented to address impacts to the Black-necked stork include the preparation of a flora and fauna management plan. As part of this plan, pre-clearing surveys would be undertaken to detect and relocate nests should they be present within the project corridor.

7. The project has sought to avoid or minimise impacts to biodiversity, where possible. During route option development and selection of the preferred route, minimising impacts such as reducing the loss of habitat or potential impacts on threatened species, populations and communities were considered as far as practicable. For details of vegetation impacts, refer to response one in Section 2.12.1. Measures to minimise habitat impacts have been detailed in Chapter 10 of the EIS. These measures include the provision of connectivity structures and preparation of a number of different threatened species management plans to guide further review of impacts and review of the management measures. The project has considered the impact on the Long-nosed Potoroo. The Working paper – Biodiversity identifies that the presence of the species was either confirmed or had a moderate to high likelihood in sections 1-3 and between sections 6-11, noting that there is a population within the Wardell Heath. This species were targeted by connectivity structures in Section 10 and would be specifically monitored as part of the ecological monitoring program. The EIS acknowledges the presence of primary koala habitat in the Wardell Heath and a high density of koala records near Wardell. The project would result in the fragmentation of koala habitat, with around 375 hectares of habitat critical to the survival of koala to be cleared along the entire length. Two land bridges are proposed in section 10 (at stations 147.6 and 156.0) to facilitate the movement of koala and long-nosed potoroo from the Wardell Heath to the vegetation habitats along the Blackwall Range. Additional koala surveys have been undertaken since display of the EIS, with results provided in Chapter 3 of this report. Roads and Maritime would undertake further targeted surveys before construction in accordance with the Ecological Monitoring program (refer to Appendix K of this report).
8. As detailed in the EIS, a management plan for threatened fish would be developed and would identify measures for the minimisation of impacts to Oxleyan Pygmy Perch and the Purple-spotted Gudgeon. This threatened fish management plan has been prepared and incorporates minimising the risk of change in pH to receiving waters from lime stabilisation and alkaline runoff from concreting activities (refer to Appendix K).
9. Aquatic ecology surveys have been recently undertaken to confirm the areas of known or potential Oxleyan Pygmy Perch habitat. This information would be used to finalise the location of management protocols and measures included in the threatened fish management plan.

10. Management measure B50 requires that batch plants are located 300 metres away from Oxleyan Pygmy Perch habitat, such that there would be no risk posed to surrounding water quality (eg due to accidental spillage, windblown lime deposition or high alkaline runoff).

This recommendation would be developed further before construction, in consideration of the Devil's Pulpit soils and water management plan, lessons learnt during the construction of that project and in consultation with DPI (Fisheries). All measures have been included in the threatened fish management plan (refer to Appendix K).

11. Biodiversity management measure B13 requires that consideration is given to reducing impacts of the construction footprint on vegetation. These management measures would be further developed in consultation with relevant Government agencies.

2.12.5 Impacts on aquatic habitat

Submission number(s)

078, 085, 093, 105

Issue description

1. The project approximates a number of significant wetlands in the Coldstream River and Shark Creek catchments and would also pass through wetlands between south of Harwood Bridge and Tyndale. This will adversely affect fauna habitat in these areas.
2. Impact on habitat of at least 10 threatened aquatic species.
3. The project would result in degradation through extensive landform modification, hydrological disturbance and disruption of surface and groundwater flows between Broadwater and Coolgardie.

Response

1. The project would avoid direct impacts to all SEPP 14 wetlands and the nationally listed Upper Coldstream Wetlands. However, there are a number of wetlands in proximity to the project corridor including the Upper Coldstream Wetlands. Bridges and waterway crossing have been designed to maintain the existing hydrological regime. The project would seek to maintain existing flows and velocities to maintain the function of the wetlands. Between Tyndale and Harwood, the project does not directly cross any wetlands, mostly passing through agricultural land including cane land. The project passes to the west of a SEPP 14 wetland area in the Yaegl Nature Reserve area, however, the project does not pass through it.
2. The EIS confirms that the project would have direct and indirect impacts on a range of aquatic habitats including watercourses and wetlands. These impacts would include disturbance to both riparian and aquatic environments. The EIS has assessed the impacts of the project on these habitats (Section 3.7). Roads and Maritime has consulted with the NSW Department of Primary Industries (Fisheries) regarding connectivity of Oxleyan Pygmy Perch through watercourses. Provision of appropriate crossing structures in known and potential Oxleyan Pygmy Perch habitats are included in the Connectivity Strategy (refer to Appendix A of the Working paper – Biodiversity). During detailed design (refer to management measure B15), further Oxleyan Pygmy Perch surveys would be undertaken in consultation with DPI (Fisheries) to confirm the Class of the waterway and the design will be reviewed to include appropriate crossing structures for the following waterways:
 - Unnamed waterway station 114.0.
 - Oaky Creek station 122.5.

- Nortons Gully station 123.6.
 - Unnamed waterway station 133.4.
 - Unnamed waterway at station 134.7.
 - Tributary of Macdonalds Creek at station 135.5.
 - Montis Gully station 141.0.
 - Eversons Creek station 143.6.
3. Cross drainage to transfer water under the project, including all waterways, would be provided as part of the project and would include box or pipe culverts, bridges and viaducts. Cross highway movement of waterways in the area (including Bingal Creek) would be maintained through culverts under the highway. However, Eversons Creek south of the Richmond River would be diverted along the length of the project for a distance of 200 metres. All drainage design for the project has sought to maintain, where feasible and reasonable, the existing surface water hydrological regimes (including flows, velocities and aquatic habitat). Section 10.4 of the EIS details management measures to minimise impacts on threatened species which include the provision of connectivity structures and preparation of a number of different threatened species management plans to guide the review of connectivity structures and other measures.

2.12.6 Impacts to flora species and communities

Submission number(s)

002, 005, 008, 010, 012, 013, 016, 019, 020, 028, 033, 035, 038, 045, 046, 051, 057, 058, 059, 064, 067, 076, 078, 083, 085, 093, 104, 105, 111, 120, 123, Ballina Shire Council

Issue description

1. The highway will affect the critically endangered vegetation community "Lowland Rainforest of Subtropical Australia".
2. The impact of continuous traffic lights at night will adversely affect the daylight requirements of plants and trees.
3. Concern raised that during construction the threatened flora communities will be destroyed resulting in their loss forever. Scientists from Seedbank should collect seeds.
4. The proposed route of the Broadwater to Coolgardie section of the Pacific Highway upgrade will impact on areas of habitat for numerous threatened species listed on the EPBC Act. Of particular concern are the Rough-shelled Bush Nut (*Macadamia tetraphylla*) and the Red Lilly Pilly (*Syzygium hodgkinsoniae*).
5. The project would impact on threatened flora species including Square-fruited Ironbark and Weeping Paperbark.
6. Areas of impacted rainforest to be revegetated will be edge affected, requiring ongoing rehabilitation and maintenance work.
7. An individual Red lilly pilly *syzygium hodgkinsoniae* is impacted at the Wardell interchange. As this represents the total population, the project will have a significant impact on the species.

Response

1. Avoiding impacts to endangered species, populations and communities (including the Lowland Rainforest of Subtropical Australia) to the extent possible, was considered during the route selection process and was an objective of the project. In addition, a design refinement at the interchange at Wardell has further reduced the impact on the critically endangered Lowland Rainforest from 5.8 hectares to two hectares. However the project would still result in some residual impacts including impacts to State and Commonwealth listed species, populations and

communities. The significance of these impacts has been detailed in Chapter 6 of Working paper – Biodiversity. An Offset Strategy has been prepared for the project (Appendix C of the Working paper – Biodiversity). Refer to Section 2.12.1 for further details.

2. There is no evidence that the growth or lifecycle of plants are affected by lights from travelling vehicles.
3. The project has sought to avoid or minimise impacts to threatened flora species. A threatened flora management sub plan would be developed before construction to identify measures to mitigate any impacts. This would include a clearing protocol (including the installation of fencing or markers to delineate the area of clearing, avoid accidental clearing and protect threatened flora species), translocation trial and protocols for the seed collection, storage and propagation to be used in revegetation of areas around the project.
4. The Working paper – Biodiversity has considered impacts to both the Rough-shelled bush nut and the Red Lilly Pilly. The assessment has found that the project would likely have a significant impact on the Rough-shelled bush nut but not the Red Lilly Pilly (refer to sections 6.3 and 6.4 of the Working paper – Biodiversity). Surveys undertaken as part of the Submissions/ Preferred Infrastructure Report have identified a greater population extent for both of these species over what was shown in the EIS. Ninety nine plants of the Rough-shelled bush nut and eight Red Lilly Pilly plants were detected. A design refinement at the interchange at Wardell has resulted in a lesser impact to the Rough-shelled bush nut from 37 individuals to one individual. As such, the project would impact one per cent and 13 per cent of the respective populations. Both the Rough-shelled bush nut and the Red Lilly Pilly would be managed in accordance with the Lowland Rainforest and rainforest plants Management Plan (refer to Appendix K).
5. The Working paper – Biodiversity (SKM, 2012) and Supplementary Biodiversity Assessment (SKM, 2013) (refer to Appendix J) has considered impacts to both the Square-fruited Ironbark and the Weeping Paperbark. The assessment has found that the project would likely have a significant impact on the Weeping Paperbark but not the Square-fruited Ironbark (refer to Section 6.3 of the Working paper – Biodiversity). Further survey of the square-fruited Ironbark found that the impact on the number of individuals is less than previously assessed (from 1213 to 760) within the project boundary (refer to chapter 6 of the Supplementary Biodiversity Assessment), confirming that a significant impact is unlikely.

Both the Square-fruited Ironbark and the Weeping Paperbark would be addressed in the Threatened Flora Management Plan (refer to Appendix K).

6. Any areas identified for ongoing rehabilitation within the road reserve would be subject to Roads and Maritime landscaping plan and general road maintenance policy.
7. The EIS did not identify the impact on Red Lilly Pilly as being a significant impact due to consideration of other records of the species and the extent of potential habitat outside of the project corridor. This identified that there would be additional specimens of this species located outside of the project corridor.

This is supported by the supplementary surveys undertaken during the Submissions/ Preferred Infrastructure Report. These surveys identified 8 specimens of the Red Lilly Pilly in and

surrounding the project boundary. While the project would still only impact on one of the specimen (as identified in the EIS), the identification of additional plants results in a reduction of impact on this population.

2.12.7 Biodiversity offset package

Submission number(s)

002, 008, 010, 011, 012, 013, 014, 015, 016, 017, 019, 020, 023, 027, 028, 034, 035, 037, 038, 041, 044, 045, 046, 051, 054, 055, 057, 058, 059, 063, 076, 083, 085, 087, 092, 093, 095, 102, Forestry Corporation of NSW, Clarence Valley Council, Coffs Harbour City Council, Ballina Shire Council, Environment Protection Authority / Office of Environment & Heritage

Issue description

1. Numerous submissions were received that questioned whether 3421 hectares of "like for like" vegetation can be acquired (eg Lowland Subtropical Rainforest and Coast Cypress Pine Forest). Details of offset lands should be known prior to the EIA being endorsed.
2. A conservation covenant does not protect the land against any critical infrastructure or mining activity, including coal seam gas. EPA's preferred method to deliver offset lands is to target land on like for like basis which is then dedicated in the national park system. EPA and NPWS are developing a list of suitable offset sites.
3. It is considered that the references to FMZ in table 10-33 and the offset strategy should be qualified to apply to FMZ 1, 2 and 3 only.
4. Compensatory habitat should be provided in accordance with Clarence Valley Council's adopted Biodiversity Management Strategy and Riparian Action Strategy. Council is to be consulted and seek concurrence for suitable land and riparian areas to be offset and rehabilitated.
5. Any loss of remnant vegetation should be offset locally.
6. How would 10 hectares of hairy joint grass be offset?
7. The Wardell/Coolgardie landscape should be rehabilitated.
8. There is no mention of compensatory lands for revocation of national parks and nature reserve.
9. Offsets should be finalised and approved before construction, lands should be secured as early as possible.
10. Should the statement in the Offset Strategy 'it is considered that on average that the edge zone is 60% less suitable' read as 40% less suitable?
11. The Biodiversity Offset Package should be updated to include Department of Environment calculator.
12. A 4:1 ratio for offset lands for all threatened species habitat directly affected, including edge affected areas.
13. All biodiversity impacts should be assessed and offset equally irrespective of land tenure (eg state forest).
14. Priority for offsets is for local offsets (Ballina Shire and Coffs Harbour City councils have indicated that vegetation to be removed in their LGAs are to be offset in the LGA). Second is for searches in 3 broad locations, Woolgoolga to Glenugie, Glenugie to Iluka Road, Iluka Road to Ballina. Third is for offsetting outside the nominated priority areas.

Response

1. The EIS provides details of the proposed Biodiversity Offset Strategy which identifies the framework for preparing and identifying the Offset Package. The Offset Package and identification of offset lands would be developed if the project is approved, as any changes to the clearing of vegetation during detailed design would need to be taken into consideration. As such, the details

of the Offset Package are not possible to provide at this stage. This Package would be developed in consultation with the Office of Environment and Heritage and the Federal Department of the Environment (DotE) and submitted to Department of Planning and Infrastructure within two years of project approval. An Offset Strategy has been prepared for the project (Appendix C of the Working paper – Biodiversity). The Offset Strategy provides a framework for the identification of offset lands, which would protect habitat and species in perpetuity. The principles for offset lands include:

- Contains suitable habitat and patch sizes for threatened species potentially impacted by the project based on the OEH threatened species profile databases (including the specific requirements identified for flora species);
- Contains vegetation of at least moderate to good condition (according to OEH native vegetation benchmarks database);
- Table C-8 of the Biodiversity Offset Strategy identifies the area of vegetation types which are present within 30 kilometres and 100 kilometres of the project (based on OEH Vegetation Types Database). For example there are over 6,000 hectares of Lowland Sub-Tropical Rainforest known within 30 kilometres of the project corridor. Field surveys undertaken for the project identified 85 hectares of rainforest surrounding the project (in sections 10 and 11), so there is opportunity to offset this vegetation type in close proximity to the project. However, there are three other vegetation types (being Coast Cypress Pine, Swamp Box Swamp Forest and Turpentine Moist Open Forest) that need to be offset, where there is insufficient vegetation within 30 kilometres of the project. There is, however, sufficient vegetation within 100 kilometres of the project which could be targeted for those offsets.

Additional information on offsets for high priority Commonwealth listed species, including surveys of potential offset properties have been provided as part of the Supplementary Biodiversity Assessment (refer to Appendix J).

2. Roads and Maritime would develop the Offset Package in consultation with EPA. The Offset Strategy has indicated that opportunities to purchase land for reservation under the *National Parks and Wildlife Act 1974* would be one manner to deliver offsets. It is noted that this is EPA's preferred method.

Offset lands would be delivered as part of the Offset Package and would be determined based on the impacts of the project including vegetation and habitat types. Roads and Maritime would consider the list of properties proposed by EPA/OEH, but would need to ensure that the property is consistent with the objectives set out in the Offset Strategy and would provide 'like for like' vegetation conditions.

3. Table 10-33 should refer only to "conservation FMZ" which would include FMZ 1, 2 and 3 only.
4. The project's offset strategy would provide compensatory lands, offsetting vegetation and habitat removed due to the project. The project's offset strategy would continue to be developed, addressing the principles of the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012) and OEH Principles for the use of biodiversity offsets in NSW (OEH, 2011).
5. The project would include an Offset Package which would be developed, identifying offset lands that are located appropriately to the area of impact. All biodiversity offsets would be located within the NSW North Coast Bioregion. Offsets would firstly be sought within 30 kilometres of the project.

As such, Roads and Maritime is currently investigating suitable offset properties within the vicinity of the project (refer to Appendix J).

6. Any impacts to Hairy Joint Grass in Section 10 of the project between Richmond River to Coolgardie Road would be considered during development of the Biodiversity Offset Strategy. Roads and Maritime notes that as part of the Tintenbar to Ewingsdale upgrade project, research is being undertaken into translocation of Hairy Joint Grass. This research would be reviewed as part of any offset package for the species.

However, supplementary surveys undertaken as part of the Submissions/ Preferred Infrastructure Report have identified an additional area of 12 hectares of Hairy Joint Grass surrounding the project.

7. Restoration work or re-establishment of native vegetation within the road corridor has been captured in the EIS and a landscape management plan would be developed (refer to management measure B12). The detail of this management measure is in the Working paper - Biodiversity. Restoration work would be developed in consultation with EPA/OEH and Ballina Shire Council.
8. As mentioned later in the submission, compensatory lands for revocation of national parks and nature reserve do not form part of the offset lands. Potential compensatory lands are currently being investigated separately from the offset package. Roads and Maritime would continue to consult with OEH regarding both the offset package and compensatory lands for the revocation of lands dedicated under the *National Parks and Wildlife Act 1974*.
9. The project includes an Offset Strategy which identifies the framework for preparing and identifying the Offset Package. The Biodiversity Offset Package and identification of offset lands would be developed if the project is approved, as any changes to the clearing of vegetation during detailed design would need to be taken into consideration. This Package would be developed in consultation with the EPA/OEH and the Federal Department of the Environment (DotE) and submitted to Department of Planning and Infrastructure within two years of project approval.

Roads and Maritime is currently investigating suitable offset properties within the vicinity of the project. Additional information on required offsets for significantly impacted Commonwealth listed species and potential suitable offset properties has been provided as part of the Supplementary Biodiversity Assessment (refer to Appendix J).

10. The potential indirect impacts associated with edge effects for the project have been calculated using the estimate of 50 metres proposed by Bali (2000, 2005). In recognition that edge affected areas retain some value for biodiversity and are actually used by some threatened species such as Rufous Bettong, this figure is discounted by 60 per cent in the overall calculation.
11. The Supplementary Biodiversity Assessment has applied the calculator to the impacts as identified in the EIS and Supplementary Biodiversity Assessment (refer to chapter 8 of the report). This would be further developed during detailed design and identification of suitable offsets would be undertaken in consultation with DotE and OEH.

12. OEH's position on the offset of threatened species habitat to 4:1 is acknowledged. The final determination of ratios to be used would be based on the Federal Department of the Environment (DotE) offset calculator and consultation with DotE, OEH and DP&I.
13. The Offset Strategy for the project would continue to be developed in consultation with OEH. This would include consideration of this principle noted regarding offsetting state forests lands impacted.
14. OEH's comment on the identification of offset lands is acknowledged. This would be considered during the further development of the Connectivity Strategy and the Offset Package. Additional information on offsets for high priority Commonwealth listed species, including surveys of potential offset properties have been provided as part of the Supplementary Biodiversity Assessment (refer to Appendix J).

2.12.8 Ecological management measures

Submission number(s)

002, 037, 044, 046, 064, 066, 076, 078, 090, 095, 123, 132, Department of Primary Industries (Fisheries), Ballina Shire Council, Environment Protection Authority / Office of Environment & Heritage

Issue description

1. Management measures, such as compensatory habitat and underpasses, may not be effective. Roads and Maritime should commit to best practice management measures including detailed management plans available to the public, commitments to deliver meaningful offsets before impact and independent review.
2. Environmental degradation through weed and pest invasion, such as foxes, would impact the existing native habitat, particularly Lowland Rainforest and the koala population.
3. Precautions should be taken to avoid accidental contamination of waterways and pastures. Proposed cuttings should be rehabilitated and planted with native trees.
4. The Roads and Maritime policy to avoid disturbance and degradation of landform and surface and ground water flows is not being followed to minimise environmental impacts between Broadwater to Coolgardie.
5. Management measures should be proposed for OPP habitat with respect to the re-use of construction water, irrigation to land etc as detailed in the Devils Pulpit SWMP and as discussed in Section 4.2.21
6. The proponent should consult with NSW DPI (Fisheries) on the design of the bridge crossings and any other watercourse crossings. All crossings should be designed and constructed consistent with the Guidelines for Controlled Activities Watercourse Crossings (DWE, 2008) and Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge, 2004).
7. Any mangroves, seagrass or saltmarsh harmed by the project should be compensated at a ratio of 2 to 1. A compensation plan should be developed in consultation with Fisheries NSW.
8. A Tannin Leachate Management Protocol should be implemented before the start of construction to manage the stockpiling of mulch and use of cleared vegetation and mulch filters for erosion and sediment control. The protocol shall be developed in accordance with the Roads and Maritime Mulch Protocol.
9. Rehabilitation work for previous Roads and Maritime highway projects (Ballina Bypass) has been completely unsuccessful.
10. Areas identified for rehabilitation for the Tintenbar to Ewingsdale project cannot be revegetated due to the installation of infrastructure such as table drains, fencing, maintenance access tracks etc.
11. Restoration work within the remaining habitats of the road corridor are proposed in the working paper but not in the EIS (Section 10.4).
12. The project should include management measures for all threatened flora, including further management measures for *Macadamia tetraphylla* at Wardell interchange.
13. Design of the Koala Drive underpass was to improve its suitability as a fauna crossing, and a landscaping strategy prepared which will reinforce tree plants with revegetation being undertaken with locally indigenous dense trees and shrubs. These recommendations are missing from the EIS.
14. Comprehensive survey should be done once clearing is complete. Effectiveness of fauna crossings and fencing can be measured relative to the recovering adjacent populations.
15. Performance measures should be set to measure long-term performance of target populations, with comparison with a control to monitor impacts/ mitigation success.

16. Wallum froglet should be included in the threatened frog management plan.
17. Habitat searches should not be restricted to optimal habitat as Giant Barred Frog has been found in sub-optimal habitat.
18. Culverts for koala will need to reflect known populations and dispersion of young or displaced animals.
19. A covenant should be placed to prevent clearing in those situations where Roads and Maritime would transfer (surplus) land to adjacent private landowners.
20. Widened medians must not be cleared for access sites or access tracks.
21. Table 5-4 with project specific management measures for threatened species should be expanded to include threatened species plans for all impacted federally and state listed species.
22. Statement in the EIS regarding use of crossings by koala should include the full referenced statement, which refers to 20m culverts, whereas culverts for this project are much longer
23. Early seed collection of *Melaleuca irbyana* should be undertaken by Roads and Maritime.
24. Need to consider the importance of Rufous bettong populations and a species management plan should be developed.
25. The commitment "until such time as the effectiveness of management measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods following establishment of vegetation" should be extended to include five monitoring periods.
26. The commitment "identified high value habitat for threatened species or threatened ecological communities would not be considered further as ancillary sites" is supported. These features need to be defined in an objective and measurable way so there is no confusion when construction starts.
27. On page 10-203, it is unclear what "three successive monitoring periods" is? Over what period of time?

Response

1. Roads and Maritime has prepared a range of threatened species management plans to address impacts and guide monitoring and management of species. These have been provided as Appendix K to this report.

The project also includes an offset strategy. Refer to responses four and five in Section 2.12.7 above for further details.

2. The EIS has identified and assessed the project in relation to the key threatening processes including 'invasion and establishment of exotic vines and scramblers', and acknowledges that there is the potential for increased weed invasion (refer to Section 4.4 of the EIS). However, during construction, a weed management plan would be developed during construction (refer to management measure B27).
3. The EIS includes a range of measures to minimise impacts to the environment during construction and operation. Section 9.4 of the EIS includes that appropriate erosion and sediment controls would be implemented before construction (refer to management measure SSW26) to avoid release of sediments off-site and into waterways. Cuttings would be progressively remediated (refer to management measure SSW7) in line with the landscape and planting strategy for the project. This strategy (refer to the Working paper - Landscape Character and Visual Impact) identifies that the length of the project would be revegetated with native grasses and scattered trees to match the existing conditions.

4. The project has sought to avoid or minimise impacts to biodiversity, where possible. During route option development and selection of the preferred route, minimising impacts such as reducing the loss of habitat or potential impacts on threatened species, populations and communities were considered as far as practicable. The project would, however, result in the clearing of vegetation and loss of habitat. The supplementary biodiversity assessment revised the area of clearing down to 932 hectares and 262 hectares of EEC, which is a reduction from the EIS. Measures to minimise habitat impacts have been detailed in Chapter 10 of the EIS. These measures include the provision of connectivity structures and preparation of a number of different threatened species management plans to guide further review of impacts and review of the management measures. Threatened species management plans are included in Appendix K of this report.
5. The threatened fish management plan for this project (refer to Appendix K) has been prepared with consideration of the Devil's Pulpit Upgrade soils and water management plan and the lessons learnt during the construction of that project. The management plan has been and would continue to be prepared in consultation with DPI (Fisheries).
6. All bridge and waterway crossings would be designed in accordance with the guidelines 'Why do Fish Need to Cross the Road?'

The Connectivity Strategy would be further developed during detailed design, in consultation with relevant State and Commonwealth agencies, building upon the Connectivity Strategy in Appendix A of the Working paper – Biodiversity (refer to management measure B2).

Roads and Maritime would continue to consult with DPI (Fisheries) on the design of the structures.

7. This comment is acknowledged. Small areas of mangroves may be affected by the project as mapped on the edges of the Clarence River, Serpentine Channel, Richmond River and Duck Creek. Detailed design would include flora surveys to inform management plans and project design further. These vegetation types would be included as some of the many vegetation communities that would be considered. Any loss of these vegetation types would be considered for compensation in consultation with DPI (Fisheries).
8. Comments are acknowledged. The EIS management measure SSW16 identifies that mulch tannins would be managed in accordance with the Roads and Maritime Mulch Management Protocol Roads and Maritime guidelines. In addition, management measure SSW3 also identifies that the Soils and Water Management Plan would address tannin leachate management controls.
9. Management measure UD3 details that the project would be carried out in accordance with the urban design and landscaping strategy, as identified in Section 11.4.1 of the EIS. It would be further developed into detailed landscape design for all project batters, and median planting areas would be developed in accordance with the Landscape Guidelines (RTA, 2008), the requirements of the Working paper – Biodiversity (Section 5.2.2) and the landscape strategy to provide a robust, successful and effective planting design. Development of this strategy would be undertaken in consultation with relevant councils and Government agencies and would be based on best-practice and lessons learnt from previous projects.

10. The Urban Design and Landscape Management Plan developed for the project would include locations of all road infrastructure elements included on the detailed design drawings. These elements would be factored into any rehabilitation or planting regimes at these locations.
11. Restoration work or re-establishment of native vegetation within the road corridor has been captured in the EIS and an Urban Design and Landscape Management Plan would be developed (refer to management measure B12). The detail of this management measure is in the Working paper - Biodiversity.
12. The EIS identified that a flora and fauna management plan (refer to management measure B10) and a Rainforest and rainforest plants management plan would be developed that would address management measures for *Macadamia tetraphylla*. A Rainforest and threatened rainforest plants management plan has been prepared (refer to Appendix K) and would continue to be developed in consultation with OEH.
13. The project in the EIS includes a bridge across Koala Drive at station 83.1 (refer to Section 5.2.5 of the EIS). This structure is also included in the Connectivity Strategy (refer to Appendix A of the Working paper - Biodiversity). The landscape and urban design strategy prepared as part of the Working paper - Urban design, landscape character and visual impact also incorporated measures for the planting of dense tree and shrub planting. This landscape and urban design strategy would be further developed during detailed design (refer to management measure UD3).

It should be noted that a design refinement at Koala Drive (refer to Chapter 4 of this report) has been proposed to improve access.

14. This comment is noted. An Ecological Monitoring Program has been prepared for the project. This program covers the timing for baseline monitoring (refer to Appendix K). The monitoring program and individual threatened species management plans would continue to be developed, incorporating results of baseline surveys, in consultation with OEH.
15. The Ecological Monitoring Program and management plans address the need for long-term performance measures for target populations to monitor impacts and the success of connectivity structures. Refer to Appendix K for the monitoring program and management plans.
16. The Wallum Froglet was not considered at high risk from the project and was found to be widespread and moderately common in the project using a range of modified habitats, including artificial drains, cleared paddocks and powerline easements. For this reason the species is not addressed in the threatened frog management plan and monitoring program. However many of the management actions for frogs documented in the plan, for example pre-clearance surveys, are also appropriate for this species (refer to the threatened frog management plan in Appendix K). This plan has a requirement to undertake targeted surveys for Wallum Froglet habitat before construction.
17. Supplementary surveys were undertaken for the Giant Barred Frog in project sections 1 and 2 (refer to Appendix J of this report). The Giant Barred Frog was confirmed at three locations including Corindi Creek, Dirty Creek and Halfway Creek.

The threatened frog management plan would identify the areas to be targeted for surveys during detailed design.

18. Supplementary koala assessments were undertaken for the Submissions/ Preferred Infrastructure Report. As well as additional field surveys, a review of targeted koala connectivity structures was undertaken and found that the structures identified in the EIS were in appropriate locations. As part of the Submissions/Preferred Infrastructure Report, further field surveys and review of crossing structures were undertaken (refer to Chapter 3 of this report). The field surveys confirmed important resident koalas and Long-nosed Potoroo populations in sections 9 and 10. The assessment also made recommendations for the augmentation of or additional culvert structures to facilitate further connectivity. As such, two culverts have been upsized at stations 146.5 and 148.5 north of the Richmond River to combined fauna/drainage structure and a new dedicated landbridge included at station 147.5. These structures now form part of the project. During detailed design, Roads and Maritime would consider opportunities for further connectivity structures at the following locations in consideration of project functional constraints:
 - Station: 144.2 south of the Richmond River.
 - Station: 144.7 south of the Richmond River.
 - Station: 156.9 south of Coolgardie Road, Pimlico.

19. Roads and Maritime would consider placing a covenant on existing vegetated land that is acquired but not required for the project before disposal. Roads and Maritime would also consider the applicability of these areas to form part of offset lands for the project, affording them protection.

20. This comment is acknowledged. A new management measure have been included to address this (refer to new management measure B9).

21. Table 5-4 identifies those threatened species where specific management sub plans would be developed. All other state and federally listed threatened species would be captured under the general Flora and Fauna management plan (refer to management measure B10).

22. It is acknowledged the culverts on the project range in size, and as such, the fully referenced statement may not be applicable to this statement. However, in acknowledgement of this issue, one of the principles in the Connectivity Strategy (refer to Appendix A of the Working paper - Biodiversity) is that "maximum openness is to be provided where the culvert length is greater than 50 metres. As a minimum this should be 3.0m x 3.0m but should consider larger structures where fill heights allow.

23. This is acknowledged. A threatened flora management sub plan is being developed that would develop procedures for seed collection, storage and propagation (refer to the threatened flora management plan in Appendix K). Roads and Maritime would develop this plan during detailed design to identify appropriate management measures that could include the early collection of seeds.

24. The Working paper - Biodiversity acknowledged that there are known hotspots of the Rufous bettong from Halfway Creek (Section 2) to Eight Mile Lane including Glenugie State Forest, Nine Mile Creek and Pillar Valley to Tucabia (Section 3).

The importance of these species is also identified through the connectivity strategy, where Rufous bettong have been targeted in most of the combined and dedicated connectivity structures in project sections 1 to 3.

A threatened mammal management plan has been prepared including the Rufous bettong (refer to Appendix K).

25. The monitoring period for the project would be up to five monitoring periods as stated in the Ecological Monitoring Program (refer to Appendix K).
26. A number of potential ancillary facility sites were identified in the EIS. These sites were further assessed as part of this report and where identification of important biodiversity features, management measures have been identified to mitigate any potential impacts (refer to management measures B52a to B52y). Where impacts could not be adequately mitigated, these sites have been avoided (refer to section 3.11 of this report).
27. Monitoring would be undertaken a minimum of six months before construction and up to five consecutive years from opening of the project to traffic. This would vary depending on the individual species targeted and the number of times that these species are monitored

2.12.9 Assessment process

Submission number(s)

035, 036, 044, 051, 058, 064, 082, 085, 093, 095, 111, 114, Department of Primary Industries (Fisheries), Ballina Shire Council, Environment Protection Authority / Office of Environment & Heritage

Issue description

1. The previous ecology surveys undertaken for the project were insufficient. Baseline surveys do not provide enough evidence to predict the likely scale of impacts or provide an appropriate base for management measures or ongoing meaningful monitoring programs.
2. Table 10.5 suggests that the destruction of five per cent of all known Square-fruited Ironbark specimens would be offset by the benefit of having the 100 metres wide highway clearing act as a fire break.
3. The flora and fauna surveys failed to identify a range of threatened species including the endangered Giant Dragonfly.
4. While the EIS identifies to some extent the significance of the koala population, far more work needs to be done. The assessment has not taken into account current work such as the koala habitat study commissioned by Ballina Shire Council.
5. Ephemeral wetland north of Somervale Road, Tucabia has not been assessed appropriately.
6. The Australasian Bittern has been confirmed north of Tyndale on Champion Creek system (in PPR documents). The EIS does not acknowledge this area as ideal bittern habitat.
7. The impacts of a highway on Champions Creek, particularly on water dependent species, shy species and upon any species reliant upon calls for breeding and other behaviour, need to be considered closely.
8. The level of consideration of impacts upon EECs, threatened species and their habitats to date has been so broad. Detailed studies that would be required to truly evaluate the scale and scope of impacts are yet to be conducted; again suggesting that an accurate costing of offsets required is presently unavailable.

9. Step 5 “Key Thresholds” of the draft guidelines on threatened species assessment have been disregarded by the insistence for the route selected. These thresholds and adherence to them, were key criteria in the Director General's requirements for this assessment.
10. There will not be a 'maintain or improve outcome' as required by agencies and as expected by adherence to the Director Generals' Requirements pertaining to the assessment process for this project.
11. The rare *Bursaria* species, is likely to occur along the route. The largest known sub-population of the species, around 50 plants, has been identified near Bostock Road in close proximity to the project.
12. A survey effort of 117 days is not sufficient given the high number of impacted threatened species. (Page 10-6).
13. In Table 10-1 of the EIS the exact survey periods for a number of activities is vague. For example, were the habitat surveys that occurred in November 2011 for a period of 1 day or 30 days? (Page 10-6).
14. In Table 10-1 of the EIS, reporting on field methods should report whether the surveys were species targeted or simply incidental to other surveys. Where a single survey effort was collecting data on a large number of species it is likely that the data is less reliable. (Page 10-6).
15. On page 10-9 of the EIS, details of the impacts caused by ancillary facilities should be part of the assessed EIS, rather than considered separately.
16. On page 10-12 of the EIS, population estimates – a poor level of detail has been provided here on belt transects. What the minimum, maximum and average length was of transects? (Page 10-12).
17. On page 10-14 of the EIS, no details were provided on what a site survey involved.
18. On page 10-15 of the EIS, survey periods of 5-20 minutes are described. These are too short. Is there reputable evidence that supports the methodology (including survey periods)?
19. On page 10-16 of the EIS, there is a lack of detail on survey effort for the endangered Bush Stone-curlew. (Page 10-16).
20. On page 10-152 of the EIS, a good analysis is provided for *Angophora robur*, however similar data analysis is lacking for many other species. Data should be presented in a consistent manner across species.
21. On page 10-152 of the EIS, why does the observation of a circling Eastern Grass Owl not make this a 'confirmed' species?
22. Page 10-153 refers to data collected on the endangered Coastal Emu population, however the EIS does not report on this data to give an indication of distribution or abundance of the species. What proportion of the population will be impacted by the proposal?
23. On page 10-166 of the EIS, details are provided for impact on Weeping Paperbark population at New Italy, however no indication is given to the broader significance of these impacts on the species as a whole.
24. On page 10-167 of the EIS, Slender screw fern is mentioned. The information provided here suggests that the impacts to this species are very significant. The EIS does not provide evidence to support the assertion that “it is likely that there are other locations of *Lindsaea incisa* in adjacent areas of habitat not surveyed which would reduce the proportion of the population being impacted”.]
25. On page 10-167 of the EIS, removal of two entire sub-populations of *Maundia triglochoides* is likely to represent a significantly large impact that should be avoided. There seems to be little regard to this fact in this section.
26. On page 10-168 of the EIS, Green leaved rose walnut is mentioned – the statement made against this species is unclear. The impact includes removing 6 of 8 unknown individuals and intersecting

- the population. The significance of this impact at a broader scale needs to be explained, including whether or not the loss of this population is significant.
27. On page 10-172 of the EIS, there is not enough evidence to support the assertion that the condition of the area "accounts for the limited distribution of the Black-chinned Honeyeater and Brown Treecreeper".
 28. On page 10-172 of the EIS, there is not enough detail on potential impacts to the endangered Bush Stone-curlew.
 29. On page 10-172, there is inadequate assessment of the proportion of the potential habitat for the critically endangered Double-Eyed Fig-Parrot.
 30. The EIS states that the Brush-tailed Phascogale and Rufous Bettong is tolerant of modified and fragmented habitats. The fragmentation created by a major highway is not akin to the current fragmentation that is provided as evidence for this assertion.
 31. On page 10-176, the EIS states NSW Wildlife Atlas confirms known locations of Spotted-tailed Quoll, including roadkill within the project area. Given low densities across large ranges for this species it is possible that populations do occur, and if so they should be considered significant populations given the current limit of known distribution.
 32. On page 10-202 of the EIS, data should be provided for the likely biodiversity impact of alternative routes, particularly for Section 3.
 33. On page 10-231 of the EIS, management measure B64 (relating to *Lindsaea incisa*) requires a review of the project boundary during detailed design to minimise clearing where possible. This management measure should be included in the EIS and not subsequent approval.
 34. On page 10-231, management measure B66 refers to offsets. The project will create a high level of fragmentation. Those ecological communities isolated by the construction of the project should be offset in the same way that directly impacted sections are.
 35. The pH for OPP should be 3.3 to 6.9, and the pH for Purple Spotted Gudgeon (PSG) should be 5 to 8 (various references through EIS).
 36. Oaky Creek should be classified as a Class 1 waterway. Further aquatic surveys in both Oaky Creek and Nortons Gully to establish the presence or absence of OPP.
 37. Redbank Creek should be reclassified as a Class 2 Waterway"
 38. Figure 3-66 should be amended to show likely OPP habitat in a consistent manner. OPP habitat should include areas that are suitable for OPP whether or not OPP were found in recent aquatic surveys.
 39. Table 4.19 Waterways and the Location of Threatened Species. This table should be considered under review, pending further aquatic surveys to establish the classification of waterways.
 40. The approach the EIS has taken to map vegetation is inconsistent. The entire project should consistently assess the full 500 metre corridor width.
 41. Numerous vegetation communities in the project area are unmapped and the EIS fails to clearly map the existing EECs that are located north of station 159.0.
 42. For the W2B section vegetation mapping relies on mapping done for the route selection.
 43. The areas depicted in the EIS as being subject to 2005 flora traverses (in the Woodburn to Ballina project) are inaccurate.
 44. The EIS incorrectly maps the vegetation communities west of station 162.0 to 162.5 as subtropical rainforest. The subject vegetation is a dry sclerophyll forest.
 45. Ballina Shire Council's vegetation mapping shows the complexity of vegetation communities between 162.0 to 162.5. Mapping attached to submission.
 46. The EIS has failed to stratify and/or undertake the required surveys in relation to the biophysical attributes as described in the DEC guidelines. Surveys should have been undertaken on all 57 different vegetation communities.

47. For forest owls the EIS confirms 38 sites were surveyed over 53 call playback nights. The guidelines require surveys for five nights per site, that is a survey effort of 190 nights.
48. The EIS confirmed a survey effort total of 152 pitfall trap nights. Based on the five broad vegetation types a total of 288 trap nights should have occurred.
49. Council considers that all of the 57 vegetation communities should have been subject to detailed assessment.
50. Table 2.10 identifies 932 hectares of native vegetation occurs within the footprint of the project area. However the offset strategy confirms around 1384 hectares would be directly or indirectly affected. The 452 hectares of vegetation indirectly affected by the project should have been subject to detailed assessment. This is not compliant with the guidelines.
51. The Woodburn to Ballina preferred route submissions report stated that further detailed flora and fauna surveys would be undertaken for the environmental assessment, the EIS has only undertaken limited additional survey.
52. The EIS refers to discussions with Ballina Council staff about obtaining threatened species records. These discussions did not take place.
53. The EIS does not accurately and/or include species records from earlier reports, for example for Blossom bat, *Syzygium moorei*, and *Isoglossa eranthemoides* on figures.
54. The EIS does not map the location of *Marsdenia longilobia*, *Oberonia titiana* and 68 individuals of *Macadamia tetraphylla*.
55. The EIS doesn't detail all the records of threatened species, all threatened species records (including records from Council and Friends of the Koala) should be included on mapping.
56. The EIS has failed to: provide a consistent approach to mapping threatened flora species. Some figures clearly depict distribution, while others provide only a vague outline, for example for Hairy-joint grass and other associated species.
57. A set of composite maps that depict all known significant ecological constraints is not provided, this information is provided through various maps. As a consequence, the true ecological value and impact remains unclear.
58. The EIS has failed to: map the location and extent of the long-nosed potoroo population within the Wardell heathland
59. Impact assessment for fauna species should be based on a species home range, habitat requirements and geographic barriers restricting movement, not the regional approach used in the EIS.
60. Impact assessment for fauna species requires assessment of numerous populations as they occur over the spatial extent of the highway.
61. The EIS confirms removal of 54 and 75 per cent of each flora species impacted near Wardell. The EIS then attempts to reduce the level of impact by identifying 94 hectares of potential rainforest habitat within and surrounding the project. However, further survey needs to confirm occurrence. Impact assessment should be based on known occurrence rather than potential occurrence.
62. The southern swamp orchid *Phaius australis* is not identified in the EIS. It has potential to occur within floodplain EECs.
63. The Wardell locality supports 2 regional core koala source populations. How do the connectivity structures in the area provide for these populations?
64. The EIS does not provide details on the overall cross section length of connectivity structures
65. The details on distance, flow velocities, water depths in which Oxleyan Pygmy Perch require to swim is not provided for connectivity structures. It remains unknown whether Oxleyan Pygmy Perch will successfully utilise these structures.
66. Council has no knowledge of potoroo for connectivity structures at stations 156 and 157. However, is known to occur at station 151.3.

67. Table 10-32 in the EIS does not identify all the threatened plant species impacted by the project.
68. Mapping of swamp mahogany in Yaegl Nature Reserve should be paperbark.
69. South eastern part of Mororo Creek Nature Reserve may be critically endangered federal rainforest- littoral rainforest and coastal vine thickets of Eastern Australia.
70. Reporting and spatial representation of survey effort and threatened species habitat mapping should be included.
71. The Emu genetic pilot study did not address two objectives:
 - Estimate the total population size and structure and the range of group territories through replicated surveys.
 - Identify the proportion of the population using habitat around the alignment in the Pillar Valley Tucabia area and therefore potentially impacted by the project (using the total population size data).
72. Records of the Giant Barred Frog (*mixophyes iteratus*) should be updated due to new locations.
73. Bat surveys should be undertaken now to cover for searches of culverts to evaluate impacts and identify management measures.
74. Biodiversity conservation principles should be applied for ancillary facilities to rest areas and truck weigh stations.
75. A precautionary approach should be applied for *Lindsaea* sp in the absence of survey data.
76. Mitigation structures and widened medians should consider conservation status of adjacent land.

Response

1. As stated in Section 10.1.4 of the EIS, the body of ecological data contributing to the biodiversity assessment of the preferred routes has been gathered over a period of six years (2006-2012) at appropriate survey times. Field surveys undertaken for the previous development projects between 2006 and 2009 were comprehensive and consistent with survey guidelines outlined in the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Department of Environment and Conservation 2004).

These studies were conducted to a level sufficient to inform an EIS. These studies were used as the framework for the biodiversity assessment, with a review identifying knowledge gaps that required additional survey work based on survey timing and effort and representativeness for the species targeted. Additional field surveys were then undertaken in 2010-2012 to address these gaps. The field survey information has provided a range of data over various seasons, with a focus on a range of different species. Surveys were conducted using a combination of sampling techniques in general accordance (where relevant) with the Threatened Biodiversity Survey and Assessment: Guidelines for developments and activities - Working draft (DEC, 2004), Draft Guidelines for Threatened Species Assessment (DEC & DPI, 2005); Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna - Amphibians (DECC, 2009). The majority of the surveys preceded the release of the Commonwealth guidelines for survey of threatened species in 2010 and 2011. Survey techniques applied through the course of the study (2006-2012) are considered to comply with these guidelines in terms of the planning requirements; equipment used, and survey technique.

As part of the EIS process, additional field investigations (refer to Working paper – Biodiversity) were undertaken. These included:

- Re-survey of previously identified threatened flora populations to identify any change in distribution and abundance since the original surveys.

- Targeted searched for cryptic summer flowering species.
- Targeted survey of the Lowland Rainforest Critically Endangered Ecological Community.
- Targeted invertebrate survey (including the Atlas Rainforest Ground Beetle).
- Targeted surveys for small terrestrial mammals.
- Extent of hollow-bearing trees
- Targeted bat surveys
- Aquatic survey of Duck Creek.

As well as field surveys, the NSW Wildlife Atlas database was reviewed to identify koala records in and surrounding the project. Koala habitat mapping was also obtained from the Environment Protection Agency.

In addition, further assessment has been undertaken as part of the preferred infrastructure report, in particular further koala and invertebrate surveys in sections 10 and 11. These surveys have increased the knowledge of the areas biodiversity, and verify the extent of impacts as a result of this project, in relation to the wider populations and habitat surrounding the project. It has also informed further management measures including connectivity structures and management plans.

The likelihood and assumed presence of species occurring in the study area is included in Appendix D of the Working paper – Biodiversity and involved consideration of both records for threatened species (including from the NSW Wildlife Atlas database) and well as field surveys. Impacts from the project were then identified for those species with a moderate to high likelihood (or those confirmed during field survey).

The significance of these impacts has been detailed in Chapter 6 of the Working paper. Detailed significance assessments were completed, and are included in Appendix E of the Working paper.

2. The EIS does not imply that the impact to the Square-fruited ironbark species is offset by a fire break. The statement: "The project would result in a larger fire break to bushfires approaching from the west of the existing highway, potentially resulting in the frequency of bushfire to be reduced in populations to the east" was in reference to whether the project would alter current disturbance regimes (refer to the *Eucalyptus tetrapleura* significance assessment in Appendix D of the Working paper – Biodiversity).
3. The Giant Dragonfly was considered in the previous assessments for the Wells Crossing to Iluka Road project, where the ecology report found that there was a minimal potential of it being present in the project boundary. The Wells Crossing to Iluka Road Biodiversity working paper (SKM, 2006) identified that: "the potential habitat for Giant Dragonfly is widespread, with numerous wetland areas associated with waterways and floodplains potentially containing this species. An unconfirmed record for the Giant Dragonfly exists for wetland areas in the Coldstream River headwaters. The majority of wetland areas in the lower catchment, such as those on the Clarence floodplain illustrate degradation as a result of land clearance and stock access. Such wetlands are unlikely to hold populations of the Giant Dragonfly given that degradation of wetland habitats is thought to be a contributing factor in its decline, and the absence of records on the Clarence floodplains." This species was not detected during field surveys. It should also be noted that this record did not appear on the NSW Wildlife Atlas database which were consulted as part of the EIS assessment.

4. Further koala investigations have been undertaken as part of the Supplementary Biodiversity Assessment, with the results identified in Chapter 3. However, additional koala surveys in particular through sections 10 and 11 were undertaken. These surveys confirmed the presence of koalas in areas where it was assumed in the EIS. These surveys were undertaken in consultation with landowners and the community. Additional management measures regarding connectivity structures and management plans have been recommended. These are included in Chapter 5. The project monitoring program (refer to Appendix B in the Working paper – Biodiversity), identifies that the monitoring of koalas in project sections 7, 9 and 10, including baseline surveys and monitoring of connectivity structures for use would be undertaken. The results of this monitoring would be reviewed in consultation with OEH and DoE.

It is understood that Ballina Shire Council is also undertaking a koala habitat study. The results of this study were not available at the time the Working paper - Biodiversity was prepared.

5. It is acknowledged there is an ephemeral water body north of Somervale Road, Tucabia, at Champions Creek. This area was subject to targeted flora and fauna surveys (refer to Appendix N of the Working paper - Biodiversity). During detailed design, further vegetation survey would be undertaken at this location once the project boundary is confirmed. Should additional vegetation be found, it would be appropriately assessed and identified as requiring offset in the Offset Strategy, by noting the biodiversity characteristics of the wetland.
6. Australasian Bittern is identified in Appendix D of the Working paper - Biodiversity as having a moderate likelihood of occurrence in project sections 1, 2 and 4, and confirmed (ie detected during field surveys) in Section 3. In section 3.9.4 of the working paper, it identifies that one individual was detected near Champions Creek, and that records are well known from the area. The assessment of wetland birds, including the Australasian Bittern is included in Table 4-16 of the working paper. An assessment of significance on the wetland birds (refer to Appendix E of the Working paper - Biodiversity) found that there would not be a significant impact on any of these species.

The Supplementary Biodiversity Assessment provides a revised assessment of significance to assess the impact to the Australasian bittern only, rather than with other wetland birds (refer to chapter 6 of the Supplementary Biodiversity Assessment). This assessment found that the project would not result in a significant impact on the species.

7. Fauna surveys around the Champions Creek area included fish surveys, anabat detector sites and a general fauna survey site (consisting of trapping for arboreal and small and medium sized fauna; anabat and bat spotlighting; transects and call playback for owl species and spotlighting; herpetological surveys including spotlighting and call recognition). Further fauna investigations would be undertaken during detailed design to inform the management plans and monitoring program.
8. Five endangered ecological communities including one critically endangered ecological community would be impacted by the project as identified in the EIS. However, further assessment undertaken identified another two endangered ecological communities including another critically endangered ecological community. Significance assessments for these endangered ecological communities are provided in Chapter 6 of the Supplementary Biodiversity Assessment. The Biodiversity offset strategy (Appendix C of Working paper - Biodiversity) details the proposed

offset ratio for endangered ecological communities and are still relevant to these communities. Table 2-15 in Working paper – Biodiversity provides a summary of the survey methods and effort for targeted threatened fauna. This assessment summary provides a listing of vegetation and habitat types linked to threatened species, and the habitat area inside the project boundary.

9. The biodiversity assessment was undertaken in accordance with the draft Guidelines for Threatened Species Assessment under Part 3A (repealed, now Part 5.1) of the *Environmental Planning and Assessment Act 1979*. The assessment addressed the key thresholds identified in these guidelines and were taken into consideration in assessing the impacts on threatened species, populations and communities as a likely result of the project (refer to Chapter 7 of the Working paper – Biodiversity).
10. The need for a “maintain and improve outcome” for the development of a project is acknowledged. The project has included a range of management measures such as connectivity strategy and a monitoring strategy to manage impacts as a result of the project. A Biodiversity Offset Package to be developed as part of the project would deliver a package of offsets to achieve a neutral or net beneficial biodiversity outcome for the region.
11. The NSW Wildlife Atlas database was accessed for the EIS to obtain threatened flora records for the area. No records of a threatened *bursaria* species was identified in the project boundary. The presence of this *Bursaria* species would be considered in flora surveys undertaken during detailed design.
12. Appendix M of the Working paper - Biodiversity details the survey effort for threatened species. Surveys were conducted during all four seasons using a combination of sampling techniques in compliance with or exceeding guidelines in the Threatened Biodiversity Survey and Assessment: Guidelines for developments and activities - Working draft (DEC, 2004). It is acknowledged that some of the survey effort did not meet the stated number of survey periods per site in the guidelines. However, the guidelines identify that based on professional experience, a species can be assumed to be present. Where this occurred, the species was assumed to be present and was considered in the biodiversity assessment.
13. A summary of all the field surveys undertaken within the project boundary and their purpose is detailed in Table 10-1 of the EIS. During all surveys, threatened flora searches were conducted continuously while traversing habitats in the study area. All threatened flora species encountered were recorded along with similar common species. This equated to a survey effort of 117 days across all seasons. This is included in Table 2-9 of the Working paper - Biodiversity. The November 2011 survey was over 5 days, between 21 and 25 November.
14. Vegetation and flora survey methods are described in Section 2.4.2, and fauna survey methods including species targeted during surveys are described in Section 2.4.3 of Working paper - Biodiversity.
15. Eighty one potential ancillary facilities were identified along the project length in the EIS and were selected in consideration of low ecological value. The ancillary facilities were subject to desktop assessment as part of the EIS. Further investigations including field surveys for biodiversity and heritage were undertaken as part of this Submissions / Preferred Infrastructure Report. The results of this assessment are included in Chapter 3 of this report.

16. Chapter 10 of the EIS contains a summary of the detailed assessment included in the Working paper - Biodiversity. Appendix N of the working paper includes a threatened species habitat matrix and survey locations. Table 2-5 of the working paper includes a summary of flora survey timing, techniques and effort. The systematic survey of vegetation used a combination of transects and plot-based surveys to provide information on vegetation boundaries, floristic diversity and the presence of threatened species. Where threatened species were identified, further survey was conducted to identify the extent of the population directly and indirectly impacted by the project. Transect lengths varied and included 10 metre, 75 metre, 100 metre lengths.

17. Details for vegetation and flora survey methods are described in Section 2.4.2 of the Working paper – Biodiversity and fauna survey methods are described in Section 2.4.3 of Working paper - Biodiversity. Methods for surveys undertaken as part of the Supplementary Biodiversity Assessment are detailed in chapter 5 of Appendix J.

18. Full details of surveys undertaken are in the Working paper – Biodiversity and in chapter 5 of the Supplementary Biodiversity Assessment (Appendix J). Surveys were conducted during all four seasons using a combination of sampling techniques in compliance with or exceeding guidelines in the Threatened Biodiversity Survey and Assessment: Guidelines for developments and activities - Working draft (DEC, 2004).

19. Section 2.4 of Working paper – Biodiversity identified the survey effort for surveying woodland birds (including Bush Stone-curlew). The Bush Stone-curlew (*Burhinus grallarius*), along with other woodland birds, were subject to systematic bird surveys targeting suitable habitat (including a range of dry sclerophyll forest types, predominantly with open or grassy understorey) at a total of 24 sites. These surveys were conducted across a full range of seasons and generally time-based consisting of direct observations of birds and identification from calls using either a line transect or random meander search technique for between 20 and 60 minutes at each site depending on the area and site accessibility.

20. A total of 15 threatened flora species were identified from ecological surveys undertaken from 2006 to 2012 in proximity to the project boundary. Table 10-8 of the EIS provided a summary of these species. Details on these species included population size and distribution has been provided where a large population is present in the project boundary. This is provided in Section 4.3.1 of Working paper - Biodiversity.

Additional threatened flora surveys undertaken as part of the Supplementary Biodiversity Assessment has, in some case identified increase in population numbers as surveys were undertaken further afield from the project boundary. In addition, two additional flora species were identified. Details on surveys and results are identified in chapters 5 and 6 of Appendix J.

21. An individual Eastern Grass Owl (*Tyto capensis*) was observed circling over a survey site at Broadwater South (Section 9), though was not confirmed from targeted surveys along the project boundary. For details, refer to Appendix D of Working paper – Biodiversity. This lists the likelihood of threatened species occurring in the study area.

22. The North Coast bioregion comprises three coastal emu sub-populations. The project would impact on the habitat of the Yuraygir coastal emu sub-population. The predicted population size is between 80-120 individuals (refer to Table 10-13 of the EIS).
23. The only Weeping Paperbark (*Melaleuca irbyana*) population known to occur in the project boundary is at New Italy and is currently bisected by the existing Pacific Highway with individuals occurring on both sides of the highway. Other populations between Glenugie and Tyndale occur outside of the project boundary comprising small localised clusters of plants in regenerating forest, as such these populations would not be impacted by the project. Impacts to the Weeping Paperbark population are provided in Section 4.3.1 of Working paper - Biodiversity.
24. Around 0.4 hectares of occupied habitat for Slender Screw Fern (*Lindsaea incisa*) is located within the project boundary (Section 3). This comprises around 14.2 per cent of the local population. The population consists of four different sub-populations in sections 1-3 and 6 of the project. The EIS (in Table 10-15) states that "47 per cent (of the population) is situated outside the project boundary and there is potential suitable habitat in adjacent areas not surveyed which would reduce the proportion of the population being impacted". Note the population number is difficult to determine due to the growth habitat of this species.

As the Slender Screw Fern was found to be restricted to narrow riparian habitats associated with creeks and drainage swales in varying abundance (Table 10-2 of the EIS and Section 2.4.2 of Working paper - Biodiversity), targeted surveys concentrated on these suitable habitat types where crossed by the project. In addition, the Supplementary Biodiversity Assessment recorded Slender Screw Fern along an access trail near a proposed ancillary facility along Section 3 of the project (Section 2.4 of Supplementary Biodiversity Assessment). This occurs in a small drainage channel on the side of the trail. The population of the Slender Screw fern would not be impacted by construction by using the existing trails for access.

25. Section 3.9.3 of Working paper - Biodiversity states Section 7 contains small to moderate populations of *Maundia triglochinos* while large, and moderate to large populations are located in Section 1 and Section 3 of the project, respectively. The project would potentially result in the removal of the entire area of two (*Maundia triglochinos*) sub-populations in Section 7 of the project, the removal of five to 10 per cent of three sub-populations (in Sections 3 and 7) and low level impact to one population in Section 2 (refer to Table 10-15 of the EIS). The project would have a significant impact on this species of threatened flora, as shown in Table 10-23 of the EIS. A design refinement at Firth Heinz Road undertaken as this Submissions / Preferred Infrastructure Report would avoid impact to the species in Section 3 (see Chapter 4 of this report).
26. The EIS identified that a total of eight Green-leaved Rose Walnut (*Endiandra muelleri subsp. bracteata*) individuals were recorded (sections 5 and 10 of the project). Of these eight individuals, six were located within the project boundary in the EIS and would potentially be affected by the project.

Supplementary surveys and a design refinement have resulted in an increase in the number of individuals detected (from eight to 44) in the study area, and a reduction in the number affected by the project (only two individual potentially indirectly impacted, and no individual directly impacted). The individuals identified are potentially part of a larger population of this species occurring in rainforest habitats surrounding the project boundary in Section 10. Around 85 hectares of potential

rainforest habitat for this species has been identified within and surrounding the project boundary in Section 10 (refer to section 6.2.5 of the Supplementary Biodiversity Assessment).

27. The EIS (Section 10.3.3) states that much of the suitable habitat for woodland birds in the study area "has been logged and is in low to moderate condition." As suitable habitat for these species, therefore, is limited, this would account "for the limited distribution of the Black-chinned Honeyeater and Brown Treecreeper".
28. The significance assessment for the Bush Stone-curlew found there would not be a likely significant impact to the species caused by the project (see Section 6.3 and Appendix E of Working paper - Biodiversity). As outlined in Section 10.3.3 of the EIS, suitable habitat for Woodland birds such as the Bush Stone-curlew, in the study area is limited and would be associated with woodland or forest dominated by Grey Box, Spotted Gum and Ironbark with open grassy understorey.
29. The Double-Eyed Fig-Parrot (*Cyclopsitta diophthalma coxeni*) was not confirmed from targeted surveys along the project boundary (see Section 3.10.2 of Working paper - Biodiversity). However, due to suitable habitat (rainforests and wet sclerophyll forest) the species is predicted to occur within sections 9-11 of the project. The project is located outside of the range of breeding populations, with predicted species presence due to potential foraging resource (Section 2.4.5 of Working paper – Biodiversity). As such, potential impacts are associated with loss of potential food resources, mainly associated with the loss of lowland subtropical rainforest (10.5 hectares of which only 5.8 meets the Commonwealth listing criteria). Refer to Section 10.3.3 of the EIS).

A revised assessment of significance for the species was undertaken as part of the Supplementary Biodiversity Assessment. While this was undertaken in the EIS, it was grouped with other rainforest birds. The revised assessment of significance confirmed that the project would not have a significant impact on the species.

30. The statement Brush-tailed Phascogale is tolerant of modified and fragmented habitats is used to define the habitat requirement for the species. It is not used as justification for the project. The severity of the impact on a regional scale is low, as the species is widespread over a large portion of the bioregion. The impacts of the barrier effect and fragmentation have been addressed via a focus on this species in the Biodiversity Connectivity Strategy (Appendix A of Working paper – Biodiversity) and the mitigation and management measures specified in Table 10-32 of the EIS:
- Monitoring of fauna connectivity structures (Monitoring Strategy) (B1).
 - Arboreal crossing structures and widened medians (Connectivity Strategy (B2, B3, B6, B7).
 - Fauna exclusion fencing (B4, B5).
 - Threatened mammal management plan (B9).
 - Pre-clearing surveys (B29).
 - Staged removal process (B31).
 - Nest boxes (B37).
 - Fauna handling (B38).

A threatened mammal management plan has been prepared (refer to Appendix K of this report) and addresses impacts to the Brush-tailed Phascogale.

31. Though the Spotted-tailed Quoll (*Dasyurus maculatus maculatus*) was not recorded during surveys within the project boundary, the EIS (Section 10.3.3) states that "based on the habitats present, in particular state forests and conservation reserves, two main areas exist which may represent important habitat for regional populations". As such, the species is predicted to occur within the project area. The impacts to the Spotted-tailed Quoll have been addressed via a focus on this species in the Biodiversity Connectivity Strategy (Appendix A of Working paper – Biodiversity) and the mitigation and management measures specified in Table 10-32 of the EIS:
- Monitoring of fauna connectivity structures (Monitoring Strategy) (B1).
 - Fauna connectivity structures (Connectivity Strategy (B2, B3).
 - Fauna exclusion fencing (B4, B5).
 - Threatened mammal management plan (B9).
 - Pre-clearing surveys (B29).
 - Staged removal process (B31).
 - Re-use of woody debris and bushrock (B32).
 - Fauna handling (B38).

A threatened mammal management plan has been prepared (refer to Appendix K of this report) and addresses impacts to the Spotted-tailed Quoll.

32. The purpose of the EIS is to identify those impacts associated with the project for which approval is being sought. Roads and Maritime has undertaken extensive investment into consideration of alternative routes. Chapter 4 of the EIS provides a summary and provides reference to the documents where the information can be found.
33. Targeted surveys of Slender Screw Fern (*Lindsaea incisa*) in 2011 recorded the species in Sections 1, 2, 3 and 6 of the project. The EIS identified current project impacts to the Slender Screw Fern (Table 10-15 of the EIS). Due to these impacts, management measure B53 "the project boundary in Section 1 to be reviewed to identify any opportunities to avoid significant impacts to the existing population" was recommended (refer to Chapter 5 of this report). Further survey was completed to identify the extent of Slender Screw Fern in Section 1 of the project. This additional assessment is included in a Supplementary Biodiversity Assessment (refer to Appendix J of this report).
34. Roads and Maritime sought to minimise biodiversity impacts through the route selection phase, however, the project would, result in the clearing of vegetation and loss of habitat. The supplementary biodiversity assessment revised the area of clearing down to 932 hectares and 262 hectares of EEC, which is a reduction from the EIS. To mitigate impacts, an offset strategy would be developed following further consultation with OEH and DotE. Further information on the Offset Strategy is provided in response 1 in Section 2.12.7.
35. This comment is noted. A threatened fish management plan has been prepared for the project to manage potential impacts on threatened fish during detailed design and construction (refer to Appendix K).

The pH values provided have been included in this plan.

Further aquatic surveys of a number of waterways in project sections 6 to 10 were undertaken in August and September 2013, in consultation with DPI (Fisheries). These surveys included both

Oakey Creek and Nortons Gully. Oxleyan Pygmy Perch were not found in either of these waterways. During detailed design (refer to management measure B15), further Oxleyan Pygmy Perch surveys would be undertaken in consultation with DPI (Fisheries) to confirm the Class of the waterway and the design will be reviewed to include appropriate crossing structures for the following waterways:

- Unnamed waterway station 114.0.
 - Oakey Creek station 122.5.
 - Nortons Gully station 123.6.
 - Unnamed waterway station 133.4.
 - Unnamed waterway at station 134.7.
 - Tributary of Macdonalds Creek at station 135.5.
 - Montis Gully station 141.0.
 - Eversons Creek station 143.6.
36. Further field investigations and assessment of threatened fish habitat, undertaken with DPI (Fisheries), assessed that Redbank Creek is unlikely to be threatened fish habitat. As such, this creek is now classified as a Class 2 waterway. The detailed design phase would consider the appropriate structure to be constructed at this waterway location and included in the relevant construction management plans eg soil and water sub-plan.
37. Figure series 3-62 to 3-70 consistently show key fish habitat, OPP habitat mapped by DPI (Fisheries) and those areas where OPP habitat was identified during field surveys for the project. The latter was provided as an indication of the survey effort undertaken.

Roads and Maritime considers the mapping sufficient to represent known and potential areas of OPP habitats that may be directly affected by the project.

38. It is acknowledged that further work has been and will be undertaken to review the waterway classifications. This would be further updated as part of the development of the Connectivity Strategy and would inform the finalisation of structure design in consultation with DPI (Fisheries).
39. It is acknowledged that the vegetation mapping across the project corridor was undertaken at different scales. In particular, the vegetation mapping in project sections 9, 10 and 11 was only undertaken to the project boundary. Further vegetation surveys and mapping would occur during detailed design.
40. Vegetation communities and threatened ecological communities that were within the project corridor were mapped as part of the project. Further vegetation survey and mapping would occur during detailed design.

It is understood that Ballina Shire Council has undertaken further vegetation mapping within their LGA. This information would be included during this stage.

41. The vegetation mapping undertaken for the project, not only used previous surveys, but also undertook additional surveys during the EIS phase (particularly to identify and map Lowland Rainforest). As well as field investigations, the assessment assumed the presence of a number of species using the precautionary approach.

42. Surveys undertaken for the previous Woodburn to Ballina project were used as part of ecological surveys in the EIS. In some cases, this information was not available graphically and was not depicted in maps in the EIS. However, the surveys and results were included in the EIS assessment. However, where data was not available for an area or a species, this was assumed to be a gap in the survey effort and this was targeted as part of the EIS surveys.
43. The area in question was surveyed during 2012 to determine the presence of Lowland Rainforest. This survey was undertaken in accordance with the Commonwealth Department of Environment guidelines. Lowland Rainforest was found in this area.
44. Mapping attached to the submission did not cover the area of 162.0 to 162.5 and it is assumed that the submission was referring to the stations 152.0 and 152.5. However, Roads and Maritime would review Council's vegetation mapping to inform the preparation of the project's Offset Package and the finalisation of the Threatened Flora Management Plan (refer to Appendix K).
45. The vegetation types referred to in the EIS were based on the BioMetric database (OEH, 2012). The EIS has used stratification to collate survey effort for both vegetation and fauna surveys. Further details can be found in Appendix M of the Working paper - Biodiversity.

46. Appendix M of the Working paper - Biodiversity details the survey effort for the forest owl. However, while the DEC survey guidelines do state that a minimum of five nights per site should be surveyed, it also provides flexibility in that a species can be assumed present based on professional experience, which has occurred in this case.

However, further surveys would be undertaken before construction to identify any owl nesting/roosting sites.

47. The DEC survey guidelines do state that a certain number of nights per site should be surveyed. However, it also provides flexibility in that a species can be assumed present based on professional experience, which has occurred in this case.
48. The EIS assessment has used stratification of all habitats present. The stratification was used to ensure that fauna surveys sampled across the full range of habitat types on the project. Stratification was based on vegetation structure and topography.

Further biodiversity surveys have been undertaken targeting survey requirements in specific vegetation types.

49. In most cases, the vegetation to be indirectly affected by the project has been subject to surveys as part of the project. However, it is acknowledged that in some project sections, the vegetation mapping has been mostly confined to the project corridor. The assessment of the indirectly affected areas is not inconsistent with the DEC survey guidelines, with a precautionary approach used, and species assumed to be present.
50. The EIS reviewed the flora and fauna surveys undertaken for the Woodburn to Ballina preferred route as part of a gap analysis, and identified that a range of detailed surveys were required in this section. These surveys aimed to identify or potential presence of species in the study to focus the impact assessment. These additional surveys included:

- Extent of hollow-bearing trees.
- Targeted bat surveys.
- Invertebrates surveys.
- Map changed extent and distribution of threatened flora, targeted summer surveys for cryptic species.
- Targeted surveys of Lowland Rainforest.
- Aquatic survey of Duck Creek.

As part of the Submissions / Preferred Infrastructure Report, supplementary surveys were undertaken for Lowland Rainforest, rainforest flora species, koala and invertebrate species in this area. Further details on the result of these surveys are in Chapter 3 of this report.

51. Discussions were held with Ballina Shire Council throughout the project development. Threatened species records were requested from the council during the Woodburn to Ballina route development. Consultation was undertaken with Ballina Shire Council through the development of the EIS, however, it is noted that no environmental staff attended.

Roads and Maritime is aware that Council has updated vegetation mapping in the Local Government area and is currently undertaking a koala survey. Roads and Maritime would consider this additional information once it is finalised and published during the finalisation of management plans during detailed design.

52. The EIS confirmed the presence of the Common Blossom-bat and *Isoglossa eranthemoides* during field surveys or identified that there was a high likelihood of presence in the area (refer to Appendix D of Working paper - Biodiversity). As such, these were considered in the impact assessment.
53. The locations of both of these species were not mapped as they were situated outside of the road boundary.

In relation to *Marsdenia longilobia*, this species was detected outside of the project boundary, however it was identified as also having a high likelihood of occurrence within the northern project sections (including Section 10 between Richmond River and Coolgardie Road), with over 10 hectares of suitable habitat within the project boundary. This species was considered in the impact assessment and a significance assessment was prepared that indicated that there would not be a significant impact on the species. Supplementary surveys undertaken as part of the Submissions / Preferred Infrastructure Report, further investigated this species and found three plants outside of the project boundary.

In relation to *Oberonia titania*, this species was located in project section 7 and 10 during earlier surveys, but could not be relocated during the 2012 surveys and as such, were not mapped. However, it was assumed that the species was present and it was considered further in the impact assessment, with a significance assessment being prepared. There would not be a significant impact on this species.

However, during the finalisation of the Rainforest and threatened rainforest plants management plan, further surveys would be undertaken to confirm the presence of species within the project boundary for consideration in the plan."

Macadamia tetraphylla has been mapped in the Working paper - Biodiversity (refer to Figure 3-79).

54. Due to the scale of the figures in the EIS and the Working paper, the inclusion of data from Council, community groups and from the NSW Wildlife Atlas database could not be shown with clarity. As such, they were omitted from the figures and only those records from field surveys were shown. However, all species records were used in determining the likelihood of occurrence of species in the project corridor (refer to Appendix D of the Working paper - Biodiversity) and the assessment of impacts from the project.

For example, in project section 10, the EIS has confirmed or identified as a high likelihood of the presence of 40 threatened fauna species in that area. These species were subject to impact assessment.

55. The mapping of threatened flora was consistent. Hairy Joint grass was detected over large areas, and the mapping identifies the surveyed distribution. Where it was reasonable to count individuals of the species, this was done and mapped, however could not be undertaken for all species (including Hairy Joint Grass).
56. The figures depicting vegetation mapping and fauna habitats in the EIS and the Working paper were provided separately to provide clarity. Due to the complexities of the mapping and the scale of the maps, these could not be shown on one map series.
57. The location of the Long-nosed Potoroo has not been mapped as part of the EIS. However, the assessment has assumed its presence in the study area (hair samples were gathered during field surveys indicating presence). A significance assessment for the species was prepared as part of the EIS.
58. The assessment was undertaken in accordance with the OEH guidelines. This included the approach, stratification of vegetation and the identification of limitations
59. The identification of threatened species that should be assessed as part of the EIS was not based solely on the results of field surveys. Instead threatened species records and vegetation types were reviewed to identify likelihood of presence within each of the project sections.

Significance assessments undertaken were based on those areas where a species was identified as being confirmed, or had a moderate to high level of presence.

60. Supplementary surveys of rainforest plants have been undertaken as part of the Submissions Preferred Infrastructure Report. These surveys undertook surveys within and outside of the project boundary to better define the extent of populations. The results of these surveys are identified in Chapter 3 of this report, with mapping provided in Appendix J.
61. *Phaius Australis* is identified in Appendix D of the Working paper as having a low likelihood of occurring within the study area.

However, during the supplementary field surveys, this species was targeted. It was not found within the project boundary, however, 68 individuals were identified outside of the project boundary and would not be impacted by the project (refer to Appendix J of this report).

Further flora surveys would be undertaken before construction. If detected within the project boundary, appropriate management measures would be developed in consultation with OEH.

62. The EIS acknowledged that one area of high density koala records was between Woodburn and Ballina. This was supported by the supplementary koala surveys. As part of the supplementary biodiversity assessment, a review of connectivity structures was undertaken. This identified two locations where culvert structures would be augmented or additional structures added to provide further connectivity (refer to Appendix J of this report).
63. Table A-5 in the Working paper - Biodiversity identifies each crossing structure and lists the cross-sectional length for culvert structures.
64. Roads and Maritime has developed Oxleyan Pygmy Perch (OPP) crossing structures in consultation with DPI (Fisheries) and in consideration of the type of crossing structures provided on other road projects to facilitate OPP movement. The appropriate conditions that are suitable to OPP movement are well documented and included within the Biodiversity Connectivity Strategy as principles that need to be incorporated into the connectivity structures.

Further consultation with DPI (Fisheries) on the development of OPP connectivity structures would occur as part of detailed design and construction.
65. A number of records of the Long-nosed Potoroo have been identified in the Wardell Heath, where there is a population of the species. The structures to the north aim to connect this vegetation to scattered vegetation surrounding Coolgardie.
66. Table 10-32 does not address all threatened species, but rather targeted species. While it addresses all fauna species, the listed flora species are those where the project would impact on large known populations of the species.
67. This comment is acknowledged.
68. It should be noted that the area identified in the Mororo Creek Nature Reserve is outside of the study area for the project, and was not mapped or assessed.
69. As a result of comments provided by OEH during the review of the EIS, additional maps and data were provided in the Working paper – Biodiversity to spatially represent survey effort and threatened species habitat mapping. Additional biodiversity investigations undertaken for threatened species during the preparation of the Submissions / Preferred Infrastructure Report, also includes survey effort and habitat mapping (refer to Appendix J of this report).
70. This study was a pilot study designed to identify whether the collection of DNA from emu scats and feathers could provide a suitable method to determine the total population size and proportion of population using the habitat near Tucabia. The conclusion of this study identified that these objectives were not able to be met as there was not enough DNA to provide the information.

71. Supplementary surveys were undertaken for the Giant Barred Frog (*Mixophyes*) in project sections 1 and 2 (refer to Appendix J of this report). The Giant Barred Frog was confirmed at three locations including Corindi Creek, Dirty Creek and Halfway Creek.

72. Bat surveys of culverts and bridges to be demolished or impacted by the project would be undertaken before construction. The threatened mammal management plan has incorporated procedures for these surveys to be undertaken before construction and in consultation with OEH.

Best-practice measures would be incorporated to mitigate any impacts to bat colonies in bridge or culvert structures. This includes lessons learnt from the successful relocation of *Myotis macropus* on the Tintenbar to Ewingsdale upgrade project.

73. Rest areas along the Pacific Highway are situated about 50 kilometres apart to enable travellers adequate opportunities to stop.

Roads and Maritime is considering delaying the construction of the heavy vehicle checking station north of the Richmond River until when it would be required due to the increase in traffic numbers. This could reduce the footprint of the facility at this location.

In addition, a design refinement (refer to Chapter 4 of this report), has relocated the rest area at Pine Brush has been moved eight kilometres south to reduce impacts to key fauna habitat (including habitat critical to the survival of Koala), threatened ecological communities and to Commonwealth listed threatened flora species *Angophora robur*. This change was made by Roads and Maritime solely to reduce impacts to biodiversity.

74. Supplementary field surveys for *Lindsaea incisa* were undertaken in 2013. Searches were conducted at locations in project section 2, 3, 6, 7 and 8. A single additional population was found in Section 3, located outside of the project corridor. The EIS identified that 0.4 hectares of this species would be impacted by the project. This impact would not change, however, due to the supplementary field surveys, the total known population in the region has increased to 2.7 hectares.

75. Connectivity structures have been developed in consideration of movement corridors and threatened species populations. However, while Roads and Maritime has attempted to place structures adjacent to state forests, nature reserves and national parks however due to the length of the project and the requirement for structures many are located adjacent to private land.

2.12.10 Weed management

Submission number(s)

005, 046, 087.

Issue description

1. Currently the site near the respondent's property is full of weeds and uncultivated plants blocking free flow of rainwater and creating a seed bank for these plants. This needs urgent attention.
2. An appropriate maintenance regime for weed control within landscaped areas should be included which considers requirements for specific species.

3. The project should include the development and implementation of a weed management plan.

Response

1. The property in question has been acquired by Roads and Maritime for the project. However, it is currently being partially used for cane farming. Part of the property is not required for the project and Roads and Maritime is currently considering the ongoing maintenance requirements for the property and early disposal.
2. The project includes measure to avoid the spread of weeds. A weed management plan would be developed as part of the Construction Environmental Management Plan in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011) (refer to management measure B27). During operation, weed management would be undertaken in accordance with Roads and Maritime' operational maintenance procedures.
3. The EIS identifies that a weed management plan would be produced as part of the project (refer to management measure B27).

2.13 Visual amenity, urban design and landscaping

2.13.1 Landscaping

Submission number(s)

087, 096, Richmond Valley Council.

Issue description

1. Lack of detail regarding landscaping. Recommendations provided for species plantings including ensuring that species are not weeds, locally occurring plants provide the source of seeds to prevent genetic pollution that occur outside the area.
2. The new Shark Creek Bridge be landscaped where possible. The respondent supports the plan outlined at Landscape WP p243. Respondent suggests that visual buffer treatments for residents affected along the corridor of the old highway as the houses face towards the highway. The respondent supports the reinstatement of riparian vegetation to bridge approaches and disturbed area near Shark Creek.
3. Roads and Maritime should work closely with councils to beautify the interchanges to promote both a positive image and to encourage travellers to deviate from the journey.

Response

1. A landscaping strategy is identified in chapter 4 of the Working paper – Landscape character assessment and visual impact. It includes the use of local and endemic species to complement existing vegetation patterns and reduce the visual impact of earthworks, adhering to ecological requirements outlined in the Working paper – Biodiversity.

This landscaping strategy would be further developed during detailed design and detailed landscaping plans (including planting schedules) prepared in accordance with the requirements of Working paper – Urban design and Working paper – Biodiversity to provide a robust, successful and effective planting design (refer to management measure UD3 in Chapter 5 of this report). One of the design principles in the Biodiversity Connectivity Strategy is to use locally indigenous species. During operation, landscape and rehabilitation work would be monitored and remedial

measures implemented where required until vegetation has stabilised (refer to management measure UD13 in Chapter 5 of this report).

2. The project would include landscaping through the landscape and urban design strategy. For the floodplains across the Shark Creek, the strategy (refer to Section 4.4.5 of Working paper – Urban design, landscape character and visual impact) recommends "intermittent tall roadside planting within the agricultural floodplains of Shark Creek" and reinstating "riparian vegetation to bridge approaches and disturbed areas near Shark Creek". Roads and Maritime can only landscape areas that are within the proposed road reserve. Roads and Maritime would continue to consult with directly affected property owners regarding landscaping.
3. The project includes a landscape and urban design strategy that detailed the landscaping treatment for the project. In particular, Working paper- Landscape character, urban design and visual impact details the landscaping for the interchange locations (refer to Chapter 4 of the working paper). A detailed landscaping strategy would be developed during detailed design. Roads and Maritime would consult with the relevant councils during preparation of the Urban Design and Landscape Management Plan.

2.13.2 Visual impact

Submission number(s)

096, Richmond Valley Council

Issue description

1. The visual impact assessment is not adequate as no viewpoint has been provided in vicinity of the new Shark Creek Bridge, factoring in the distant view to Clarence Peak in the context of local homes and the potential to develop a farmstay oriented to the eastern view. The EIS implies that the seasonal nature of sugar cane would provide some screening, but this is unlikely as sugar cane only grows to 2 metres, however, the bridge would be 10 metres.
2. The overpass bridges at each of the interchanges should have an artistic stylised finish applied.

Response

1. Viewpoints were chosen to represent the project from a number of different vantage points. In particular, viewpoints were chosen that (Section 11.1.2 of the EIS):
 - Address views from public vantage points (streets, lookouts, public places).
 - Typically represent particular views that might be experienced from residences.
 - Address a location of high impact and major change (bridges, overpasses).
 - Address areas where the project traverses greenfield areas, where new infrastructure is introduced in native forest or traditional agricultural areas.
 - Address places of interest or high perceived cultural value such as heritage or conservation items, lookouts, schools or community facilities.
 - Typically represent the entire project alignment and nominated catchment area.

The visual impact assessment identified 75 viewpoints focused around the areas with the highest anticipated impacts (namely, at major interchanges, bridges, and the most populated and used areas).

Three viewpoints were situated in the cane fields north of the interchange at Tyndale and the Shark Creek bridge. Two viewpoints were selected due to the closeness of the residences to the project, with viewpoint 21 being a location representative of residences along the existing highway.

The rating and sensitivity ranking is also valid for this residence. The assessment identifies that there would be a moderate-low impact on these residences as the changed view would be repeatedly visible from these locations. However, it should be noted that the highway alignment, particularly around the Shark Creek bridge would be landscaped to mitigate visual impacts. It should be noted that the bridge over Shark Creek was assessed as having vertical clearance (ie to the soffit of the bridge) of 5.5 metres, not 10 metres as mentioned in the submission.

Depending on the location of the viewer, fully grown cane could obstruct the view of the bridge. The statement in Table 11-1 (of the EIS) "the seasonal nature of the sugarcane would create a changeable amount of screening for the road" relates to Section 4 as a whole, as "the project would mostly traverse areas of sugarcane and cleared land".

2. The landscape and urban design assessment has identified urban design principles for the design of overpass bridges (refer to Chapter 4 of the working paper). Roads and Maritime would consult with the relevant councils during preparation of the Urban Design and Landscape Management Plan.

2.14 Aboriginal heritage

2.14.1 Impacts to Aboriginal heritage

Submission number(s)

078, 093, 123, 125, 133, Coffs Harbour City Council, Environment Protection Authority / Office of Environment & Heritage

Issue description

1. The project would disturb and destroy culturally significant features including scar trees, middens and ceremonial grounds.
2. There are a number of archaeological sites of Aboriginal Significance listed on the Coffs Harbour LEP.
3. The project should be conditioned to continue: consultation with Aboriginal communities.
4. The project should be conditioned to prepare an Aboriginal Heritage Management Plan.
5. The project should be conditioned to prepare an Archaeological Site Impact Recording form.
6. The project should be conditioned to include a human remains procedure.
7. The project should be conditioned to include a cultural awareness program for employees.
8. The upgrade will have a long lasting and devastating effect on a number of culturally sensitive sites including Lang and Giddos Hill.
9. The Jali LALC is concerned about the destruction of the Melino property and removal of the Gumi Scar Tree.
10. There are flaws with the process of this upgrade (including consultation undertaken in 2004) which Jali LALC believes the information provided to Roads and Maritime and SKM has not been taken seriously with concerns and input for local Aboriginal culture.

Response

1. The project has assessed impacts to Aboriginal heritage, and included field work and sub-surface testing. Extensive consultation with Aboriginal stakeholders has occurred during the project's development. In preparing the EIS, the project was realigned to avoid impacts on several scarred trees north of the Richmond River crossing (refer to Section 12.3). No middens or ceremonial grounds are impacted by the project and the route selection process went to great lengths to avoid such places as they became known to the project team. Further surveys were undertaken to investigate reports of a burial site north of the Richmond River. Following extensive investigations, no such burial or evidence of possible burial was found.

Management measures (refer to Section 12.4 in the EIS and Chapter 5 of this report) are proposed to manage potential project impacts on Aboriginal heritage. These measures have been developed with Aboriginal stakeholders. Before construction, an Aboriginal heritage management plan would be prepared including these measures.

In addition, the design has been refined to reduce the impact on Aboriginal heritage at the Lang Hill borrow site (refer to Chapter 4) in response to Aboriginal stakeholder consultation. The refinement substantially reduces impacts to the denser concentrations of stone artefacts (by 84 per cent), and avoids all of the more significant Aboriginal features of the site (including the blue rock, the artefact cache, the paint wells, the ground rock and the potential scarred tree). These features would all have been impacted by the previous design shown in the EIS (refer to Chapter 12 of the EIS).

The design refinement would allow 77 per cent of all the recorded artefacts to be avoided, in comparison to less than one per cent when assessed against the design shown in the EIS. In terms of area, around 40 per cent of the site would be impacted, in comparison to around 95 per cent of the site when assessed against the design shown in the EIS.

2. Of the archaeological sites identified in the Coffs Harbour LEP, the area to the north of Kangaroo Trail Road is the only area which would be crossed by the project. This area is known to be of Aboriginal heritage significance, with AHIMS listed sites located to the west of the project alignment.
 - This site was identified through an extensive Aboriginal heritage assessment undertaken in consultation with Aboriginal stakeholders.
 - Roads and Maritime would continue to consult with Aboriginal stakeholders and undertake further investigations/salvage operations as required.
3. The EIS identifies management measure (AH10) for ongoing consultation with Aboriginal stakeholders.
4. The EIS identifies management measure (AH12) for the preparation and regular review of an Aboriginal Heritage Management Plan.
5. A new management measure (AH8) has been included in Chapter 5 of this report to specifically identify the preparation of the Aboriginal Site Impact Recording form.
6. The EIS identifies a management measure (AH9) for the procedures to be followed in the event of discovery of human remains.

7. The EIS identifies a management measure (AH11) for the Aboriginal cultural awareness training of all staff and contractors.
8. It is noted that the project would impact on Aboriginal heritage, including culturally sensitive sites. The assessment of the sites is included in the Working paper- Aboriginal Cultural Heritage (Woodburn to Ballina).

Extensive field investigations were undertaken on Aboriginal heritage sites identified along the alignment to understand the heritage significance and impact to sites. This has included Lang Hill.

9. The damage to the Melino property does not fall within the project boundary, nor was any damage undertaken as a result of investigations into the project. However, Roads and Maritime investigated the line of inquiry regarding damage to Aboriginal sites on the property. The unrecorded site that this referred to was damaged from storm felled trees. Before removal of these trees, discussions with OEH and a local Aboriginal stakeholder was undertaken by the owner to avoid any further impacts to the site.
The trees were cleared with full knowledge (and apparent care) of the Aboriginal sites on the property. No damage has occurred to the registered scarred trees.
The Gumi Tree is situated within the project boundary and would be removed as part of the project. However, investigations undertaken as part of the project indicate strong evidence that this scar is around 30 years old and not a man-made scar.
10. Roads and Maritime has followed the relevant guidelines for consultation and undertaking Aboriginal impact assessment throughout the development of the project.

For consultation, the Interim Community Consultation Requirements for Applicants (DECC 2005) were adhered to (note this occurred August 2005 through the previous project (Woodburn to Ballina). For this project, consultation was undertaken in line with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (NSW Department of Environment, Climate Change and Water [DEECW] 2010). Consultation was also undertaken in compliance with the PACHCI 2011 document when released, however, consultation was updated to reflect the changing requirements of the document.

The investigations and assessments were undertaken with regard to the Office of Environment and Heritage's (OEH) Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (NSW) 2010, Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011), the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (ACHCRP) and the now obsolete Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC, 2005).

Roads and Maritime has taken and will continue to take impacts to Aboriginal heritage seriously. Due to concerns raised by the Aboriginal heritage community, Roads and Maritime has:

- Relocated the project alignment north of the Richmond River to avoid four scarred trees (now to the east and west of the alignment).
- Used ground penetrating radar to confirm whether the alignment passed through a burial site north of the Richmond River. On receipt of the results and in consultation with Registered Aboriginal Parties, it was determined that there was no burial site at this location.

- Reduced the cutting on Lang Hill (refer to Chapter 4 of this document) to minimise impacts to artefacts and avoid all significant features.
- Investigated a private collection of artefacts from the Melino property. This found the artefacts have low scientific significance and are not especially related to either Gumi PAD or Gumi Tree – they are a collection of artefacts collected generally across this property, not from one specific location.
- A range of management measures have been provided as part of the project to minimise any impact to Aboriginal heritage sites. Where sites are directly affected, salvage would be undertaken to provide further information on the nature and age of Aboriginal occupation of the area. Roads and Maritime would continue to consult with the Aboriginal community throughout the detailed design and construction period.

2.15 Non-Aboriginal heritage

2.15.1 Impacts to historic heritage

Submission number(s)

096, Heritage Council of NSW, Trade & Investment Resources and Energy, Coffs Harbour City Council, Richmond Valley Council.

Issue description

1. The heritage item identified as the cane barracks at 18 Gallaghers Road was relocated in 2011 to around 200 metres south on the same property. It is now on the other side of Gallaghers Road and integrated with the house precinct.
2. Additional information should be provided regarding the assessment of the impact on the High Conservation Value Old Growth Forest and some increased explanation of the relationship to the biodiversity offset strategy being development for the whole project would be desirable.
3. A Non-indigenous Heritage Management Plan should be prepared in consultation with the Heritage Council of NSW.
4. A specialist heritage consultant shall be nominated for the work.
5. All construction contractors, subcontractors and personnel are to be inducted and informed by the nominated heritage consultant before commencing work on site as to their obligations and requirements in relation to historical archaeological sites and 'relics' in accordance with guidelines issued by the Heritage Council of NSW.
6. Significant heritage items and built elements are to be adequately protected during the work from potential damage.
7. More detailed research and other investigations are to be undertaken for each identified heritage item to address specific impacts arising from more detailed design development and to provide mitigation and management measures for those impacts.
8. Photographic and archival recording of all affected Heritage items, as identified in the specialist reports prepared as part of the EIS, is to be undertaken before the start of any construction activity.
9. All affected historical archaeological sites of Local and State significance are to be subject to professional archaeological excavation and/or recording before construction work starts. The nominated Excavation Director(s) for the project work must meet the Heritage Council endorsed Criteria for Excavation Directors for open area salvage excavations of State significant sites.

10. After archaeological work is undertaken, a copy of the final excavation report(s) shall be prepared and lodged with the Heritage Council of NSW, the Local Studies Library and the Local Historical Society in the relevant Local Government area(s). The proponent shall also be required to nominate a repository for the relics salvaged from any historical archaeological excavations.
11. There are known gold shafts near Maloney's house. The locations of these should be checked for heritage/safety issues.
12. Council provided a list of 13 non-Aboriginal sites of significance near Corindi from the 2000 LEP.
13. The New Italy Monument will be destroyed and access to the front entrance to the Museum complex will be lost. This should be relocated inside the Museum grounds.
14. Council requests a full archaeological assessment and recording of the Roder's Well site, including the house remnants be undertaken before construction work and fabric should be relocated to the grounds of the New Italy Museum and reconstructed as a display with interpretive signage.

Response

1. The cane cutters barracks (Clarence Valley Local Environment Plan 2001, site ID 1387) was identified as a site with local historical heritage significance in the EIS (refer to Section 13.2.3). The EIS identified that while the project impacts the property containing the heritage item, it would not impact on the heritage item itself or its curtilage. It is understood the historical heritage item has been relocated within the property. However, again, the project would not impact on the item or its curtilage.
2. All information available on the listing for High Conservation Value Old Growth Forest has been used in the assessment on this heritage item.

The Biodiversity Offset Strategy would offset the 2.14 hectares based on vegetation type. The Offset Strategy aims to offset vegetation type based on similar biodiversity features and vegetation condition.

3. A Heritage Management Plan would be prepared for the project in consultation with the Heritage Council of NSW, including procedures to be implemented during construction (refer to new management measure HH3).
4. Specialist heritage consultants would be engaged as required during the pre-construction and construction phases of the project.
5. This comment is acknowledged. Management measure HH2 in the EIS requires awareness training on non-Aboriginal historical heritage before start of construction work. Any induction and awareness material for the project would be developed before construction. Inductions of construction contractors, subcontractors and personnel would be undertaken by the project team and not the heritage consultant.
6. Management measures have been proposed for heritage items in proximity to the project to avoid or minimise impacts from construction (refer to Chapter 5 of the Submissions / Preferred Infrastructure Report).
7. The Working paper- Historical (non-Aboriginal) heritage has assessed the heritage significance and impact from the project. The assessment has identified that no further work is required to understand the heritage significance of a site. However, a new management measure (HH4) has

been included to provide for further assessment should project refinements during the detailed design phase alter impacts on historical heritage items.

8. Specific management measures have been developed for each heritage item to avoid or minimise impacts before construction (refer to Chapter 5).
9. Management measures have been proposed to avoid or minimise impacts to identified heritage items (refer to Section 13.4 of the EIS). All items have had management measures developed based on the individual heritage items and the degree of impact from the project. Items 7, 23 (Roder's stone well) and 28 have been identified for salvage excavations before construction.

Only items 7 and 28 have been identified for sub-surface salvage investigations. Salvage excavation would be undertaken in accordance with the Heritage Branch guidelines including an appropriate research design and methodology to best realise the research potential of this area of the site.

Salvage excavations for heritage items would be undertaken under the supervision of an appropriately qualified and experienced historical archaeologist (refer Section 13.4 of the EIS).

10. The comment is noted. Management measure HH3 requires the preparation of a non- Aboriginal Heritage management plan for the project, which would include these requirements.
11. No gold shafts were identified near the Maloney property during heritage investigations or geotechnical investigations within the project corridor. However, further investigations would be undertaken during detailed design, as required (refer to new management measure HH40).
12. The list of non-Aboriginal heritage sites identified in Council's submission would not be directly impacted, and are not expected to be indirectly impacted by the project.
13. A design refinement proposed as part of this Submissions / Preferred Infrastructure Report has resulted in a change at this intersection. As a result, the New Italy Memorial would no longer be directly impacted by the project and not require relocation. The access to the front entrance to the Museum complex would be improved. The initial upgrade of the proposed highway to arterial standard would retain and upgrade the current southerly and northerly access points from the highway to the New Italy Museum. The design has formalised car parking which should allow a greater number of vehicles to park in the area than currently.

A design refinement proposed as part of this Submissions / Preferred Infrastructure Report has resulted in a change at this intersection. The car park area has been designed to tie into the service road proposed as part of the class M upgrade, with no loss of car parking.

The access to and from the northbound carriageway can remain as part of the class M upgrade. This would provide direct access to the New Italy Settlement and Swan Bay New Italy Road for this one direction only. An access including an auxiliary merge slip would be required to access the northbound carriageway. Access to the New Italy Museum and Swan Bay New Italy Road for southbound traffic would continue to be via the interchanges at Trustums Hill Road, Woodburn from the north and Iluka Road, Woombah heading south.

Alternative access arrangements would be further considered for the upgrade to class M.

14. A range of management measures have been proposed as part of the project to address the impact to Roder's well and mango orchard. These are identified in management measures HH33-HH36 and involve salvage excavations of the well and photographic archiving for the orchard. Note that HH35 has been revised to include consideration of relocating any salvage materials to the New Italy Museum. Note that the project would not impact on the house remnants and as such, no management measures have been identified for this heritage item.

2.16 Traffic and transport

2.16.1 Public transport, pedestrian and cyclists

Submission number(s)

080, 122, Coffs Harbour City Council, Richmond Valley Council.

Issue description

1. There has been little focus on bicycle road users in the EIS.
2. Cyclists should be catered for on the highway and the service road. The service road should be redesigned to provide a dedicated shared path on one side of the road formation. Ongoing development of cycleway solutions should be subject to ongoing consultation.
3. While there is support for the minimum 2.5-3 metre shoulder on the highway, there are several locations to be further considered:
 - The existing highway north and south of Grafton currently is dangerous due to traffic numbers.
 - Highway between Range Road and Glenugie would not have a service road- and would not provide for continuous cyclist movement.
 - Seamless transition to the Sapphire to Woolgoolga project.
4. The development of the coastline cycleway would result in local roads in the area being used by cyclists and a review of speed limits of these roads is necessary.
5. The design and assessment of the project should consider cycle path infrastructure work required on the by-passed sections of the Pacific Highway which continue to form part of the Coastline Cycleway
6. Shared path connection between the Corindi/Red Rock residential areas and the Sapphire to Woolgoolga upgrade shared path needs to be provided to meet community expectations.
7. All proposed local road bridge connections over the Pacific Highway should include provision for cyclists and pedestrians unless otherwise agreed to by Council.
8. Any new or existing infrastructure proposed to be transferred from Roads and Maritime to local councils needs to be subject to negotiation which takes into account any increases in asset management liabilities to Council. Large sections of existing highway should remain as state roads rather than be transferred to Council.
9. Suggest naming the old Pacific Highway alignment, between Woodburn and Broadwater, as "Richmond Valley Way".

Response

1. The respondent provided a quote from Section 14.2.6 of the EIS (Pedestrian and cyclist network). However, assessment of impacts to both pedestrian and cyclists are addressed in other sections of the EIS and working papers in addition to this reference. This includes Working paper – Traffic and Transport, Working paper – Social and Economic and associated chapters in the EIS (refer to

Chapters 14 and 17). The EIS also addressed the provision of pedestrian and cyclist facilities as part of the project in Chapter 5 of the EIS.

2. Roads and Maritime is in discussions with Coffs Harbour City Council regarding the details of a dedicated shared user path along Eggins Drive. Similarly, Roads and Maritime would consult other affected Councils along the project regarding shared user access during the detailed design. Once these discussions are complete and the design finalised, Roads and Maritime would further consider providing a shared user path along the service road for other sections of the project in consultation with relevant councils and Bicycle NSW.
Roads and Maritime would investigate and continue to discuss opportunities for provision for cyclists with councils and Bicycle NSW.
3. The project provides for cyclists on the highway through the 2.5 metre shoulder and footpaths on overbridges. Shoulder widths currently vary along the existing highway, and are less than the standard width proposed for the project in some cases, including bridges. Roads and Maritime would further consider the provision of a shared user path along the service road for other sections of the project, including consultation with relevant councils. The need for a shared user path that forms part of the road formation may not be feasible due to the rural nature of the study area. However, Roads and Maritime would continue to investigate shared user opportunities with stakeholders during detailed design.

The particular areas of concern listed in the submissions are addressed below:

- Cycle access would be available on the existing highway between Glenugie and Maclean which is presently used by cyclists, as this would be retained as the service road. The project would result in around 57 per cent of traffic using the upgraded highway, resulting in a reduction in traffic along the service road, potentially improving conditions for cyclists. The future maintenance and ownership of this section of highway would be discussed between Roads and Maritime and relevant councils.
 - Under the interim upgrade to class A (arterial standard) between Range Road and the interchange at Glenugie, there would not be a continuous service road and cyclist access would be via the shoulder on the highway. However, when this section of road is upgraded to class M (motorway standard), a continuous service road would be provided enabling cyclist access from Corindi to Grafton via a continuous service road.
 - Refer to response two above for further details.
4. The review of road speeds and bike user issues along country roads are outside the scope of this project. The review of the speed limits of the existing highway would occur in consultation with the relevant road authority and the anticipated character of the traffic. In addition, Roads and Maritime is currently conducting a state wide review of speed zones. To provide feedback to that review please visit the website Saferoadsnsw.com.au.
 5. Roads and Maritime is in discussions with Coffs Harbour City Council regarding the details of a dedicated shared user path along Eggins Drive. Once these discussions are complete and the design finalised, Roads and Maritime would further consider providing a shared user path along the service road for other sections of the project in consultation with relevant councils and Bicycle NSW.

Roads and Maritime would continue to discuss opportunities for provision for cyclists with councils and Bicycle NSW during detailed design.

6. Roads and Maritime is currently consulting with Council regarding the provision of a shared path along Eggins Drive and interface with the Sapphire to Woolgoolga project.
7. Current NSW legislation permits cyclists to use the upgraded highway's road shoulders, including across bridges. In addition, cyclist access, signposting and crossing points would be provided across the interchanges. .
Signposting and crossing points for cyclists would be provided at interchanges and highway on/off-ramps. Cyclists would also be able to use the 2.0 metre shoulder along service roads, where there would be less traffic.
8. Roads and Maritime would consult with local councils across the project regarding reclassification of sections of the existing Pacific Highway. Some sections of the existing highway would be transferred to the local council, and requirements would be confirmed with councils prior to this transfer taking place. However, some sections of the existing Pacific Highway could remain a state road under Roads and Maritime control.

A new management measure has been included in Chapter 5 of this report (refer to management measure SE6) for meetings with relevant agencies to discuss the handover process and resolve issues.

9. Roads and Maritime would consider the name of the service road at a time closer to the opening of the highway. This may involve seeking feedback from stakeholders and the community.

2.16.2 Road safety

Submission number(s)

051, 060, 093.

Issue description

1. While the project would reduce fatalities, the increase in heavy vehicle usage would result in an increase in serious accidents.
2. The project would result in an eight lane highway with a sharp bend at the edge of the respondent's property.
3. No treatment of the Cowper bus crash site, a known danger spot on the old Pacific Highway which would continue to be used by 70% of traffic despite the bypass. Local traffic is expected to increase as a result of growth areas nearby.
4. The project could not reduce road accidents as there would be to high volumes of traffic that would remain on the old highway and the faster travelling speed of heavy vehicles (including B-triples) on the upgraded highway.

Response

1. An objective of the overall Pacific Highway Upgrade Program is to improve road safety. Currently the highway between Woolgoolga to Ballina has an average crash rate of 20.7 per 100 million kilometres travelled. Along the project, the Glenugie to Tyndale section within the Clarence Valley LGA had the highest number of crashes between 2006 and 2010 with 182 crashes. The project seeks to reduce the crash rate to 15 crashes per 100 million vehicle kilometres travelled.

Physically separated carriageways would reduce the occurrence of head-on crashes, while better sight lines and controlled access points would result in fewer incidents as a result of local traffic trying to merge with fast flowing highway traffic. The project has been designed to meet current Roads and Maritime safety standards, with the motorway standard road being suitable for 110 kilometres per hour. An increase in traffic incidents is not anticipated due to the improved alignment, lane widths and sight lines. The project would result in an improvement in safety greater than that afforded by an upgrade of the existing highway.

It is estimated the project would result in an overall crash rate reduction of 27 per cent in 2016.

2. The project is seeking approval for a motorway standard four-lane dual carriageway, however the footprint is wide enough to cater for a future upgrade to six lanes, should the need occur. The curve in question is not a sharp bend, but meets the criteria under the Roads and Maritime Pacific Highway Design Guidelines (with a radius of 1200 metres). This curve is suitable for a highway upgrade with a design speed limit of 110 kilometres an hour.
3. Safety work on the existing highway has made the highway safer to use. In particular, at Cowper, the highway has been duplicated for a length of about two kilometres, separating the northbound and southbound carriageways.

One of the Pacific Highway Upgrade Program objectives is to significantly reduce road crashes, injuries and to reduce travel times. The project would result overall in a reduction of around 27 per cent in the crash rate, compared with the existing Pacific Highway crash rate.

The existing highway would similarly have a reduction in crashes through a reduction in vehicles using the existing highway. For Section 3 of the highway (which bypasses Cowper), it is estimated around 57 per cent of traffic would use the upgraded highway. This would reduce the traffic volumes on the existing highway to around 43 per cent of current traffic (and not 70 per cent as indicated in the submission). The difference in the traffic split numbers is due to updated modelling and more recent traffic counts (refer to response one in section 2.6.1 for further information). This would improve road safety and reduce traffic delays. It would also improve the amenity to residents and businesses in townships along the section, such as Ulmarra.

Roads and Maritime are still maintaining the existing highway, with ongoing safety works being undertaken on the road. This includes at Ulmarra, Swan Creek and further north at Shark Creek.

4. Along the project, the Glenugie to Tyndale section had the highest number of crashes between 2006 and 2010 with 182 crashes. The project would reduce the crash rate to 15 crashes per 100 million vehicle kilometres travelled. The greatest reduction in crashes is also forecast to be between the Glenugie interchange to Tyndale, where the project would result in 36 crashes, compared to 51 predicted without the project.

The existing highway would similarly have a reduction in crashes through a reduction in vehicles using the existing highway. In the opening year (2016), the EIS estimates that between 57 and 100 per cent of current traffic, depending on location would use the upgraded highway. In addition, safety works on the existing highway have made the highway safer to use. There are no current plans to allow B-triples on the upgraded Pacific Highway and elsewhere where the highway has been upgraded there have been significant improvements in the rate and severity of crashes.

Heavy vehicles are limited to a maximum speed limit of 100km/h, even where roads are signposted at 110/kmh.

2.16.3 Travel times

Submission number(s)

091, 106.

Issue description

1. Changes to property access would result in increased distance to access the property leading to higher running costs.
2. There would be an increase in distance of six kilometres at Bruxner Highway impacting on emergency services.

Response

1. Roads and Maritime is continuing to consult with affected property owners regarding property severance and access in the Shark Creek and Tyndale area. A design refinement is proposed to respond to the respondent's access concern (refer to Chapter 4). The request for an internal property access to be provided by bridge or culvert would be considered further during detailed design. A Cane Farm Strategy has also been developed with the sugar cane industry, in which maintaining access is highlighted as an important issue (refer to Chapter 3 of this report). This strategy would continue to be developed with property owners and the sugar cane industry. Access to the existing Pacific Highway would continue to be maintained, where possible.
2. At the Pimlico Road intersection, a U-turn bay on the highway south of the intersection provides access for emergency vehicles, to facilitate right-out movements to the northbound carriageway and the Bruxner Highway. However, under the class M upgrade, the Pimlico Road intersection with the highway is closed. Pimlico Road would connect into an alternative service road, connecting down to the Whytes Lane intersection and travelling across Emigrant Creek to Smiths Drive.

2.16.4 Traffic volumes

Submission number(s)

001, 017, 085.

Issue description

1. Around 1500 trucks use the Pacific Highway past Corindi. With every kilometre of highway completed, another 2 trucks join this queue. By the time the highway is completed, there will be 2000 trucks passing Corindi each night.
2. What percentage of the current traffic will use the new highway between Glenugie and Maclean? The options paper prepared in 2004 suggested only 30 per cent of the traffic will be using this road while the remaining 70 per cent which comprises local traffic will continue to use the old highway.

Response

1. Surveyed traffic volumes from November 2011 indicated total daily volumes along the existing Pacific Highway passing Corindi Beach of around 8671 vehicles on average, 25 per cent being heavy vehicles (2,133). It is acknowledged the upgrade would be used by increased numbers of

vehicles, which is an objective of the Pacific Highway Upgrade Program. In 2009, the Bureau of Infrastructure, Transport and Regional Economics (BITRE) prepared traffic forecasts for the national road network. This indicated annual heavy vehicle growth of 1.28 per cent between Coffs Harbour and Grafton. At the time of the project opening to traffic, it is predicted around 2500 heavy vehicles would pass through Section 1 of the project (including volumes both on the existing highway and the proposed highway).

2. The figures quoted from the submission are from the previous Wells Crossing to Iluka Road project route options phase in 2004. Origin/destination surveys were undertaken as part of the traffic and transport assessment and included in the EIS. This updated the traffic forecast that would use the upgraded highway through Section 3 to 57 per cent, with the remaining 43 per cent of existing traffic using the existing highway. The change in traffic split that would use the upgraded highway has come about from more comprehensive modelling with recent traffic counts was undertaken for the traffic and transport assessment in the EIS. Refer to Section 2.6.1 (response one) for further details.

2.16.5 Local and regional access

Submission number(s)

018, 051, 053, 056, 093, 097, 099, 110, 120, Forestry Corporation of NSW.

Issue description

1. Too much slow local traffic enters onto motorways to travel short distances before exiting again.
2. The respondent suggests that the existing highway should be the service road and that cane haulage trucks should continue to use it after the upgrade, as if the existing highway is upgraded, then the trucks will have no suitable bypass route
3. A number of access options are suggested for northern Pimlico highway access. The options were to not provide access, shift access 200 metres south to the present access point or to build a bridge across Emigrant Creek to link to Smiths Drive.
4. The safety statistics cited in the EIS would be obsolete in 10 years' time due to the increase in local traffic on the existing highway. It would be local taxpayers who would need to maintain the road.
5. Request for the upgrade of Eggins Drive and an extension to Corindi Beach to enable better access to the proposal.
6. Access points used by heavy vehicles to access the proposal would likely see these vehicles use a portion of the existing highway rather than doubling back.
7. Suggestion for a cross road at Kungala Road that joins the two carriageways, allowing residents to travel south on the project.
8. The project would not benefit local residents or the Clarence Valley Local Government Area and therefore the project does not meet the objective of "Develop a route involving the community and considering its interests"
9. The project will not enable Broadwater residents to access the highway due to the distance to entry points. Locals would have to use the inferior local roads. It would result in a large unmitigated impact on Broadwater, businesses and motorists.
10. Concern about access for B-Doubles at the new service road from Broadwater Evans Head Road. Suggests the intersection joins at the roundabout located on the Broadwater Evans Head Road. Clarification sought as to where the service road terminates.
11. If the animal underpass at station 39.7 is larger it could allow for future bicycle and light traffic use.

12. McPhillips Road (Section 1) also serves as a principal access route to a significant Forestry Corporation plantation resource within Barcoongere and Newfoundland state forests.

Response

1. Roads and Maritime is seeking project approval for a motorway standard highway comprising a four-lane dual carriageway (two lanes in each direction). The project design seeks to improve highway capacity and reduce travel times, however, it is acknowledged between Maclean and Yamba Road the project would be used by a mix of local and through traffic. Although access along the upgrade would be restricted to controlled access points only, an alternative route for local traffic between Maclean and Yamba Road is available via Cameron Street and River Street.

The dual carriageway would increase highway capacity, permit overtaking up to the posted speed limit, and divide northbound and southbound traffic to improve safety for vehicles travelling in different directions, at different speeds. During detailed design, an operational incident management plan would be prepared to manage alternate access in the event of a road traffic incident. This plan would detail strategies to manage traffic cross-overs and contra flow arrangements. This management plan would be developed further with councils, the police and emergency service providers.

2. One of the objectives of the project is to improve travel efficiency for freight including cane vehicles. The highway would be duplicated to a dual carriageway (ie two lanes either direction), improving the overall efficiency and safety of the highway. Cane haulage trucks would be able to access the upgraded highway, via the interchange at Maclean, and exit the upgraded highway via the interchange at Yamba Road, maintaining the existing travel movements. This interchange would enable access to Harwood Mill via the parallel service road, and the existing Harwood Bridge crossing of the Clarence River. Roads and Maritime would continue to consult with the cane industry regarding highway access during the project approval and detailed design of the project. Access for cane vehicles is further considered in the Cane Farm Strategy (refer to Chapter 3). A principle of this strategy is to maintain access to the highway, or to provide alternative access, wherever possible.

All cane traffic would be able to continue using the existing Pacific Highway (future service road). A bypass route would be required when the highway becomes unpassable such as from flooding or an accident. In these cases, most traffic could divert and use Cameron Street and River Street as an alternative access to Yamba Road. However, it is acknowledged this route is not suitable for heavy vehicles including cane trucks. The project has been designed to reduce traffic delays and to improve flood immunity. This reduces the requirement for an alternate bypass and minimises the number of highway closures during a flood

At this location, the project also incorporates an emergency cross over facility adjacent to the Yaegl Nature Reserve (refer to Figure 5-43 in the EIS). This could be used as a cross over point, for traffic to merge onto the other carriageway when a contra-flow traffic arrangement is required on the highway, thereby reducing traffic delays.

3. The respondent proposes various options for alternative access to northern Pimlico. All parts of the Pacific Highway upgrade north of Pimlico Road are part of the Ballina bypass upgrade project. The Pimlico Road intersection with the Pacific Highway is a left in-left out intersection, with a U-turn bay to access the northbound carriageway.

However, as part of the Woolgoolga to Ballina Pacific Highway upgrade, the class M upgrade would remove this intersection. Instead Pimlico Road would connect into the alternative service road, connecting to Smiths Drive to the north via a bridge crossing Emigrant Creek and access to the Pacific Highway beyond. This bridge forms part of the project.

Pimlico Road to the south would connect to Whytes Lane and connect to the constructed service road down to the Coolgardie Road interchange, where it would connect into the highway or the existing Pacific Highway which would become the local service road.

4. It is acknowledged future local and regional growth in the area would result in an increase in traffic volumes on the existing (and upgraded highway). Roads and Maritime would consult with local councils across the project regarding how the existing Pacific Highway would be maintained. Some sections of the existing highway would be transferred to the local council, and funding would be confirmed with councils prior to this transfer taking place. However, some sections of the existing Pacific Highway could remain a state road under Roads and Maritime control. In this instance, maintenance would be funded by Roads and Maritime rather than the local council.
5. The current intersection with the existing highway at Eggins Drive, near Eggins Close, would be closed. Eggins Drive would form part of the service road network, connecting with the existing highway (to become the service road) north of Eggins Close. Eggins Drive would connect to the highway via the interchanges at Arrawarra Beach Road and Range Road.

Roads and Maritime is currently in discussions with Coffs Harbour City Council about the level of flood immunity of Eggins Drive.

6. It is acknowledged heavy vehicles servicing South Grafton and Grafton may choose to remain on the existing highway and access the upgraded highway via the interchange at Tyndale, rather than using the upgrade from the interchange at Glenugie. However, the upgraded highway would have a speed limit of up to 110 kilometres per hour, improving travel efficiency, travel times and provide cost savings, when compared to the existing highway, where speed limits are reduced to 40 kilometres per hour, through school zones. The upgraded highway may also provide a shorter route, reduce risk of incidents delaying traffic and improving access during flooding. These improvements would attract more vehicles to travel the shorter distance to the interchange at Eight Mile Lane, Glenugie to travel north, rather than remaining on the existing highway.
7. The respondent requests a cross roads at Kungala Road, which is not considered viable due to road safety concerns for traffic directly accessing the project including the southbound carriageway. This design would also be inconsistent with Pacific Highway Design Guidelines.

In the initial upgrade to arterial standard, Kungala Road connects with the upgraded highway through a left-in, left-out and right-in arrangement. The right-out movement was not incorporated due to safety concerns from crossing traffic. To travel south on the highway, vehicles can travel north to the U-turn bay around station 21.5, just over a kilometre north of Kungala Road.

When upgraded to motorway standard, the intersection onto the highway is closed, and Kungala Road would connect with the continuous western service road. Access to the highway would be via accessing the interchanges at Range Road, Corindi and Eight Mile Lane, Glenugie.

8. Currently the highway between Woolgoolga to Ballina has a crash rate of 20.7 per 100 million kilometres travelled. Along the project, the Glenugie to Tyndale section had the highest number of crashes between 2005 and 2009 with 182 crashes. The project is designed to reduce the crash rate to 15 crashes per 100 million vehicle kilometres travelled (a 29 per cent decrease for the Glenugie to Tyndale section). In addition to a reduction in road crashes, the upgrade also reduces travel times, improves freight efficiency, and supports economic development. It also improves connections between areas forecast to experience significant population growth and those locations identified as major tourist destinations.

The project also benefits road users along the existing highway. The existing Pacific Highway is retained as a service road, so vehicles can continue to access Grafton via this route. The project, between Glenugie and Tyndale would reduce traffic using the existing highway, reducing delays and improving road safety. The existing highway passes through several towns, including South Grafton, and Ulmarra and a number of rural residential areas. The constant flow of through traffic creates a number of adverse impacts for local communities, including noise and air pollution. Upgrading the highway away from these towns would improve amenity for these towns.

The community have been involved and provided feedback throughout the development of the project. The route options were placed on public exhibition to obtain community feedback. Various community and specialist focus groups were held and community stakeholders were invited to a Value Management workshop to determine the way forward for the route options and the project. Community stakeholders involved in the Value Management workshop were selected from the community focus groups established for the project.

9. The design of the interchange at Broadwater is proposed to provide connections to local roads, and facilitate access to local towns and amenities. The interchange with north facing ramps would enable access to Broadwater and to Evans Head from the north. It would also provide access to Woodburn to the south. The existing highway would become a local service road and will be realigned through Broadwater National Park. The interchange at Broadwater has been located and designed to allow for future south-facing ramps in the future. The design of the interchange has been developed in consultation with Richmond Valley Council.

Motorists wanting to join the upgrade to go south from Broadwater Evans Head Road would need to travel to the interchange at Woodburn along the existing highway (which becomes the local service road). At the interchange at Woodburn, southbound and northbound access is available. The inclusion of north-facing ramps would also greatly improve accessibility of the upgraded highway to emergency crews from Woodburn wanting to go north and would also enable more direct access from Coraki to the upgraded highway. The design was prepared in consultation with Richmond Valley Council, Woodburn Chamber of Commerce and emergency service providers.

10. Roads and Maritime is reviewing the design around the interchange at Broadwater to provide more appropriate access for B-doubles. Roads and Maritime would continue to consult with stakeholders including the respondent regarding this access issue during detailed design.

11. The crossing structure at this location is 1.2 metres high by three metres wide. This particular structure is a combined structure for fauna movement and waterway culvert for a tributary of

Glenugie Creek. Bicycle and light traffic would not be able to use the culvert, as Roads and Maritime's assessment is that there is no demand or requirement at this location.

12. It is acknowledged that McPhillips Road is a principal access road for forestry vehicles. Access under both the initial and ultimate upgrades would be maintained for existing turning movements. Under the initial upgrade, an intersection would be provided to the highway. Under the class M, an overbridge would be constructed to maintain local connectivity.

2.17 Noise and vibration

2.17.1 Construction noise

Submission number(s)

005, 032, 039, 062, 066, 073, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. The project would result in increased noise level to respondent's property at Woodburn and appropriate measures should be undertaken to mitigate the impacts.
2. Concerned that noise impacts would be high as house is not noise insulated and is of wooden construction.
3. Proposed construction work creates noise impacts as they are within 30 metres of the respondent's house.
4. The construction noise level during the day will have impacts on shift workers.
5. Concern the noise levels would be unacceptable due to work on the nearby borrow site and requests noise management measures be implemented.
6. Satisfied with predicted noise levels during construction.
7. The construction of the project would have a significant noise impact on the property, even though the EIS states that in Section 9 there would not be any receivers highly noise affected.
8. Blasting should be assessed against ANZECC guidelines.
9. Extended construction working hours should be supported by detailed justification and clear community support.
10. The implementation of the Construction Noise and Vibration Management Plan will not be able to reduce the impacts from the work to the relevant construction and vibration goals.

Response

1. A noise and vibration assessment in the EIS (SKM, 2012) assessed construction noise impacts from the project. The respondent's residence is located outside the 600 metre study area (as set by the OEH NSW Road Noise Policy 2011). Therefore, the residence was not assessed. However, construction noise levels are not expected to be exceeded, due to the distance between the respondent's residence and the project.

Further assessment before construction would inform the project's Construction Noise and Vibration Management Plan. The management plan would detail noise management measures to be implemented during construction. These measures would include community consultation, temporary barriers, respite periods, alternate quieter construction methods and temporary relocation of residents, where required.

2. Roads and Maritime notes the respondent lives in a timber dwelling with potential heritage value. Section 15.4 in the EIS identifies measures to mitigate construction noise, including requiring the contractor to implement a Construction Noise and Vibration Management Plan. The management plan would detail noise management measures required during construction. These measures include further community consultation, temporary barriers, respite periods, alternate quieter construction methods and temporary relocation of residents, where required. The EIS includes a specific management measure (HH39) for heritage items requiring noise treatment. This requires proposed noise mitigation including architectural treatment to be developed with a qualified heritage consultant.
3. The construction of the project would generate temporary noise and dust impacts to residents living near construction sites. A Construction Environment Management Plan (CEMP) would be prepared to control and minimise dust and noise by the contractor during construction. Specific management measures for noise and air are included in Chapter 19 of the EIS and would be detailed in a CEMP. Where possible, noise impacts would be minimised through time and duration restrictions and respite periods. Management measures could also include temporary relocation of residents for short term periods, when nearby work is particularly noisy Roads and Maritime would continue to consult with directly affected residents to ensure construction impacts are appropriately managed.
4. It is acknowledged construction noise would affect residences along Hillside Lane. The assessment (refer to Section 6.11 of Working paper – Noise and vibration) indicated some properties on Hillside Lane closest to the proposed borrow site west of Wardell Road would be noise affected during construction. Construction noise would be minimised where practicable. As stated in Section 15.4 (management measure CNV2) in the EIS, where possible, construction would be designed to minimise noise impacts through time/duration restrictions and by providing respite periods. Management measures would be identified following consultation with affected residents.

However, further noise monitoring pre construction is planned to collect baseline data. This data would inform a Noise and vibration management plan, to e. A complaints handling procedure would be implemented during construction. Roads and Maritime would explore opportunities to install architectural noise treatments early, where required, to further minimise construction noise.

5. The noise assessment considered construction noise impacts at residences at Hillside Lane. The properties are unlikely to be highly noise affected during construction. However, noise exceeds target noise management levels. Therefore, construction noise would be minimised where practicable.

Refer to response one and four above for further details of potential construction noise mitigation. It should be noted that this residence has been identified for operational noise mitigation (architectural treatment). These architectural treatments could be installed before construction to provide noise mitigation to construction as well.

6. This is acknowledged by Roads and Maritime.
7. Predicted construction noise levels are shown in Appendix E of the Working paper – Noise and vibration (SKM, 2012). At Evans Head Broadwater Road, Section 6.9 of the working paper

identifies most construction activities are likely to be within the target noise management level (NML) of 54dBA (including earthworks, clearing, paving and piling). The exception to this relates to noise from ancillary facilities, which is predicted to be above the NML of 54dBA. However, nearby residential residences are unlikely to be highly noise affected as noise levels would not exceed 75dBA. During construction, noise impacts would be managed. In particular, Section 15.4 in the EIS identifies a number of management measures, including requiring the contractor to implement a Construction Noise and Vibration Management Plan. Refer to response one and four above for further details of potential construction noise mitigation.

8. The blasting assessment undertaken for the EIS was assessed against the ANZECC guidelines. The need for blasting would be confirmed before construction and further noise and vibration assessment would be undertaken before construction.
9. Justification for extended work hours was provided in the EIS (refer to Chapter 6 of the EIS). This is repeated in Chapter 3 of this report. Chapter 3 also provides preliminary community feedback on the proposal for extended work hours. Roads and Maritime contacted over 5500 people regarding the proposal for extended work hours. Over 100 responses were received. Preliminary feedback indicated that of those people who responded, 61 per cent of respondents were in favour of extended construction hours. Roads and Maritime is still seeking approval for these extended work hours. Refer to Section 2.8.1 (response two) for further details.
10. It is acknowledged that in some localised areas, construction noise would exceed the Interim Construction Noise Guideline. However, the construction noise management plan would detail noise management measures to minimise construction noise. These measures would include community consultation, temporary barriers, respite periods, alternate quieter construction methods and temporary relocation of residents, where required. Roads and Maritime would continue to consult with the community regarding construction working hours and construction noise through the detailed design and construction period (refer to management measure CNV31).

Roads and Maritime would consider the need for temporary noise shielding during construction (refer to management measure CNV11). Roads and Maritime has also identified a range of management measures to minimise noise impacts. Where possible traffic movements and haulage routes during construction would be located as far away from residences as possible (refer to management measure CNV3).

2.17.2 Existing noise

Submission number(s)

073.

Issue description

1. Property on Banana Road already receives an unusual amount of traffic noise from the highway and request that noise management measures be implemented in the vicinity to reduce noise for four houses.

Response

1. The noise assessment in the EIS included sensitive receivers within 600 metres of the project, in line with Office of Environment and Heritage's (OEH) NSW Road Noise Policy 2011. While the

respondent is located outside this area, one residence on Banana Road did fall inside the study area. At this location, noise levels are predicted to remain the same. No noise management measures are proposed at this location.

2.17.3 Noise assessment

Submission number(s)

032, 124.

Issue description

1. Respondents house is located over 500 metres from the nearest noise monitoring location, so the existing noise levels would be lower than those monitored.
2. Sugar cane farming is some distance from house and currently has a minimum noise impact, contrary to what is indicated in Table 15-13 of the EIS.
3. Noise monitoring, assessment and mitigation should be undertaken for the respondent's residence.

Response

1. As stated in Section 15.2.2 of the EIS, noise monitoring across the project was used to inform the background noise levels. These background noise levels informed the noise model to predict project impacts.

Monitoring of road traffic noise 12 months after opening is proposed to enable Roads and Maritime to check compliance against criteria from the OEH NSW Road Noise Policy 2011. Where there is an exceedance, additional feasible and reasonable noise mitigation may be required.

Monitoring locations (including Evans Head Broadwater Road) were selected based on the number of properties nearby, the location's proximity to the existing Pacific Highway and the project. These monitoring locations were selected at appropriate locations using qualified noise engineers to assess the acoustic characteristics of the area to provide a representative sample of current noise levels. The data captured the trends for the area, eliminating the need to measure noise at each individual property. A noise model was then developed, using existing terrain data, current and projected traffic volumes and mixes, and the existing and proposed highway design. The model was calibrated using noise monitoring data and measured traffic data collected concurrently. Predicted noise levels at sensitive receivers were based on this model and took into consideration distance from the highway and other noise sources. Noise levels have been identified separately for each sensitive receiver. Individual predicted noise levels at sensitive receivers are identified in Appendix D of the Working paper – Noise and vibration. Additional noise assessments would be carried out before construction to verify EIS predictions.

2. It is acknowledged that the closest sugarcane farm is one kilometre north of the respondent's property and would have a low overall noise impact at the property. However, Table 15-13 in the EIS provides a general statement of noise levels within each project section. It relates to sugarcane farming around and north of Broadwater.
3. The noise assessment in the EIS included sensitive receivers within 600 metres of the project, in line with the OEH NSW Road Noise Policy 2011. As the respondent is located outside this area, this residence was not considered in the operational noise assessment. Due to distance, it is not

considered the residence would have construction and operational noise impacts requiring noise mitigation.

2.17.4 Operational noise

Submission number(s)

005, 032, 036, 061, 062, 114.

Issue description

1. Increased noise level to respondent's property at Woodburn.
2. Noise and vibration impacts where the project diverts from current highway around Wardell.
3. Vegetation on the respondent's property should be replanted to mitigate visual and noise impacts- and fencing and noise barriers should be considered.
4. Removal of hill at the West of Wardell borrow site will result in an increase in traffic noise.
5. The project is too close to houses and would impact on amenity.

Response

1. The respondent's residence is located outside the 600 metre study area set by OEH's NSW Road Noise Policy 2011, so was not assessed. Appropriate operational noise levels are unlikely to be exceeded, due to the distance between the respondent's residence and the project.
2. It is acknowledged at this location, the project potentially impacts the amenity of a community not currently affected by road traffic noise. The existing background noise level at the respondent's property is around 49dBA during daytime and 48dBA during night-time. During the project's opening year, predicted noise levels are around 62dBA during daytime and night-time, an increase of around 14dBA.

However, management measures include (at Wardell Road overpass) the use of landscape mounds to partially screen the roadway from residences, which could reduce road traffic noise (refer to Chapter 3 of this report). The residence is identified for architectural noise treatment to mitigate highway noise. Refer to Section 13.4 of the EIS (item 26-HH39) for further details. In addition, a low noise wearing pavement is proposed near the interchange at Coolgardie (stations 155.4 and 157.7), potentially resulting in a reduction of between 2dBA and 4dBA. Further noise assessment is proposed during detailed design to confirm required noise mitigation.

3. At this location, the project follows the existing highway alignment. However, the widening of the formation results in tree removal along the property boundary. As part of the landscape strategy (refer to Working paper – Urban design, landscape character and visual impact assessment), trees would be replanted along the highway in this location. Visual impacts are expected to be minor. Replanting would not affect or reduce noise impacts.

The respondent's property is currently influenced by road traffic noise from the existing Pacific Highway and Bruxner Highway. The noise and vibration assessment undertaken for the EIS identified that a residence on this property would experience increased noise levels of 2-3 dBA. However, the residence was not identified as requiring noise mitigation. Further noise modelling would be carried out during detailed design to confirm predicted noise levels and noise mitigation requirements.

Any property acquisition or adjustment that occurs would require boundary fencing to be reinstated in line with the project's fencing strategy (refer to Chapter 3 of this report).

4. The noise assessment considered the existing terrain at Hillside Lane and the use of the site south of the respondent's residence as a borrow site. The assessment indicated noise levels would exceed appropriate criteria at the respondent's residence. Architectural noise treatments were recommended for this location. Further noise assessment would be undertaken during detailed design to confirm noise management measures.

In addition, several spoil placement sites have been identified across the project (refer to Chapter 3 of this report). A potential landscape mound has been identified at Hillside Lane between the proposed upgrade and the respondent's property. While provided for landscaping purposes, this could provide some noise attenuation.

For further details regarding impacts at this location, refer to sections 2.17.3 (construction noise), 2.17.4 (operational noise) and 2.18.2 (property access).

5. The respondent's residence in Tucabia is in a rural area with low existing background noise. At the respondent's residence, in 2016, noise levels are predicted to be around 56dB(A) during daytime and night-time. This is around 25dB(A) higher than the existing background noise level. Appropriate noise mitigation would be provided in line with OEH's NSW Road Noise Policy 2011 for noise affected residences. In particular, this residence has been identified for architectural treatments. Architectural treatments could include sealing off wall vents, upgrading windows, double-glazing or air-conditioning. It is, however, noted the respondent's residence comprises a wooden structure, and may require specialist treatment. All treatments would be discussed with property owners and confirmed during the detailed design phase.

2.17.5 Noise mitigation

Submission number(s)

001, 032, 042, 048, 087, 126.

Issue description

1. Night time noise is very loud in Corindi, particularly when there is a westerly wind or a temperature inversion.
2. Increase of traffic noise and provision of management measures (particularly low noise pavements and noise walls) at Corindi Beach.
3. Would like noise and vibration impacts to be mitigated through low noise pavement, no audible lines, and noise barriers. Any noise management measures should consider the heritage value of the residence.
4. Specified noise monitoring 12 months after completion and in 2026 is not enough and 2026 is too long away.
5. Suggests management measures including earth mound and wall barrier with a low noise pavement to mitigate noise impacts to Townsend.
6. Request for compensation for the area of Bagotville Barrage if noise management measures are not adequate.

Response

1. It is acknowledged that the dominant noise source in the Corindi Beach area is from the highway, however, as the distance from the highway increases, other rural noise sources contribute to the background level. Climatic conditions such as a westerly winds or temperature inversion can affect how noise propagates. The project near Corindi deviates away from the existing highway south of the Tasman Street intersection. At this intersection with the existing Pacific Highway, the highway would be about 200 metres further west. At the northern end of Corindi, at Coral Street, the project would be over 600 metres away from the existing highway. The noise modelling indicates the Corindi Beach community would generally experience a 2 dB(A) reduction in noise levels through the main residential areas, due to the realignment of the highway. This noise reduction would be confirmed during detailed design.

However, the modelling also identified there are locations where noise levels may increase from the project. Six residences west of the existing highway at Corindi Beach are predicted to exceed operational road noise criteria, therefore are identified for architectural treatments (refer to Figure 15-12 in the EIS).

2. The noise and vibration assessment identified management measures for Corindi Beach using the same method applied across the overall project. The need for noise mitigation has been assessed consistently, considered against exceedances of the NSW Road Noise Policy 2011 noise criteria.

The project deviates from the existing highway south of the Tasman Street intersection. At this intersection with the existing Pacific Highway, the highway would be about 200 metres further west. At the northern end of Corindi, at Coral Street, the highway is over 600 metres away from the existing highway. Noise modelling indicates the Corindi Beach community would generally experience a 2 dB(A) reduction in noise levels through the main residential areas, from realigning the highway. This noise reduction would be confirmed during detailed design.

However, noise modelling identified locations where noise levels may increase. Six residences to the west of the existing highway at Corindi Beach are predicted to exceed operational road noise criteria. Where there is an exceedance of the noise criteria, there are a number of different treatments that can be considered. These include low noise pavement, noise walls and architectural treatments. These measures are considered in terms of what is reasonable and feasible, based on the number of sensitive receivers required to be treated. As the six residences that would experience an exceedance of the noise criteria are not in close proximity to one another and are in grouping of three or less, low noise pavements and noise walls are not suitable. Instead, architectural treatments have been proposed (refer to Figure 15-12 in the EIS).

Architectural treatments could include sealing off wall vents, upgrading windows, double-glazing or air-conditioning, and would be confirmed with property owners during detailed design.

3. It is acknowledged the respondent's residence comprises a wooden construction and has heritage value. Section 5.9.6 of the Working paper – Noise and vibration identifies this receiver for architectural noise treatment. In addition, as a historic heritage item a specific management measure (HH39) was identified for noise treatment. This requires proposed noise mitigation including architectural treatment to be developed with a qualified heritage consultant. No low noise pavement or noise barriers have been recommended at this location.

4. Noise levels and appropriate mitigation would be reassessed during detailed design. The project includes a package of noise management measures (refer to Section 15.4 in the EIS), including low noise wearing pavement and architectural treatment at individual residences. Monitoring of road traffic noise 12 months after opening is also proposed to check compliance against criteria from the OEH NSW Road Noise Policy 2011. Where there is an exceedance, if reasonable, additional noise mitigation may be required.

The project, in the EIS, had the southbound highway off-ramp connecting into Jubilee Street via a roundabout, continuing south to the interchange at Maclean, as a combined off-ramp and access road. This increases noise issues with heavy vehicles using compression brakes on the off-ramp. Chapter 4 of this report includes a design refinement at this location, which removes the combined southbound off-ramp and access road to Jubilee Street. Instead, the southbound off-ramp moves south of Jubilee Street by 600 metres. A separate access road from the interchange at Maclean would travel north and connect to Jubilee Street.

The removal of the southbound off-ramp would reduce noise from traffic along the off-ramp in particular compression braking from heavy vehicles.

5. The noise and vibration assessment in the EIS (SKM, 2012) recommended a low noise wearing pavement north of the interchange at Maclean, to minimise noise (between station 80.5 and 82.5). No noise barriers or earth mounds are recommended for this location. Further noise assessment during detailed design would confirm required noise mitigation.
6. Appropriate noise mitigation would be provided in line with OEH's NSW Road Noise Policy 2011 for noise affected residences. In this project section, a number of residences are identified for architectural treatment, to include sealing off wall vents, upgrading windows, double-glazing or air-conditioning. All treatments would be discussed with property owners. Further noise assessment during detailed design would confirm required noise mitigation.

2.17.6 Vibration

Submission number(s)

005, 039, 066, 068, 105, Rous Water, Richmond Valley Council.

Issue description

1. Increased level of vibration at respondent's property at Woodburn.
2. Concerned about possible structural damage to property on Pimlico Road due to project construction.
3. Concerned about possible damage to foundations and shed slab as well as landslip due to the proximity of cutting, particularly from explosives or heavy equipment.
4. Concern of impacts from vibration to heritage home.
5. The project would consist of earthworks for the Shark Creek bridge in proximity to the respondent's residence, resulting in structural and aesthetic impacts.
6. Appropriate blasting limits at Lang Hill may need to be applied and monitored during any blasting work, particularly in relation to underground and surface infrastructure.

Response

1. The major vibration sources from construction near Woodburn include piling, rock hammering / breaking and blasting. At this stage, no controlled blasting has been identified within 200 metres of residents near Woodburn Evans Head Road. However, piling from the Woodburn Evans Head Road overpass bridge could generate some vibration, in particular for residents living above sandy soils and a high water table. The EIS includes management measure CNV15 which specifies that where piling, hydraulic hammering or dynamic compaction is proposed within 50 metres of any structure or service, a building condition survey is required. Preliminary vibration monitoring will also be undertaken by a qualified contractor before and during construction. Direct (physical) property impacts would be managed via pre-construction surveys for buildings. This enables direct property impacts to be checked via "before and after" building surveys. Where Roads and Maritime or the contractor are found to be responsible, any property damage caused directly or indirectly by the project would be rectified at no cost to the property owner/s.
2. It is acknowledged the southern embankment of the bridge across Emigrant Creek would be located near the respondent's residence, resulting in potential vibration impacts. During detailed design, the need for driven piling would be confirmed. Where piling, hydraulic hammering or dynamic compaction is proposed within 50 metres of a structure, a building condition survey would be prepared, and preliminary vibration monitoring undertaken (see management measure CNV15). Before construction, a Construction Environment Management Plan would be prepared to control and monitor vibration. During construction, a complaints handling procedure would be implemented, to manage construction noise and vibration issues.
3. Blasting at the borrow site west of Wardell Road could be required to extract fill material. A blasting assessment in the EIS indicated residences within 90 metres of the site could be impacted from exceedences of air-blast overpressure and ground vibration criteria. However, as the respondent's residence is around 300 metres away, impacts are unlikely due to distance and proposed controls to manage blast noise and vibration.

The need for controlled blasting would be confirmed during detailed design and if required, a detailed noise assessment would identify management measures. Direct (physical) property impacts would be managed via pre-construction surveys for buildings within 200 metres of the blast site, to enable direct property impacts to be checked (refer to management measure CNV23 in Chapter 5 of this report).

It is acknowledged the respondent's residence is a heritage item, located around 270 metres east of the southbound carriageway of the project. Due to distance, construction vibration is unlikely to exceed appropriate criteria. However, further vibration assessment is proposed during detailed design to confirm predicted vibration levels. A Construction Noise and Vibration Management Plan is proposed to minimise noise and vibration impacts. Should this assessment identify vibration impacts above the relevant vibration criteria, vibration monitoring would be undertaken and a building condition survey undertaken before and after construction. Best practice methods would be considered during detailed design and implemented during construction, to mitigate noise impacts from the project.

4. The project would result in the Shark Creek bridge being located around 70 metres east of the residence, so the bridge and the earthworks would be visible.

The assessment identified construction noise would exceed relevant criteria at this residence. A Construction Noise and Vibration Management Plan would be developed before construction to identify how impacts can be minimised. Management measures could include further consultation with affected residences, temporary barriers, respite periods, alternate quieter construction methods, and temporary relocation of residents.

5. At the residence located on the respondent's property, road traffic noise would increase by around 14 dB(A), requiring architectural treatment to mitigate road traffic noise impacts. Mitigation options could include sealing off wall vents, upgrading windows, double-glazing or air-conditioning, requiring property owner discussion during detailed design.

A vibration assessment considered the proximity of the respondent's residence to Shark Creek bridge. However, structural damage from piling activities is unlikely due to the distance between the bridge and the residence. Further vibration assessment during detailed design would confirm predicted vibration levels. If potential vibration impacts are predicted at the respondent's residence, a building condition survey before and after construction is proposed. Best practice methods would be considered during detailed design and implemented during construction, to mitigate noise impacts from the project.

6. Roads and Maritime would consult with Rous Water regarding blasting limits at this site and potential impacts to underground utilities and water reservoirs on an adjoining property. An assessment of the need for blasting and the potential effects to the structures would be undertaken during detailed design. That assessment, as a minimum, will recommend a structural condition survey of the reservoirs to be undertaken before blasting work commences (refer to new management measure CNV24 in Chapter 5).

2.18 Land use and property

2.18.1 Land use

Submission number(s)

024, 028, 038, 051, Trade & Investment Resources and Energy, Forestry Corporation of NSW, Richmond Valley Council, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. Section 3 appears to traverse through undeveloped / public land.
2. Non EEC habitat has social values and beneficial land uses (ie timber production, beekeeping).
3. The highway is near the coast and could result in the further development of small coastal villages, particularly if an easily accessible exit is provided from the highway. The potential impact of this development has not been included in the EIS.
4. The project would result in the loss of 204 hectares of timber resource within state forests.
5. Blasting constraints to quarry near the project may adversely affect cut and fill balance and cause additional demand on quarries, access roads, and communities
6. The EIS foreshadows need for a quarry offset program however lacks a proposed offset program or suitable analysis to justify such a program.
7. The Project severs around 40 hectares from Wells Crossing Flora Reserve reserved under s16 of the Forestry Act 2012 and this reserve with statutory protection should also be included in Table 4.18 of the working paper.

8. The flora and fauna management and monitoring plans may impact on areas of state forest where the proposed upgrade traverses state forests. State forests expects that there will be ongoing consultation with the proponent to ensure that any further impacts on forest productivity and timber resources are minimised
9. The assessment of Forest Management Zones may have benefitted by the provision of a brief outline of the Forest Management Zoning classification.
10. There is the potential for a greater indirect impact on timber resource availability following the implementation of the biodiversity offset strategy where hectares of native vegetation, some of which will have been historically managed for private native forestry would be acquired.
11. Properties to the south-east of Broadwater were being assessed to be rezoned for Rural Residential development. Adoption of the eastern bypass option for Broadwater resulted in the potential development being jeopardised. Advice from the Department of Planning at the time indicated a possibility that part of the site could still be developed as an industrial estate, being a compatible land use adjoining a highway.
12. The Woodburn interchange and highway alignment are adjacent to an identified urban release area at Trustums Hill. Consideration for noise attenuation, acoustic walls and of vibration will be considered in the planning for a development.
13. SEPP 14 does not apply to national parks and nature reserves but areas formerly mapped under SEPP 14 within reserves are recognised as endangered ecological communities.
14. Ancillary facilities and sedimentation basins are not to be located in national parks or nature reserves.
15. Section 16.3.13 identifies those lands directly impacted or adjacent to the project that are reserved under the *National Parks and Wildlife Act 1974*. The reference to Bundjalung State Conservation Area should be deleted and Mororo Creek Nature Reserve added.

Response

1. Between Glenugie to Tyndale, the alignment would pass through a mix of open grazing land and remnant bushland on the eastern side of the Coldstream River basin. It would cross Pillar Valley and be located about two kilometres east of Tucabia. Land ownership through this area is mostly private land, with some Government land.

The NSW Government land affected by the project includes crown reserves, Glenugie and Pine Brush state forests. Other Local Government owned land includes road and grazing land.

2. The project would impact on vegetated areas, which as well as biodiversity values, have social values. Areas in State forests are managed for multiple uses including timber harvesting, recreation, bee keeping and conservation. State forests affected by the project include Wedding Bells, Newfoundland, Pine Brush, Tabbimoble, Mororo and Doubleduke. The values of these forest areas have been considered in the EIS as noted in Section 4.5.3 of the Working paper – Social and economic.
Management measures have been developed for the project to manage or offset remnant native vegetation and compensation for property acquisition.
3. Future development of villages on the east coast is governed by the Mid North Coast Regional Strategy (NSW Department of Planning, 2009), and Far North Coast Regional Strategy (NSW Department of Planning, 2006).

The strategy identifies Woolli, Minnie Waters, Sandon, and Brooms Head as growth areas, however, these are within a limited boundary. The strategy also states that "no further rezoning for rural residential development, other than land in a current or future approved local growth management strategy, will be permitted in Coastal Areas".

The project supports future development proposed in the Mid North Coast Regional Strategy (NSW Department of Planning, 2009) through improved access to major centres and future growth areas within the region. However, there would be no change to access to Woolli, Minnie Waters, Sandon and Brooms Head. In addition, there are no plans to locate an interchange at Woolli Road to facilitate highway access to villages on the eastern coast.

4. The project would impact around 204 hectares of state forest. The project includes management measures for these areas including harvesting millable timber before construction and the provision of compensatory land to offset the loss in vegetation. Roads and Maritime would continue to consult with Forestry Corporation of NSW regarding the acquisition and management process for affected State forest.
5. Working paper - Land use and property acknowledges that there is the potential that the project could result in blasting restrictions to some adjoining quarries. This would be further investigated during detailed design in consultation with quarry owners (refer to management measure LU29).
6. This comment is incorrect. The EIS does not note the need for an offset program for quarry resources, nor does the assessment recommend it. The foreshadowing of an offset program was in relation to biodiversity offsets. Chapter 4 of this report includes design refinements at two proposed borrow sites, located at Lang Hill north of Woodburn and at west of Wardell Road (Wardell). At west of Wardell Road, the refinement enables increased excavation to provide more fill material for construction to minimise the need to obtain materials from commercial sources. Provisions for sustainable management of resources are identified in management measures WM2 in Chapter 19 of the EIS and Chapter 5 of this report.
7. The EIS identifies that the project would require the acquisition of 40 hectares of Wells Crossing Flora Reserve. This is detailed in Working paper - land use and property. The area would be acquired in accordance with the requirements of the *Forestry Act 2012*.
8. Roads and Maritime would continue to consult with the Forestry Corporation of NSW with regards to impacts on state forest land (refer to LU24 and LU25), including consultation regarding any biodiversity management measures such as connectivity structures and monitoring programs.
9. Further details on the FMZ system has been provided in the Working paper - land use and property (refer to Section 3.7.1)
10. Offset properties have not yet been identified, and as such, an assessment of impact on privately forested properties cannot be made.
11. This comment is acknowledged.
12. This comment is acknowledged. It is outside the scope of this project to consider provision of any noise attenuation measures for as yet unapproved development areas. This would be the responsibility of the developer of the site.

13. This comment is acknowledged.
14. The project identified 85 potentially ancillary facilities (refer to Chapter 3 of this report) as well as identifying potential locations for temporary sedimentation basins (refer to Chapter 6 of the EIS). None of these are proposed within national parks or nature reserves.
15. It is acknowledged that the project does not pass near the Bundjalung State Conservation Area. It is also acknowledged that the project is adjacent to the Mororo Creek Nature Reserve.

2.18.2 Property access

Submission number(s)

006, 043, 053, 066, 105, 113, Forestry Corporation of NSW, Rous Water, Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. Any impacts to access for a tourism business near Moylans Lane at East Wardell.
2. Concerned about lack of an alternative access to the respondents property, located north of the Interchange at Iluka Road.
3. Alternative access options for the Ponderosa property at Broadwater.
4. Alternative property access is required for Hillside Lane due to the removal of access.
5. High ground needed by cattle for refuge from floods would be difficult to access due to the highway cutting the property in half.
6. Forestry trails to be relocated by the project are generally of low design standard and low environmental impact but should be subject to environmental assessment particularly biodiversity and cultural heritage by the proponent and consistency with terms of approval.
7. Rous Water also would like to ensure that appropriate access to existing and relocated infrastructure is maintained during and on the completion of the highway project.
8. The project should provide uninterrupted access to existing management trails in Broadwater and Bundjalung National Parks, and Tabbimoble Swamp Nature Reserve for fire, pest and other management purposes by NPWS vehicles (and other authorised by NPWS).

Response

1. The project alignment is to the west of Wardell. To access this business, southbound and northbound traffic on the project would exit via the interchange at Wardell, travel along the service road to River Drive and then Moylans Lane. Traffic from Broadwater can use either the upgraded highway or the existing Pacific Highway and local roads (as per the current access arrangements) to access this business.
2. A recent subdivision north of Iluka Road (and south of Mororo Road) has resulted in property to the east of the highway not having property access designed in the upgrade to motorway standard (class M).

A minor design refinement is included in Chapter 4 of this report to address the respondent's submission. In the upgrade to motorway standard, property access would be via the existing Pacific Highway would be provided via the Iluka Road Interchange extension to the upgraded eastern access road from station 95.9 to 97.2.

The highway in this location would be upgraded in the interim to arterial standard (class A), property access would be left-in left-out intersection on the highway. Access from the south can be obtained via the U-turn opportunity at station 97.0.

3. The existing level of access to all privately owned properties would be maintained where possible, or as otherwise agreed with property owners, during construction and operation. Roads and Maritime has separately consulted with the respondent regarding their property access. Consideration has been given to the three options provided in the submission received including the possibility of an alteration of the intersection between the existing highway and MacDonald Street.

Modifications to access at MacDonald Street would be further considered during the detailed design phase of the project to enable B-double access from the mill at Broadwater to the molasses storage area.

Roads and Maritime would continue to discuss opportunities to resolve the access issues with NSW Sugar Milling Co-op during detailed design (as stated in Chapter 4 of this report).

4. Roads and Maritime has discussed the alternative access road with the respondent, and would continue to discuss access arrangements during the approval and detailed design of the project. A design refinement has been developed for the borrow site at this location to include a proposed U-turn bay at the end point of the property access west of Hillside Lane (refer to Chapter 4 of this report).

Where the project temporarily or permanently affects any legal property access, feasible and reasonable alternative access to an equivalent standard will be necessary, unless a property owner agrees to alternative arrangements.

5. Cattle movement during times of flood at this property would be under the Shark Creek bridge, which spans over Shark Creek Road. The need for stock access under the bridge would be further considered in detailed design, in consultation with the landowner.
6. Where forestry trails would be relocated and result in an environmental impact outside of the project corridor (and therefore not covered by the EIS), it would be subject to additional assessment. This would be undertaken during detailed design.
7. Roads and Maritime would maintain access to utilities and properties throughout construction and operation (refer to management measures LU9 and LU31). When relocating utilities, ongoing access would be a key consideration.
8. Roads and Maritime would consult with EPA/OEH regarding the maintenance or reinstatement of access to national parks and nature reserves (refer to new management measure LU28 in Chapter 5 of this report).

2.18.3 Property acquisition

Submission number(s)

060, 062, 065, 109. Department of Primary Industries (Agriculture), Trade & Investment (Crown Lands), Environment Protection Authority / Office of Environment & Heritage.

Issue description

1. Roads and Maritime should acquire two lots owned by the respondent that are not affected but could be used as offset lands.
2. Roads and Maritime should acquire the respondent's property in Hillside Lane due to the adverse impacts that would result from the construction of the project.
3. Interest in acquiring surplus land adjoining the respondent's property north of Woodburn Evans Head Road.
4. The project would result in impacts to the respondent's property and requests a private underpass of highway from eastern to western side of property.
5. Consideration should be given to compensating or acquiring agricultural land which would be severed or sterilised.
6. The EIS identifies 22 parcels of Crown land affected by the proposed upgrade. These are only reserves, and there are a number of Crown waterways and Crown public roads held under enclosure permits that will also be affected.
7. Until compensatory lands are transferred, Roads and Maritime would not be able to gain access to or receive transfer of parts of Yaegl Nature Reserve or Broadwater National Park.

Response

1. As part of the project, Roads and Maritime would investigate and identify potential offset lands. These investigations would determine the suitability of the property for offsets, looking at the available vegetation type and condition on the property or the possibility of revegetation. Roads and Maritime would continue to consult with directly affected property owners and landholders regarding land acquisition and potential offsets.
2. Roads and Maritime would consult the landowner regarding their proposal.
3. Acquired land not required for the project would generally be disposed of by public auction or tender. Roads and Maritime acknowledges interest in this land and would continue to consult with the respondent regarding the disposal of the land.
A remnant land and property strategy has been prepared for the project to identify options for surplus property (refer to Section 5 of the Working paper – Land use and property).
4. As part of any acquisition process, Roads and Maritime would resolve issues regarding property infrastructure (such as farm dams) and property access.

Roads and Maritime would continue to consult with directly affected land owners during the project approval and detailed design phase of the project. Appropriate compensation would be negotiated in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy (refer to management measure LU1 in Chapter 5 of this report).

5. The process of project design and of property acquisition negotiation, considered in detail the issue of severance of land use. Measures implemented include arrangements for alternative access to be provided or an adjustment of the project design boundary to reduce the impact of severance or sterilisation of land. However, some residual impacts would remain.

Property owners directly affected by the project would be consulted and appropriate compensation negotiated in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy.

6. Roads and Maritime acknowledges that a number of Crown lands would be impacted and would consult with the department regarding acquisition.
7. This is acknowledged. Roads and Maritime is currently investigating lands to be transferred to NPWS.

2.18.4 Property impact

Submission number(s)

030, 031, 039, 061, 091, 105, 109, 113, 116 Department of Primary Industries (Agriculture), Trade & Investment (Crown Lands), Coffs Harbour City Council.

Issue description

1. Does the project directly impact on 110 Luthers Road, Halfway Creek?
2. Partial acquisition of the respondent's property has affected the use of the property.
3. Various property owners have concerns regarding partial acquisition impacts, impacts to property infrastructure and internal property access.
4. Concerned about the impacts the project may have on the agricultural property from the interchange at Tyndale.
5. High ground needed by cattle for refuge from floods would be difficult to access due to the highway cutting the property in half.
6. Concern with flooding impacts from Cassons Creek and the project on property and stock.
7. Rehabilitating and/or reconstructing dams including any irrigation infrastructure to minimum existing capacity or provide another water source for the impacted agricultural properties should be included as a management measure.
8. The project will sever two Crown Flood Refuges, the under/ overpasses connecting the severed portions of Crown Reserve 53804 and Crown Reserve 36645 must be wide enough to accommodate cattle movements. Roads and Maritime should discuss appropriate requirements with the relevant reserve trusts for the severed refuges.
9. The project traverses the Corindi wastewater treatment plant. Council will need to have suitable alternatives made available by Roads and Maritime for a treatment plant, such as surplus land on the northern side of Kangaroo Trail Road

Response

1. The project corridor is adjacent to the property referred to in the submission. However, the project does not directly impact the property at 110 Luthers Road.
2. Roads and Maritime has acquired land for the project from the respondent. It is acknowledged there would be agricultural, amenity and property impacts from construction. Impacts to agricultural land uses from the project are outlined in Chapter 16 of the EIS. The respondent's residence was assessed in both the non-Aboriginal heritage and noise assessments (refer to Chapters 13 and 15 of the EIS). The noise assessment recommended architectural noise treatment to manage noise impacts. However, as the residence is a heritage building, noise mitigation would be developed with the property owners and a qualified heritage consultant.
3. As part of the acquisition process, Roads and Maritime would resolve issues regarding partial acquisition, property infrastructure (such as diesel tanks) and property access.

Roads and Maritime would consult further with directly affected land owners during the approval and detailed design phase of the project. Appropriate compensation would be negotiated in line with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy.

4. It is acknowledged the realignment of the highway and the design of the interchange at Tyndale would impact the respondent's property. The alignment and overbridge arrangements of the interchange were refined to improve functionality, safety and to reduce the footprint of the interchange.

While there would be impacts to the respondent's property, the project has sought to minimise impacts on prime agricultural land where possible. Agricultural impacts of the project are detailed in Chapter 16 of the EIS (refer to response 3 above regarding compensation and acquisition).

5. Cattle movement during flooding at this property would be under Shark Creek bridge, which spans Shark Creek Road. Stock access under the bridge would be further considered in detailed design with the landowner.
6. The project would change the hydrology of the area, however, the project is designed to improve flood immunity along the Pacific Highway by specifying flood free conditions at this location up to a 100-year ARI flood event.

The project includes a twin bridge crossing of Cassons Creek around 75 metres long. The embankment at Cassons Creek increases flood levels up to 170 millimetres upstream of the project, during a 100-year ARI flood event (and 110 millimetres in the 20 year ARI flood event). At this location, the area is a mix of wooded and cleared grazing land so impacts are limited. However, about 350 metres upstream of the project on Cassons Creek, flooding impacts would be as low as increases of 50 millimetres in the 100 year ARI flood event (and 25 millimetres in the 20 year ARI flood event). Further flood modelling is proposed during detailed design to confirm predicted impacts and required mitigation.

7. As stated in Working paper – Land use and property, during the acquisition process, Roads and Maritime would consult with affected landowners about mitigating impacts on farm infrastructure. This would include mitigating impacts on farm dams (refer to management measure LU2).
8. Assessment of impacts to flood refuges (including the identified parcels of land) is included within the Working paper - Hydrology and flooding and Working paper - Land use and property. Access would be provided to both of these locations. Access at station 48.8 would be via Mitchell Road and access at station 64.9 would be via a constructed new access road across the highway. Access would be finalised through the property acquisition process. Roads and Maritime would continue to consult with Crown Lands and stakeholders (including reserve trusts) regarding the ongoing functionality of flood refuges.
9. The area of council land to be acquired for the project is used to irrigate wastewater derived from the wastewater treatment plant. No infrastructure for the plant is affected by the project.

Acquired land not required for the project would generally be disposed of by public auction or tender. A remnant land and property strategy has been prepared for the project to identify options for surplus property (refer to Section 5 of the Working paper – Land use and property).

However, Roads and Maritime would consider Council's proposal as part of the acquisition process.

2.18.5 Property values

Submission number(s)

039, 066, 104, 109.

Issue description

1. The project would affect property values due to direct and indirect impacts on the property.

Response

1. Many aspects influence property values such as location and use. It is recognised that properties affected by the project may be difficult to market before completion of construction due to uncertainty of environmental impacts.

Directly affected landowners are being consulted where property acquisition is required. Appropriate compensation would be negotiated in line with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy.

2.18.6 Agricultural impacts

Submission number(s)

051, 053, 074, 084, 091, 104, 105, 109, 110, Department of Primary Industries (Agriculture), Richmond Valley Council.

Issue description

1. The project would impact on large prime agricultural land along the project, but particularly through the Clarence Valley.
2. Request for confirmation that NSW Sugar Milling Co-operative would not have its infrastructure (eg cane pads) or operations impacted.
3. Suggestion to build yards and loading ramps with holding paddocks to enable the easy movement of cattle over the highway at the Tyndale Flood Refuge.
4. Drainage around Shark Creek would need to be provided to the equivalent or better than the current situation.
5. Reduced area for and impact to sugar cane growing area.
6. Loss of additional agricultural land due to the construction of arterial roads to connect to the highway.
7. The project would split the property in two and a private underpass should be provided as well as construction of additional cattle holding yards and compensation for loss of watering holes.
8. Rehabilitating remnant land where it can be returned to agriculture uses should be to existing agricultural capacity.
9. Significant areas of agricultural land will be impacted by the highway upgrade outside the road corridor. Of significance are agricultural lands which will be severed by the road and have no alternative means of access. No assessment has been given to these impacts.

Response

1. The project would impact agricultural land. Overall, around 954 hectares of agricultural land would be impacted, of which around 386 hectares is regionally significant farm land. The project would impact on around 386 hectares to regionally significant agricultural land, making up 0.14 per cent of regionally significant agricultural land in the Northern Rivers and Mid North Coast regions. However, the project has sought to minimise the impact on prime agricultural land. Most notably, the alignment between Tyndale and Maclean was altered in 2010 to avoid the high yielding sugar cane land located adjacent to the existing highway. Agricultural impacts of the project are detailed in Chapter 16 of the EIS. Roads and Maritime would continue to consult with landholders directly affected by the project. Appropriate compensation would be negotiated in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy.

2. Roads and Maritime is in consultation with the Cane Harvesters Cooperative regarding impacts to the sugar cane industry including impacts to cane pads. Management measure LU26 in Chapter 16 (Land use and property) of the EIS states suitable locations for relocated cane pads and restoration of affected cane drains would be identified where possible in consultation with impacted landowners. This management measure has been revised due to the development of a cane farm strategy (refer to Chapter 3 of this report) to address these issues on an industry wide, property specific basis.

3. Roads and Maritime would continue to consult with the Tyndale Flood Refuge Reserve Trust on the functionality of the property.

Property owners directly affected by the project would be consulted and appropriate compensation negotiated in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy. This would be considered as part of the acquisition process for this property.

4. It is recognised maintaining drainage is important to the ongoing viability of cane farming operations.

In the Shark Creek area between Tyndale to Maclean, the project design has sought to maintain and improve cane drainage where possible. Preliminary hydrology investigations have suggested changes to the proposed drainage in the Shark Creek area. The results of these investigations would be discussed with property owners and would be further considered during detailed design, in accordance with the cane farm strategy (Chapter 3 of this report).

5. It is acknowledged that the project would potentially impact agricultural land uses. At the respondent's property on Shark Creek Road, around 40 per cent of the property would be directly affected by the twin bridge crossing of Shark Creek and the realigned highway. Roads and Maritime would continue to consult with landholders directly affected by the project. Appropriate compensation would be negotiated in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy.

6. The ultimate upgrade (class M) of the highway would result in the highway becoming a controlled access highway, with access only available at interchange locations. Arterial (or local) roads and

property access would not be able to connect to the highway. Instead these roads would connect to the service road.

However, should any roads be upgraded or relocated in the vicinity of the project, this would be subject to a separate approval by the road authority undertaking the work.

7. As part of any acquisition process, Roads and Maritime would resolve issues regarding property infrastructure and property access.

Roads and Maritime would continue to consult with directly affected land owners during the project approval and detailed design phase of the project. Appropriate compensation would be negotiated in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy.

8. Acquired land not required for the project would generally be disposed of by public auction or tender. A remnant land and property strategy has been prepared for the project to identify options for surplus property (refer to Section 5 of the Working paper – Land use and property).

The principles in the strategy include consideration to returning remnant land use to agricultural use. The remnant land and property strategy would be prepared in consultation with the appropriate authorities.

9. Potential impacts to agribusinesses, including potential severance impacts are detailed in Section 4.4 of the Working paper - Social and economic. Directly affected properties severed by the project would be considered further by Roads and Maritime as part of the acquisition process. Where appropriate alternative access would be provided for directly affected landowners, this will be confirmed during detailed design.

Roads and Maritime has not identified any issue with broad agricultural severance across the upgrade. Four interchanges from Woodburn to Ballina and overpasses provide regional connectivity. The local road network would interconnect with these arterial routes.

2.19 Social and economic

2.19.1 Assessment process

Submission number(s)

126, Coffs Harbour City Council

Issue description

1. The Census data is out of date. 2006 data was used, however the 2011 Census data was released last year.
2. Council endorses ongoing consultation with the community, including dialogue with target groups, regarding local issues and needs. This should include construction and operational noise impacts and mitigation

Response

1. The 2011 census statistics was progressively released through 2012, at which time the EIS had been prepared. The 2006 census was used in the socio-economic assessment as the full data was available. This information was used to illustrate population and demographics in the study area. While it is acknowledged that changes in demographics occurred during this period, it is not considered that the use of the 2006 census data would have adversely affected the impact assessment or the identification of management measures.
2. Roads and Maritime would continue to consult with the community and stakeholders during the detailed design and construction phases of the project.

2.19.2 Amenity

Submission number(s)

040, 091, 109, 115, 119.

Issue description

1. The project will impact on small villages of the Clarence Valley.
2. The project would be constructed in proximity to the respondent's residence at Tyndale and would result in noise, visual and lifestyle impacts.
3. The respondent's property located at Corindi Beach would be subject to noise impacts, light spill, vehicle emissions and visual amenity.
4. Respondents property would be subject to noise, vibration and air quality impacts as a result of construction.
5. Issues surrounding the Blackadder Creek safety work has impacted on health and amenity.

Response

1. Construction of the project could result in temporary changes in the amenity of an area. The highway across Harwood Island would be constructed along the existing alignment, to minimise amenity disruptions on the island. However, at Harwood village there would be a significant impact from construction of the new crossing of the Clarence River, and a large ancillary facility nearby. However, ancillary facility impacts are temporary.

A Construction Environment Management Plan (CEMP) would be prepared to include management measures for minimising dust and noise during project construction. Specific management measures for noise and air are included in Chapter 19 of the EIS and would be detailed in a CEMP. Where possible, noise impacts would be minimised through time and duration restrictions and by specifying the requirement for respite periods.

2. The construction and operation of the project would change the amenity and visual character of the area.

The noise and vibration assessment identified that for one of the residences located on the respondent's property, road traffic noise increases by around 6 dB(A). The residence has been identified for architectural treatment to potentially include sealing off wall vents, upgrading

windows, double-glazing or air-conditioning. All treatments would be confirmed with property owners during detailed design.

The project includes a landscape strategy, to minimise visual impacts where possible. Roads and Maritime continues to consult with directly affected property owners regarding property severance and access, which would be confirmed during detailed design. A design refinement is proposed to improve local access between Bondi Hill Road and Byrons Lane (refer to Chapter 4 of this report), which may assist in minimising travel time and distance to internal property access.

3. The project would have amenity impacts, particularly where property is in proximity to the alignment.

An air quality assessment included in Section 18.2 of the EIS identified no exceedances of EPA assessment criteria along the length of the project.

An operational noise assessment identified a number of residences at Corindi Beach for noise mitigation, including the respondent's residence. This is likely to comprise architectural noise treatment to potentially include sealing off wall vents, upgrading windows, double-glazing or air-conditioning. Directly affected property owners would be further consulted about required noise mitigation during project development and detailed design.

A landscape strategy has been developed for the project to minimise visual impacts where possible. The landscape strategy, through the Corindi Beach area, has identified maintaining surrounding land uses in the revegetation of the road corridor as an important issue. This requires revegetation of dense trees where the surrounding area is vegetated or planting of grasses to complement adjoining agricultural land uses.

Regarding light spill, the project would generally be unlit, except where lighting is required for safety reasons, such as interchange roundabouts and merge and diverge traffic lanes and on major bridges. The respondent's property is not located near a major bridge structure or interchange, therefore lighting impacts should be minimal.

4. A Construction Noise and Vibration Management Plan would be developed before construction. This would identify measures to minimise noise and vibration impacts at residences including those located along Tallowood Lane, Tucabia.

The noise assessment has identified that when the project is opened, this residence would experience an increase in noise levels of around 30 dB(A). As a result of this increase in noise levels, the assessment has identified the residence for noise mitigation (architectural treatments). Architectural treatments could include sealing off wall vents, upgrading windows, double-glazing or air-conditioning. All treatments would be discussed with property owners and confirmed during the detailed design phase. Where possible, these treatments would be installed before construction to provide some benefit to the residents during the construction period.

Dust would be generated through construction, however a number of best practice measures are proposed during construction to minimise dust generation. The Construction Environmental Management Plan would include proactive measures to manage dust levels, such as real time

measures of wind speed and direction, targeted allocation of water carts, and reduction of dust generating activities during windy periods.

5. Roads and Maritime has initiated a consultation process with community members and Coffs Harbour City Council to address a range of flooding issues at this location. In addition, a Corindi community focus group has been established for the Woolgoolga to Ballina Pacific Highway Upgrade to provide feedback to the community on a range of project issues including the cumulative assessment undertaken.

2.19.3 Business and economic impacts

Submission number(s)

017, 031, 040, 051, 077, 089, 091, 093, 096, 102, 103, 109, 121, Trade & Investment Resources and Energy, Coffs Harbour City Council, Richmond Valley Council.

Issue description

1. The project does not provide a short access to Grafton, which would isolate the town from through traffic. Retailers in Grafton would be impacted by the bypass of the city centre.
2. Concern over the project dividing property. Belief that this would result in higher running costs and extra wear of machinery due to the additional eight kilometres required to travel to access property.
3. The project needs to maintain the current access to the Matilda service station at Kungala Road. Suggestions of a cul-de-sac are rejected.
4. The project would result in the loss of wallabies from the area which would decrease the number of visitors staying at the Tyndale Tourist Park.
5. Employment during construction will only be short term and not offset the potential economic losses to towns bypassed by the project.
6. The project would substantially impact on our profitable petrol station business and would like to explore alternative sites.
7. The project would impact on the property which has private timber production.
8. The project would result in economic impacts.
9. The EIS should incorporate adequate and appropriate assessment of the quarry industry (particularly the competing demands on resources while the project is being constructed), its markets and opportunities for offsets, not only of quarries to be acquired or adversely impacted.
10. Resolution of any adverse impacts on the Berry Exchange business needs to be a high priority.
11. Consideration of strategies to facilitate local employment on the project should be considered.
12. The impact of the project on availability of affordable rental housing, including increased rental prices due to transient workers, should be considered.
13. Achieving the proposed highway elevations would involve excavation and disruption to the existing car park for the museum. Under class M the entire car park would be resumed.
14. Appropriate directional signage should be incorporated into the design of the highway to direct travellers to New Italy.
15. Closing immediate access to New Italy will have a dramatic impact upon the viability of businesses operating from the Museum premises. Compensatory measures should be considered.
16. Roads and Maritime should be mindful of construction close to urban areas, dwellings, and businesses will have a significant social impact.
17. The recent flood caused the Highway to be cut, with traffic being diverted via Casino. Local businesses suffered extensive losses due to the closure and lost passing trade. This situation will become permanent once the highway upgrade is complete.

18. A package of compensatory measures will be required to assist bypassed communities to mitigate the impacts.
19. The project should be conditioned to have a full Socio-Economic Study to identify management measures to minimise both short and long term impacts upon Broadwater, Woodburn and New Italy.

Response

1. Grafton town centre is already bypassed by the existing Pacific Highway. The social and economic assessment in Chapter 17 of the EIS identified that “the size of a township is another driver influencing the degree of impact on local businesses.

Research for Roads and Maritime by Parolin (2011) found that highway bypasses are seldom either detrimental to, or the saviour of, an established community. Overall, impacts for medium to larger towns are generally small and insignificant to the well-being of the community (Chase and Gustavon 2004 cited in Parolin 2011).

The business survey undertaken for the EIS identified that over 50 per cent of businesses in Grafton are traffic related (such as service stations). These businesses are more reliant on local traffic rather than passing highway traffic. While some traffic dependent businesses may be impacted from the highway moving further away, the viability of these businesses is predicted to be sustained by local demand for services, as well as the continued use of the existing highway as a service road and gateway into Grafton. Grafton's economy is not expected to be adversely affected by the project. Grafton also provides access to the Gwydir Highway and Summerland Way and access to other large regional towns.

However, Roads and Maritime would consult with Clarence Valley Council and the Grafton Chamber of Commerce for the implementation of appropriate signage to promote Grafton (refer to management measure SE4 in Chapter 5 of this report).

2. Roads and Maritime is consulting with directly affected property owners regarding property severance and access. Within Chapter 4, a design refinement is proposed to improve local access between Bondi Hill Road and Byrons Lane, located near the respondent's property. This may assist in minimising travel time and distance for property access. For severed properties, access would be confirmed during the detailed design of the project.
3. Roads and Maritime is in discussion with the service station owners regarding access from Kungala Road. In the initial arterial road upgrade, Kungala Road would connect with the upgraded highway through a left-in, left-out and right-in arrangement. .

In the upgrade to motorway standard, the intersection would be closed and Kungala Road would form a T-intersection with the western service road. Further discussions with the service station owners are proposed during the detailed design phase of the project to confirm the access and options to be considered in connecting to the project.

4. It is acknowledged some businesses on the existing highway would experience some loss of passing trade. However a large amount of traffic would still pass by on the existing highway. Signage would also assist in directing traffic off the highway, particularly as the tourist park is so close to the interchange at Tyndale.

5. It is acknowledged increased employment during construction would only temporary. When the project is opened, it is acknowledged that some towns with a high number of highway-based businesses would experience a reduction in passing trade, where the highway bypasses their location. However, the bypass of a town would result in improvements in amenity that could provide further economic opportunities.
6. Alternative sites suitable for a petrol station would be discussed as part of Roads and Maritime' ongoing property acquisition process. However, sites with direct access onto the highway would not be permitted. Access to petrol for highway travellers would be via potential highway service centres (identified at Woolgoolga, Maclean or Ballina) or from service towns along the route, accessible from interchanges.

Roads and Maritime would not relocate this petrol station. Any operator of a petrol station would need to obtain planning approval from the relevant approval authority.

7. Roads and Maritime is consulting with directly affected property owners regarding property acquisition. Freehold land required for the project would be acquired in accordance with the provisions of the *Land Acquisition (Just Terms Compensation) Act 1991*.
8. The project has assessed the potential economic impacts from the project in regards to highway based businesses, town centres and agribusinesses (refer to Chapter 17 of the EIS). Assessments of each town bypassed considered potential impacts on South Grafton, Grafton, Ulmarra, Maclean, New Italy, Woodburn, Broadwater and Wardell. Overall, while the removal of a highway away from a town centre may result in some loss of highway trade, there is the benefit of improved amenity which could provide economic opportunities for the town.

The project would directly affect a number of highway-based businesses and agribusinesses. However, any property owner whose property requires acquisition would have compensation negotiated in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy.

Overall, the project supports regional economic development by providing good access to Grafton, Grafton Airport, Maclean, Yamba and the villages of Tyndale and Harwood.

9. Referring to this industry specifically, it is acknowledged that during the construction of the project, there would be an increased demand for resources in the regional area (refer to Section 4.5.2 in Working paper - Land use and property).

Provisions for sustainable management of resources are identified in management measures WM2 in Chapter 19 of the EIS and Chapter 5 of this report.

10. Roads and Maritime would continue to consult with the Berry Exchange. In particular, a management measure (SE7) has been identified to review the access into Berry Exchange. The design refinement to the interchange at Range Road (refer to Chapter 4 of this report), has in part addressed this management measure.
11. Roads and Maritime and its contractors endeavour to use local workforce, products and services through all road projects. This would include this project.

12. The Working paper - Social and economic has identified that the Clarence Valley, Richmond Valley and Coffs Harbour Local Government areas have household vacancy rates above the regional average. This suggests that these Local Government areas have a greater capacity to service the demand for housing and accommodation needs of the workforce. In this regard, a likely consequence of increased demand for accommodation would be higher property values and rents, reflecting growth in demand for real property from increased construction activity. As exact numbers of transient workers that would be employed are unknown, no further assessment can be undertaken to quantify this impact.
13. The EIS design and the design refinement (proposed in this report) would require excavations that would impact the current car park arrangements to the museum. For further details of proposed access at the New Italy Museum Complex, refer to Section 2.15.1 (response 12).
14. Roads and Maritime would consider the inclusion of appropriate signage as part of the project (refer to HH26) to direct travellers to the New Italy museum as part of the upgrade to class M (motorway) standard. The requirement for permanent signage would be considered during detailed design, in line with Roads and Maritime policies.
15. The EIS notes that during the construction period, there would be a range of social impacts related to disruption of traffic and a range of amenity impacts. These are addressed in Working paper- Traffic and transport, Working paper - Social and economic, Working paper - Noise and vibration.
16. The traffic assessment has indicated that around 43 per cent of traffic would still use the existing highway (service road) between the interchange at Woodburn and Broadwater National Park. In addition, the improvement in amenity provides opportunities for further economic and tourist development.
17. Impacts to local businesses are addressed in Section 4.5 of the Working paper- Social and economic. This section addresses the impacts to each township either along the highway alignment or that are bypassed by the project. This includes New Italy, Woodburn and Broadwater. Also, refer to Working paper – Hydrology and flooding for further information regarding the project's flood management objectives.
18. Management measures (SE4 and SE5) provide for Roads and Maritime to discuss issues with Councils directly impacted by the project during detailed design. Roads and Maritime would also consider the inclusion of appropriate signage as part of the project for bypassed towns.
19. The EIS has undertaken a socio-economic study including a business review of bypassed towns and New Italy (refer to Section 4.3 and 4.5 of Working paper – Social and economic for further information).

No further studies are proposed. However, Roads and Maritime is willing to facilitate focus groups involving Chambers of Commerce, local Councils and other relevant stakeholders to assist in developing appropriate strategies for bypassed towns.

2.19.4 Tourism impacts

Submission number(s)

040, 059, 102.

Issue description

1. Project construction will destroy biodiversity in the Glenugie to Maclean area and impact future tourism potential and tourist related employment for local residents.

Response

1. Refer to Section 2.12 for further information. The project would not directly impact and would increase access to tourist destinations, so is not likely to impact on the potential of the tourism industry. However, the project would provide improved access to the region, supporting regional economic development for both businesses and tourism.

2.20 Other issues

2.20.1 Air quality

Submission number(s)

005, 036, 062, 066, 090.

Issue description

1. The project would result in increased level of fossil fuel exhaust smoke and smog and cause air quality, soil and water impacts and affecting the wellbeing of residents.
2. The respondent collects rainwater for drinking water, worried that dust and pollution from construction will impact the quality of their drinking water.
3. There is a lack of detail regarding dust and noise at the respondent's property at Broadwater, particularly as there are strong southerly winds.

Response

1. An air quality assessment is included in Section 18.2 of the EIS. Where the project deviates from the existing highway, it will introduce a new pollution source to a rural environment. However, the air quality modelling predicts pollutant levels across the project as below EPA assessment criteria.
2. Air quality would be monitored during construction, to assess dust levels. Where require, steps shall be taken to minimise and address dust impacts, to minimise nuisance.

Regarding soil and water impacts, the project includes water quality ponds to contain accidental fuel and chemical spills, potentially resulting from crashes along the highway. To prevent spillages from reaching downstream drinking water supplies, basins are designed to contain spill volumes up to 40,000 litres (refer to management measure SSW59 in Chapter 5 of this report). Temporary sedimentation basins would be provided during construction to safeguard water quality, some will be retained once the project is opened to traffic.

3. Dust and particulate matter could be washed into rainwater tanks and potentially affect drinking water quality. An air quality assessment considered pollutant concentrations from project traffic near the roadside. This assessed particulate matter from motor vehicles using the project. The air

quality results were compared to OEH criteria, showing there are no exceedances of air quality criteria from road traffic near the project. This includes dwellings located near Wardell.

The Commonwealth Department of Health and Ageing (2004) considers that in most parts of Australia, industrial and vehicle emissions are unlikely to cause significant impacts on the quality of rainwater collected in domestic tanks.

During construction, dust generation would be minimised where possible, or managed. The Construction Environmental Management Plan would include proactive measures to manage dust levels, such as real time measures of wind speed and direction, targeted allocation of water carts, and reduction of dusty activities during windy periods.

The noise and vibration assessment undertaken for the EIS identified that noise levels at the respondent's residence are predicted to increase by around 16 dBA once the upgraded highway is opened to traffic. Noise mitigation is recommended at this residence consisting of architectural treatment. Architectural treatment measures could include sealing off wall vents, upgrading windows, double-glazing or air-conditioning. Directly affected property owners would continue to be consulted during project development. Noise mitigation would be discussed and agreed with property owners during detailed design.

2.20.2 Greenhouse gases

Submission number(s)

051, 098, 121.

Issue description

1. The project would result in increased greenhouse gas production. The project is unnecessary and that a rail line would be more sustainable as they do not produce CO₂ emissions.
2. Concerned that the offset in greenhouse gas emissions would only be achieved in 70 years' time and that the use of the highway would be substantially different at that time.
3. Concerned about the lack of detail in the greenhouse gas calculations. If the results of the assessment are accurate, the project would produce close to 1,000,000 tonnes of CO₂e. Figure 18.1 only appear to add up to half this amount.
4. The underlying assumptions used for the greenhouse gas model are not likely to reflect the reality of clearing in the project area. Much of the material may be left in piles to slowly degrade or will be piled up and burnt.

Response

1. Greenhouse gas emissions from road traffic are expected to reduce as a result of the project. As shown in Figure 18.2 of the EIS, in 2016, the emissions from the project would be about 250,000 tonnes of carbon dioxide per year, in 2026, the emissions estimate is about 310,000 tonnes of carbon dioxide per year. If the project were not completed, the emissions from the Pacific Highway with no upgrade would be about 325,000 tonnes of carbon dioxide per year. Therefore, the project would reduce traffic emissions by around 15,000 tonnes of carbon dioxide per year (from 2026 onwards). This moderate decrease in traffic emissions is due to the shorter overall length of the project and improved traffic efficiency when compared to the existing Pacific Highway (refer to Section 18.1 of the EIS).

While rail does play an important role in meeting freight demand, it is important to note only a small proportion of heavy vehicle traffic on the Pacific Highway is exclusively Sydney- Brisbane traffic. A large volume of the traffic (ie around 78 per cent) between Woolgoolga and Ballina originated from or were destined for Grafton. Therefore, even if the North Coast Railway was upgraded, the Pacific Highway would still need to be upgraded to meet the needs of the growing North Coast region.

2. It is acknowledged that construction related emissions are forecast to be offset about 70 years after the project is opened to traffic.

During construction, a resource management strategy would be developed to identify resource consumption and waste minimisation measures, to reduce emissions where possible. Further steps would be taken before and during construction to minimise emissions. This includes minimising vegetation clearance where feasible, by identifying opportunities during detailed design to reduce the project boundary. Areas to be revegetated would include native species, where practicable (Refer to GHG1 in Table 18-1 of Chapter 18 of the EIS). An education program has also been recommended for construction personnel to promote energy-efficient work practices, to minimise emissions. (Refer to GHG8 in Table 18-1).

The project would include an offset strategy. The offset strategy would provide compensatory lands to preserve lands from development, offsetting the same type of vegetation and habitat to be removed from a project. For details, refer to Chapter 10 of the EIS and Working paper – Biodiversity (SKM, 2012).

3. Greenhouse gas emissions were calculated for a range of sources, for each of the 11 sections of the upgrade from Woolgoolga to Ballina. Emissions were calculated for both construction and operation (operational emissions were based on current and projected traffic flows). To help standardise greenhouse gas assessments of road construction projects, Roads and Maritime – in collaboration with other state (and New Zealand) transport authorities – has released the Greenhouse Gas Assessment Workbook for Road Projects (Transport Authorities Greenhouse Group, 2011). This workbook is used to estimate construction, operation and maintenance stages of road projects, including vegetation clearance, but does not estimate the greenhouse emissions associated with traffic. Emissions associated with traffic from the project have been calculated using Roads and Maritime' Tools for Roadside Air Quality (TRAQ) (RTA, 2008).

Greenhouse gas emissions from construction are shown in Figure 18-1 of the EIS. The histogram in this figure indicates the potential for around 1,146,535 tonnes of carbon dioxide (CO₂e) from construction related activities. Steps would be taken before and during construction to minimise emissions (refer to management measures GHG1 to GHG7 in Chapter 5 of this report). This includes minimising vegetation clearance where feasible, by identifying opportunities during detailed design to reduce the project boundary.

4. Cleared vegetation would be temporarily stockpiled and create emissions during decomposition. Vegetation would be mulched and re-used wherever possible during landscaping and revegetation, to minimise emissions. Landscaping/revegetation of parts of the road reserve would assist in part offsetting project emissions, by acting as a carbon sink. Vegetation would not be burnt on site.

2.20.3 Hazard and risk

Submission number(s)

028.

Issue description

1. Concerned about wildfire and property access / egress in the Iluka Road to Woodburn section.

Response

1. Roads and Maritime is continuing to consult with directly affected property owners regarding property severance, access and emergency response.

Access would continue to be provided to property owners. Under an initial upgrade to class A, property accesses would either be maintained to the highway or would connect to an access road which would connect to the highway. Under a class M upgrade, a continuous service road would be provided along the highway maintaining local and property access.

Access for emergency services onto the highway in this section would be via the interchanges at Iluka Road and Woodburn. Once on the highway there are a number of emergency accesses (U-turn bays) that could be used. Roads and Maritime would continue to consult with emergency service providers regarding emergency access across the project.

2.20.4 Management measures

Submission number(s)

119.

Issue description

1. The project has not provided adequate management measures and would require further measures during operations.

Response

1. The project has been informed by extensive route selection, community consultation, concept design and environmental assessment work. As part of the project, a range of management measures have been proposed to manage impacts to a range of environmental issues, including biodiversity and water quality.

Further assessment would be undertaken during the detailed design phase to confirm potential impacts and management measures to be implemented. Once implemented, Roads and Maritime has adopted an adaptive management approach, and should further assessment or monitoring of impacts identify that management measures are not as effective as possible, measures would be reviewed to ensure a beneficial environmental outcome.

2.21 Miscellaneous

2.21.1 Peak oil

Submission number(s)

051.

Issue description

1. The project is not warranted due to peak oil and that rail transport is the logical alternative.

Response

1. Government and industry believe that that peak oil is likely to occur and that there is a need to establish alternatives to oil as a fuel for transport, and to improve the energy efficiency of transport. This aligns with recognition of the greenhouse effect and the need to reduce greenhouse gas emissions.

There is a close link between economic growth and transport growth. As the Australian and NSW economies continue to grow the need for transport also grows. Freight transport, for example, is predicted to more than double between 2000 and 2020 (BTRE Report 107: Greenhouse gas emissions from transport – Australian trends to 2020).

Historically, there has been a link between transport growth and growth in the demand for fuel. Action is now being taken through Government-supported programs and commercial initiatives to identify alternative sources of fuel and to develop technology to reduce the fuel consumed by vehicles – as evidenced by the commercial availability of bio-diesel, ethanol blended fuels and hybrid cars. This would enable the economic benefits provided by road transport to continue to be delivered with a reduced need for fossil fuels.

Therefore, the Pacific Highway Upgrade Program is justifiable as it forms part of both the State and Commonwealth Governments' strategies for a sustainable transport system. On the basis of these strategies, the highway is expected to remain the key interstate transport route for both freight and people between Sydney and Brisbane well into the foreseeable future. The highway would also continue to serve the ever-expanding coastal communities of the Far North and Mid North Coast of NSW.

It should also be noted that while rail does play an important role, only a small proportion of traffic on the Pacific Highway is exclusively Sydney- Brisbane traffic. Therefore, even if the North Coast Railway was upgraded, the Pacific Highway would still need to be upgraded to meet the needs of the growing North Coast region.

2.22 Support for the project

2.22.1 Support

Submission number(s)

003, 007, 053, 061, 073, 080, 099, 128, Clarence Valley Council, Rous Water, Richmond Valley Council.

Issue description

1. Respondent supports the project.
2. The respondent supports the upgrade for improving transport mix, safety, local and state connections and alternative modes of transport.

Response

1. The support for the project is acknowledged.
2. This is acknowledged by Roads and Maritime.