NSW GOVERNMENT

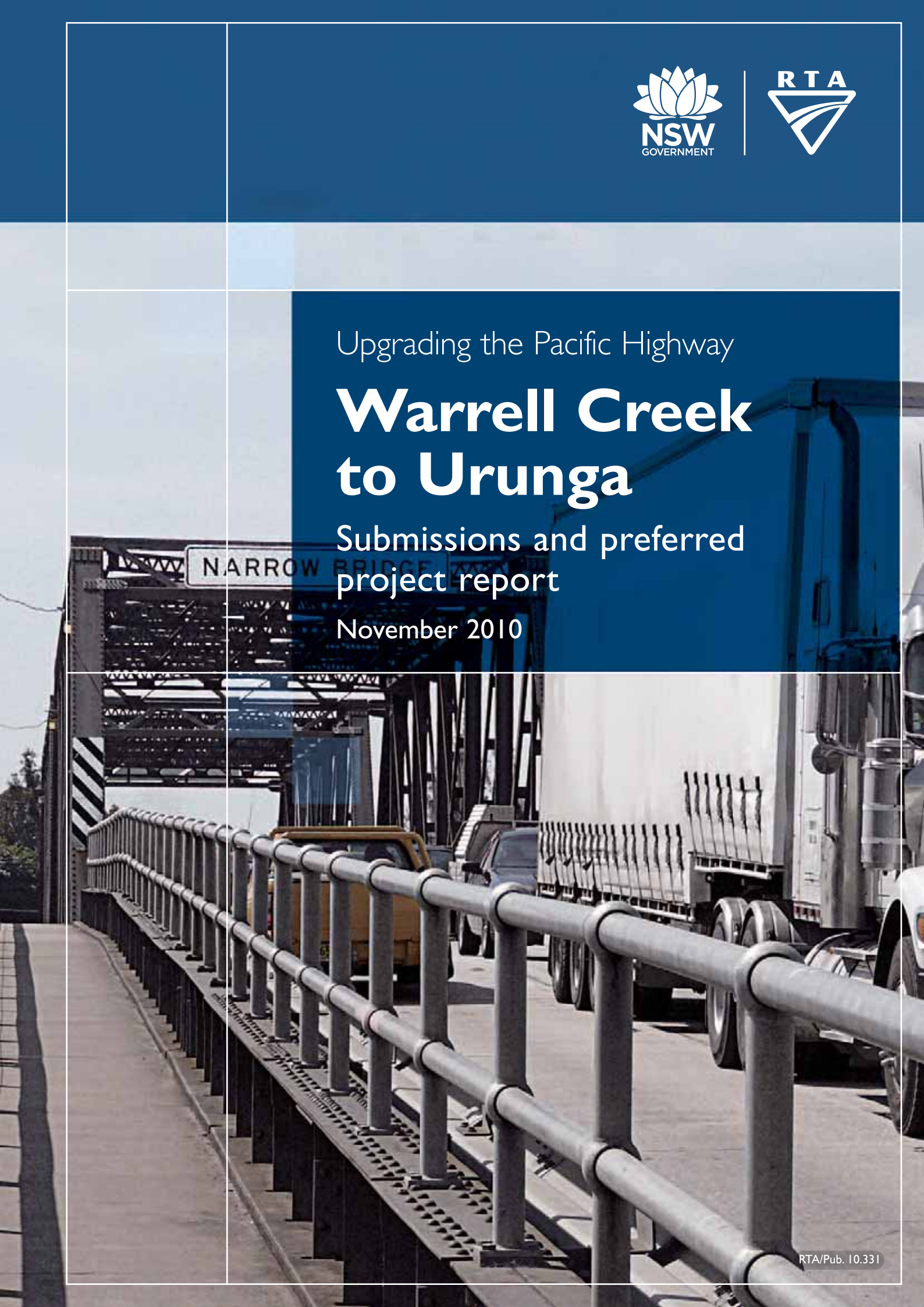
RTA

Upgrading the Pacific Highway

Warrell Creek to Urunga

Submissions and preferred project report

November 2010



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Roads and Traffic Authority

Pacific Highway upgrade – Warrell Creek to Urunga

Part 3A Response to Submissions and Preferred Project Report

November 2010

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1 Introduction and background

1.1 The Proposal

The proposed upgrade of the Pacific Highway between Warrell Creek and Urunga (the Proposal) is part of the Pacific Highway upgrade program being implemented by the NSW Roads and Traffic Authority (RTA). The Proposal is 42 kilometres in length, commencing at the northern end of the existing dual carriageway highway at Allgomera (referred to as the Allgomera deviation), connecting with the existing Waterfall Way interchange, north of Urunga. The Proposal for which approval is being sought involves a full motorway style (class M) upgrade.

A more detailed description of the Proposal is found in Volume 1 of the *Pacific Highway upgrade – Warrell Creek to Urunga Environmental Assessment*, prepared by the RTA in January 2010.

1.2 Statutory context

The Minister for Planning declared by Order published on 5 December 2006 in the NSW Government Gazette number 175 that the Warrell Creek to Urunga upgrade is a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* applies. The Minister also declared that the Warrell Creek to Urunga upgrade is a critical infrastructure project under section 75C of the *Environmental Planning and Assessment Act 1979*.

In accordance with the requirements of the *Environmental Planning and Assessment Act 1979*, an environmental assessment was prepared to assess the potential impacts of the Proposal.

1.3 Environmental assessment exhibition

The environmental assessment was exhibited for 60 days from 28 January to 29 March 2010. The environmental assessment was exhibited at:

- Nambucca Shire Council – Princess Street, Macksville.
- RTA Pacific Highway Office – Prince Street, Grafton.
- Bellingen Shire Council – Hyde Street, Bellingen.
- Urunga Post Office – Bonville Street, Urunga.
- Nambucca Heads RTA Motor Registry – Shops 11 &13 Seascape Shopping Centre, Ridge Street, Nambucca Heads.
- Department of Planning – 23 Bridge Street, Sydney.

Property owners whose properties would be directly affected by the Proposal were sent a letter on 28 January 2010 inviting them to meet with representatives of the project team to discuss the potential impacts of the Proposal on their property. Also included with the letter was a map that showed the nature of the Proposal's impact on their property. The project

team endeavoured to telephone all directly affected landowners during the exhibition period.

During the public exhibition period, the RTA hosted three staffed displays for the general public. The purpose of the sessions was to give local residents the opportunity to ask the project team any questions regarding the Proposal. The details of these displays were as follows:

- Tuesday 2 February 2010, 9am to 4pm, Nambucca Shire Council – Princess Street, Macksville.
- Wednesday 3 February 2010, 10am to 4pm, Urunga Golf and Sports Club – Morgo Street, Urunga.
- Thursday 4 February 2010, 10am to 8pm, Nambucca Plaza – Pacific Highway, Bellwood.

Approximately 570 community members attended the displays over the three days.

Representatives of the project team held individual meetings with any landowner whose properties would be directly affected or close to the Proposal.

Representatives of the project team also met with the noise and ecology focus groups. Community interest groups were convened early on in the environmental assessment process to allow for inputs from community members with a specific interest in these topics. It also allowed the RTA to explain the methodology used in the environmental assessment for noise and ecology, and to discuss the key outcomes of those investigations.

The project team also met with the following organisations during the exhibition period:

- Bellingen Shire Council.
- Nambucca Shire Council.
- Nambucca River Estuary and Coastline Management Committee.
- Department of Environment, Climate Change and Water.
- Nambucca Chamber of Commerce.
- Urunga Mylestom Chamber of Commerce.
- Macksville Chamber of Commerce.

1.4 Purpose of the document

During the exhibition of the environmental assessment, 49 submissions were made within the statutory timeframe. Three submissions were received by the RTA as late submissions to the environmental assessment at a meeting held between the RTA and Nambucca Shire Council on 16 June 2010. The Director-General of the Department of Planning provided copies of the submissions to the RTA.

In accordance with section 75H(6) of the *Environmental Planning and Assessment Act 1979*, the Director-General required the RTA to address the issues raised in the submissions. The Director-General also requested if the

response required changes to the Proposal to minimise its environmental impact, a preferred project report would be required and the statements of commitments should be revised. The Proposal has been changed and accordingly a preferred project report has been prepared.

This report identifies the issues raised during exhibition of the environmental assessment and provides the RTA's responses to those issues (chapter 2). It includes information regarding additional studies carried out since the exhibition of the environmental assessment and includes changes to the Proposal in the form of a preferred project report (chapter 3) and a revised statement of commitments (chapter 4).

2 Response to issues

2.1 Respondents

The Department of Planning received 49 submissions between 28 January and 29 March 2010, in response to the exhibition of the environmental assessment. Three submissions were received by the RTA as late submissions to the environmental assessment at a meeting held between the RTA and Nambucca Shire Council on 16 June 2010. No reference numbers for these three submissions have been provided by the Department of Planning, however, issues raised in these submissions were addressed separately in section 2.15. Of the 49 initial submissions, six were from NSW Government agencies, one from Nambucca Shire Council, three from local businesses or business groups, and 39 from individual community members.

Submission 48, which was made directly to the Department of Planning, is a duplicate of submission 25, which was made to Nambucca Shire Council and later forwarded to the Department of Planning. Submission 39 is a duplicate of submission 38, but was submitted under a different name. Several community members made multiple submissions, which were numbered by the Department of Planning as parts a, b and c of the same submission number.

Each of the submissions was examined by the project team to understand the issues raised. The issues were extracted and collated and corresponding responses to each of the issues provided. One response has been provided where similar issues were raised in different submissions. The issues raised and the RTA's response to these issues forms the basis of this chapter.

Table 2.1 lists each submission by number and indicates which section of the report addresses the issues raised in the submission.

Table 2.1: List of submissions and respondents

Respondent	**Submission no.**	**Report section where issues are addressed**
Individual	1	2.4; 2.7.3; 2.12; 2.13.4; 2.17.2
Individual	2	2.13.4; 2.13.5
Individual	3 (parts a, b and c)	2.7.5; 2.7.6; 2.13.4; 2.19
Individual	4	2.8.1
Individual	5	2.7.4
Bellbird Park Developments	6	2.13.4; 2.21
Individual	7	2.7.4; 2.11.4
Individual	8	2.7.6; 2.8.1; 2.10.2; 2.10.3; 2.11.4; 2.12; 2.13.1; 2.13.4; 2.15.2
Individual	9 (parts a and b)	2.5; 2.6.1; 2.7.4; 2.7.5; 2.9.4; 2.10.1; 2.10.3; 2.11.4; 2.15.2; 2.15.6; 2.17.1
Individual	10	2.15.2; 2.15.3; 2.15.6; 2.17.1; 2.17.2
Saltwater Developments	11	2.4; 2.11.2; 2.19

Individual	12	2.5; 2.6.12.10.1; 2.10.2; 2.10.3; 2.11.4; 2.13.5; 2.15.5; 2.18.2; 2.19
Individual	13	2.13.4; 2.13.5
Individual	14	2.4; 2.7.4; 2.21
Individual	15	2.11.4; 2.12; 2.13.1; 2.13.4; 2.13.5
Individual	16	2.7.6; 2.11.5; 2.15.7
Individual	17	2.6.1; 2.9.4; 2.19
Individual	18	2.6.1; 2.10.1; 2.10.3; 2.12; 2.13.4; 2.13.5; 2.18.2
Individual	19	2.7.3; 2.7.6; 2.10.3; 2.10.3; 2.13.4; 2.18.1; 2.18.2
Individual	20	2.5; 2.6.1; 2.9.3; 2.12; 2.13.4; 2.15.5
Individual	21	2.5; 2.9.4; 2.11.4; 2.13.1; 2.15.3; 2.15.5; 2.18.1
Nambucca Shire Council	22	2.7.2; 2.8.2; 2.9.4; 2.10.3; 2.11.3; 2.13.3; 2.13.4; 2.15.2; 2.15.3; 2.15.5
Individual	23	2.10.3; 2.11.4; 2.11.5; 2.12; 2.13.5; 2.16; 2.18.2
Individual	24	2.7.3; 2.11.4; 2.15.3
Individual	25	2.3.1; 2.6.1; 2.15.2; 2.15.5; 2.19
Individual	26	2.3.1; 2.5; 2.9.4; 2.11.4; 2.13.4; 2.13.5; 2.15.7; 2.19
Individual	27	2.3.1; 2.6.1; 2.8, 2.8.2; 2.11.4; 2.12; 2.13.1; 2.13.2; 2.13.4; 2.15.1; 2.16; 2.18.1; 2.19
Urunga-Mylestom Chamber of Commerce	28	2.6.2; 2.7.1; 2.7.4; 2.11.2; 2.11.4; 2.12; 2.16
Individual	29	2.6.1; 2.13.1; 2.13.2; 2.18.1; 2.21
Land and Property Management Authority	30	2.3.2; 2.6.2; 2.7.6; 2.7.4; 2.10.1; 2.10.3; 2.11.3; 2.14; 2.15.6; 2.19
Individual	31	2.7.5; 2.13.4
Individual	32	2.13.4
Northern Rivers Catchment Management Authority	33	2.9.4; 2.17.2
Individual	34	2.7.6; 2.9.3; 2.12; 2.13.1; 2.13.2; 2.13.4; 2.15.2; 2.18.1; 2.18.2
Industry and Investment NSW	35	2.6.1; 2.6.2; 2.8.2; 2.9.1; 2.9.3; 2.9.4; 2.10.2; 2.11.1; 2.19; 2.20
NSW Department of Environment, Climate Change and Water	36	2.3.1; 2.3.2; 2.4; 2.7.2; 2.7.3; 2.8.1; 2.8.2; 2.9.1; 2.9.2; 2.9.3; 2.9.4; 2.13.3; 2.13.4; 2.13.5; 2.14; 2.15.3; 2.15.4; 2.15.6; 2.17.2; 2.18.1; 2.19; 2.20
Individual	37	2.6.1; 2.10.3; 2.15.3
Individual	38	2.7.4; 2.16
Individual	39	Duplicate of submission 38
NSW Department of Transport and Infrastructure	40	No issues raised
Individual	41	2.3.1; 2.5; 2.6.1; 2.8.1; 2.8.2; 2.9.4; 2.10.1; 2.11.4; 2.11.5; 2.12; 2.13.12.13.2; 2.13.4; 2.13.5; 2.16; 2.18.2
Individual	42	2.7.2; 2.10.3; 2.15.2; 2.17.1
Individual	43 (parts a and b)	2.8.2; 2.10.3; 2.11.4; 2.11.5; 2.12; 2.13.4
Individual	44	2.5; 2.11.4; 2.15.3; 2.15.5
Individual	45	2.6.1; 2.7.6; 2.19
Individual	46	2.15.2; 2.15.6; 2.15.7; 2.17.3

Individual	47	2.13.4
Individual	48	2.5; 2.6.1
NSW Office of Water	49	2.3.2; 2.6.2; 2.15.4; 2.15.6; 2.15.7; 2.20

2.2 Overview of the issues raised

Each submission was examined to understand the issues it raised. The issues raised in each submission were extracted and collated.

Submissions received from the government agencies focussed predominantly on their particular area of statutory or advisory responsibility. The agency submissions also made recommendations for conditions of approval and amendments to the statement of commitments.

2.2.1 Department of Environment, Climate Change and Water

The Department of Environment, Climate Change and Water's submission provided comments on key issues, including water, flora and fauna, noise and vibration, and Aboriginal heritage. An important focus of the submission was the sizing and location of water quality controls, validation of noise modelling and proposed mitigation measures including flora and fauna connectivity.

Table 2.2 provides further details of the categories of issues raised and where they have been responded to within this report. Issues raised by the Department of Environment, Climate Change and Water have been discussed with the department and subjected to further detailed investigations and analysis where necessary. A detailed response to the department's submission on noise is provided in Appendix A of this report. Where necessary any changes have been captured in the revised statement of commitments (section 4).

The Department of the Environment, Climate Change and Water expressed a preference for the majority of the issues raised in its submission to be addressed in a revised environmental assessment or via a revised statement of commitments. This submissions report addresses the issues raised in the DECCW submission and the statement of commitments (section 4) has been revised to include appropriate changes. Consequently, it was not considered necessary or appropriate to prepare a revised environmental assessment for the Proposal.

Table 2.2: Issues raised by the Department of Environment, Climate Change and Water

Issue	**Report section where issues are addressed**
Environmental assessment process and decision making	2.3.1, 2.3.2
Project support	2.4
Design and access	2.7.2; 2.7.3
Construction	2.8.1; 2.8.2
Flora and fauna	2.9.1; 2.9.2; 2.9.3; 2.9.4

Noise and vibration	2.13.1; 2.13.3; 2.13.4; 2.13.5
Aboriginal heritage	2.14
Water quality and hydrology	2.15.1; 2.15.2; 2.15.3; 2.15.4; 2.15.6
Soil and fill	2.17.2
Air quality	2.18.1
Clarifications to the environmental assessment	2.19
Statement of commitments	2.20

2.2.2 Industry and Investment NSW

The submission from Industry and Investment NSW focused on potential flooding issues, impacts on waterways and aquatic habitats, as well as agricultural impacts.

Table 2.3 provides details of the categories of issues raised by Industry and Investment NSW and where these issues have been responded to in this report.

Table 2.3: Issues raised by Industry and Investment NSW

Issue	**Report section where issues are addressed**
Consultation	2.6.1; 2.6.2
Construction	2.8.2
Flora and fauna	2.9.1; 2.9.3; 2.9.4; 2.9.5
Land use and property	2.10.2
Social and economic	2.11.1
Water quality and hydrology	2.15.2
Clarifications to the environmental assessment	2.19
Statement of commitments	2.20

2.2.3 NSW Office of Water

NSW Office of Water's submission focused on the environmental assessment process for licence and approval requirements during construction. Other issues raised include water quality and hydrology in relation to acid sulphate soil disturbance in particular. A number of recommendations were also provided for the statement of commitments, which NSW Office of Water advised should also be incorporated into the conditions of approval.

Table 2.4 provides details of the categories of issues raised by the NSW Office of Water and where these issues have been responded to in this report.

Table 2.4: Issues raised by NSW Office of Water

Issue	Report section where issues are addressed
Environmental assessment process and decision making	2.3.2
Consultation	2.6.2
Water quality and hydrology	2.15.4; 2.15.7
Statement of commitments	2.20

2.2.4 Land and Property Management Authority

The submission from the Land and Property Management Authority focussed on the potential environmental impacts of the Proposal on Crown land and property acquisitions.

Table 2.5 provides details of the categories of issues raised by the Land and Property Management Authority and where these issues have been responded to in this report.

Table 2.5: Issues raised by the Land and Property Management Authority

Issue	Report section where issues are addressed
Environmental assessment process and decision making	2.3.2
Consultation	2.6.2
Design and access	2.7.6
Flora and fauna	2.9.4
Land use and property	2.10.1; 2.10.3
Social and economic	2.11.3
Aboriginal heritage	2.14
Water quality and hydrology	2.15.6
Clarifications to the environmental assessment	2.19

2.2.5 NSW Department of Transport and Infrastructure

The NSW Department of Transport and Infrastructure noted in its submission that concerns previously raised in consultation had been addressed. No further issues were raised during exhibition of the environmental assessment.

2.2.6 Nambucca Shire Council

Nambucca Shire Council raised a number of issues, regarding flooding, noise and community impacts of the Proposal. It also raised concerns about the Proposal's impacts on its assets and facilities.

Bellingen Shire Council did not provide a submission on the environmental assessment.

Table 2.6 provides details of the categories of issues raised by Nambucca Shire Council and where these issues have been responded to in this report.

Table 2.6: Issues raised by Nambucca Shire Council

Issue	**Report section where issues are addressed**
Design and access	2.7.2
Construction	2.8.2
Flora and fauna	2.9.4
Land use and property	2.10.1; 2.13.4
Social and economic	2.11.3
Water quality and hydrology	2.15.2; 2.15.3; 2.15.5
Statement of commitments	2.20

2.2.7 Northern Rivers Catchment Management Authority

The issues raised by the Rivers Catchment Management Authority relate to flora and fauna. A response to these issues is provided in section 2.9 of the Submissions Report.

2.2.8 Businesses and individual submissions

Submissions from businesses and individual community members were predominantly concerned with property impacts: including acquisition, noise, land use, and access arrangements. Several individuals also questioned the validity of the route selection process and flood impact assessment.

There were 17 broad issues raised in business and community submissions. These were:

- Environmental assessment process and decision making.
- Project support.
- Alternatives considered and route development.
- Consultation.
- Design and access.
- Construction.
- Flora and fauna.
- Land use and property.
- Social and economic.
- Visual amenity and design.
- Noise and vibration.
- Aboriginal heritage.
- Water quality and hydrology.
- Traffic and transport.
- Soil and fill.
- Air quality.

- Clarifications to the environmental assessment.
- Statement of commitments.

2.3 Environmental assessment process and decision making

2.3.1 General

Submission numbers

25 – Individual
26 – Individual
27 – Individual
36 – Department of Environment, Climate Change and Water
41 – Individual
49 – Individual

Issue description

Four community submissions and the Department of Environment, Climate Change and Water submission included general issues regarding the environmental assessment and project approvals process. The issues raised in the submissions are numbered below.

1) The community submissions expressed concern that the outcome of the project approvals process had been predetermined.

2) One submission queried the legislative process. This submission raised the concern that if Nambucca Shire Council is responsible for planning and land management in flood prone land, then how can the RTA Proposal which will pass through areas of flood prone land, be permitted to go ahead.

3) The Department of Environment, Climate Change and Water stated that the environmental assessment's deferral of the process for offsetting environmental impacts to a later date did not allow for adequate assessment of the impacts against all proposed management measures for the Proposal.

Response

1) The Minister has not predetermined or approved the Proposal.

   On 5 December 2006, the Minister for Planning under 75B(1) of the *Environmental Planning and Assessment Act 1979* ordered that 13 projects on the Pacific Highway, including the Warrell Creek and Macksville to Urunga upgrades, be projects to which Part 3A of the *Environmental Planning and Assessment Act 1979* applies. Having formed the opinion that the 13 projects, including the Warrell Creek and Macksville to Urunga upgrades, were essential to the State for economic and social reasons, the Minister for Planning also declared on 5 December 2006, the projects to be Critical Infrastructure under Section 75C of the *Environmental Planning and Assessment Act 1979*. The order

and declaration were gazetted in the NSW Government Gazette No.175 on 8 December 2006.

The assessment and approvals process for Part 3A projects is described in sections 75A – 75ZA of the *Environmental Planning and Assessment Act 1979*, and summarised in section 2.3.1 of the environmental assessment. Part 3A of the *Environmental Planning and Assessment Act 1979* establishes the statutory approval process for the Proposal.

The RTA applied to the Minister for Planning for project approval under Part 3A of the *Environmental Planning and Assessment Act 1979*. The Director-General of the Department of Planning subsequently issued environmental assessment requirements for the Part 3A environmental assessment on 23 September 2007. These requirements were subsequently reissued on 13 October 2009, following which RTA prepared an environmental assessment. Section 75H of the *Environmental Planning and Assessment Act 1979*, requires a public exhibition period for environmental assessments of not less than 30 days. The Pacific Highway upgrade – Warrell Creek to Urunga environmental assessment was on public exhibition between 28 January and 29 March 2010 (inclusive) – 60 days, in total – thus exceeding the requirements of the Act.

The Director-General has provided RTA with copies of the submissions received during the exhibition period, and has asked RTA to respond to issues raised in those submissions. The RTA's response to the issues raised in those submissions is contained in this response to submissions and preferred project report.

The Director-General will now prepare a report on the Proposal for the Minister's consideration in determining the project application (section 75I). Following consideration of the Director-General of Planning's report on the Proposal, and other relevant materials, the Minister may approve or disapprove the carrying out of the Proposal.

2) Nambucca Shire Council does not have a statutory approval role on this project, which will be assessed and approved with conditions, or not approved, as determined by the Minister for Planning as described above.

3) The RTA is committed to the development of a biodiversity offset strategy in consultation with the Department of Planning and the Department of Environment, Climate Change and Water. The agreement will be implemented during either the pre-construction and/or construction phases of the Proposal. The offset strategy would be applied for only in respect of those impacts after all attempts have been made to avoid, minimise or manage the impacts.

2.3.2 Licensing

Submission numbers

30 – Land and Property Management Authority
36 – Department of Environment, Climate Change and Water
49 – NSW Office of Water

Issue description

The Department of Environment, Climate Change and Water, NSW Office of Water and Land and Property Management Authority made a number of comments regarding the environmental licences required for construction and operation of the Proposal.

1) The Department of the Environment, Climate Change and Water stated that an environment protection licence would be required.

2) Licences would be required from NSW Office of Water for the following activities:
   - Dewatering activities (under the *Water Act 1912* and the *Water Management Act 2000*).
   - Extraction of surface or groundwater for construction purposes.
   - Installation of groundwater monitoring bores.
   - Any works that intersect the water table.
   - Permanently changing the course of a stream or river.

3) For works on Crown land a lease would need to be obtained from the Minister under section 34A of the *Crown Lands Act 1989*. This would provide the RTA with exclusive possession of the subject lands until such time as the land has been acquired.

4) The Land and Property Management Authority identified two parcels of Crown land subject to Aboriginal land claims.

Response

1 to 3) The RTA would obtain any necessary approvals under the *Water Act 1912* prior to the start of construction. The RTA does not require approvals under the *Water Management Act 2000*. The licences and approvals required for construction would be identified through the construction environmental management plan. All necessary licences and approvals would be obtained prior to construction commencing.

4) The RTA would consult with the relevant local Aboriginal land council and the NSW Aboriginal Land Council in relation to the Aboriginal land claims. The necessary statutory regime for addressing the land which is subject to these claims, will be adhered to.

2.4 Project support

Submission numbers

1 – Individual
11 – Saltwater Developments
14 – Individual
36 – Department of Environment, Climate Change and Water

Issue description

Three community submissions expressed support for the Proposal. The Department of Environment, Climate Change and Water also stated its support for the Proposal, subject to its recommendations being incorporated.

Response

The support for the Proposal is acknowledged and appreciated. The Department of Environment, Climate Change and Water's recommendations have been considered and (where appropriate) incorporated in the revised statement of commitments.

2.5 Alternatives considered and route development

Submission numbers

9 – Individual
12 – Individual
20 – Individual
21 – Individual
26 – Individual
41 – Individual
44 – Individual
48 – Individual

Issue description

Eight community submissions questioned the authenticity of the route selection process, particularly in relation to community consultation, and the justification for the preferred route.

Response

The RTA implemented an extensive and comprehensive route selection process, which commenced in 2002 and concluded in 2008. The RTA has sought community input at the following key Proposal milestones:

- Development of route options.
- Selection of the preferred route.
- Preparation of the environmental assessment.

Coinciding with the three key milestones outlined above are three reports that identify the issues raised, and how the RTA has responded to those issues. The Macksville to Urunga route options submissions report (RTA 2004) and preferred route submissions report (RTA 2007), and this response to submissions

and preferred project report provide responses to issues raised by the community throughout the development of the Proposal. The Warrell Creek review report (RTA 2008) also provided a response to issues raised during the display of the Warrell Creek options in 2008. The RTA has considered all issues raised by the community prior to progressing to the next phase of the Proposal's development.

Community members also attended a value management workshop. The outcomes of the value management workshop were used as an input into determining the preferred route for the Macksville to Urunga section of the Proposal.

An initial investigation area was identified from Macksville to Urunga. The southern end of the Macksville to Urunga route options linked to the previously approved preferred route for the Warrell Creek upgrade. Approval for this section was granted in the 1990s to an earlier standard than that proposed for current upgrades of the Pacific Highway. A review of the route approved in the 1990s identified that the design would need to be modified to meet current design standards for the Pacific Highway and provide an appropriate connection between the existing Allgomera deviation and the Macksville to Urunga upgrade.

The route development process evolved over time and in response to suggestions from the community. The Proposal was initially divided into four sections, and when the Warrell Creek section was included, this became part of section one. The route options developed as follows:

- Five options that traversed east of the existing highway between Albert Drive, Donnellyville and the Nambucca River at Macksville (section 1).
- Three options that traversed west of the existing highway were considered between the northern bank of the Nambucca River at Macksville to where the existing Pacific Highway crosses the main north coast railway line, west of Nambucca Heads (section 2).
- One route option was considered adjacent to the western side of the existing highway due to topographical constraints between the southern end of Section 2, and Ballards Road at south Urunga (section 3).
- Three options that traversed west of the existing highway were considered between Ballards Road and the existing Waterfall Way interchange at Raleigh (section 4).
- Four route options were developed for the Warrell Creek section between the existing dual carriageway highway south of Warrell Creek (the Allgomera Deviation) and Albert Drive, Donnellyville.

In response to a request from some sections of the Macksville community, two options were developed that traversed west of the existing highway between Warrell Creek and Nambucca Heads. The RTA also investigated options north of the Nambucca River in the vicinity of Old Coast Road that were suggested by the community. A detailed assessment of the options to the west of Macksville was provided in the Macksville to Urunga draft assessment of west of Macksville options (RTA 2004) and the Macksville to Urunga preferred route submissions report (RTA 2007). Following detailed assessment and comparison of options it was concluded that the preferred route announced in

November 2005 for the Macksville to Urunga section, provided the best overall balance between functional, economical, ecological and social considerations.

The route options were created to address the key Proposal objectives as detailed in section 3.4 of the Warrell Creek to Urunga Pacific Highway Upgrade Environmental Assessment Report (RTA 2010). All route options were developed through an iterative process involving a range of environmental, community, engineering, urban design, safety and cost considerations. The preferred route was a combination of the options that on balance, best met these considerations.

Extensive community consultation has been undertaken for this Proposal. For details of the community consultation activities refer to section 2.6.1.

2.6 Consultation

2.6.1 Community consultation

Submission numbers

9 – Individual
12 – Individual
17 – Individual
18 – Individual
20 – Individual
25 – Individual
27 – Individual
29 – Individual
35 – Industry and Investment NSW
37 – Individual
41 – Individual
45 – Individual
48 – Individual

Issue description

Industry and Investment NSW and 13 community members made submissions regarding community consultation. Some submissions were concerned with the general consultation process, while others related specifically to consultation during the route selection, environmental assessment exhibition, and construction phases.

1) A number of community submissions expressed dissatisfaction with the general consultation process. It was suggested that the RTA provided inaccurate or inconsistent information and that the RTA only provided information to property owners whose properties would be directly impacted by the Proposal. One submission stated that the process did not satisfy the definition of "consultation".

2) Several community submissions suggested that issues raised during the route selection process were not addressed or taken into consideration.

Three submissions suggested that a decision on the preferred route had been made prior to consultation.

3) A number of community submissions were made regarding the quality of consultation conducted for the environmental assessment exhibition. Concerns included the quality of information available online, the Proposal knowledge of staff at the staffed displays, and the legitimacy of the submission process.

4) One community submission requested that local residents be consulted prior to construction so that impacts could be addressed and management measures implemented before work commences.

5) Industry and Investment NSW stated that it would support further consultation with affected property owners noting that this should include a property level assessment of the impacts and negotiation about offsets and mitigation measures. It also suggested that the flooding assessment and proposed impact mitigation measures be presented to the floodplain community and possibly the local emergency management committees in Bellingen and Nambucca to obtain comment and feedback.

Response

1) Consultation undertaken during the display of the environmental assessment is described in section 1.3 of this report. Members of the project team also met with directly affected landowners, landowners who lived near the Proposal, and interested community members during the route selection and preferred route phases of the Proposal. The information provided to community members was accurate at the respective phase of the Proposal's development. Consultation with the community has been undertaken throughout development of the Proposal, commencing in the route selection phase. Further details of the nature and extent of consultation with the community was provided in chapter 5 of the environmental assessment (RTA 2010).

2) The project team considered issues and suggestions made by the community and, where appropriate, undertook additional investigations such as those conducted for the west of Macksville route options. Input from the community was considered with resulting enhancements to the Proposal. This report, the Macksville to Urunga preferred route submissions report (RTA 2007), and the Warrell Creek review report (RTA 2008) contain details of the submissions received and the RTA's responses to these submissions.

3) Information presented by the RTA or its representatives during the display of the environmental assessment included high quality maps, detailed Proposal reports, aerial photography, presentations, a three-dimensional animation and engineering plans. The information was subject to reviews in relation to technical content and quality control prior to release.

Some Proposal documents, and the three-dimensional animation provided on the RTA website, were sized at a resolution to cater for people with a general interest in the Proposal and those with slow internet download speed. The RTA offered to meet with affected property owners to provide more detailed information, including more detailed and higher resolution maps.

All Proposal staff attending the staffed displays had a good working knowledge of the Proposal. When a member of the project team was unable to answer a question of a specific technical nature at a staffed display, the community member's details were recorded and an offer was made to follow up the request with a Proposal specialist. The information was then provided to the community member by email, telephone or an on-site meeting.

The level of information available since the commencement of the Proposal's development through to the display of the environmental assessment has been updated coinciding with more detailed investigations. For example, the environmental assessment contained a higher level of detail than the preferred route report. It is acknowledged that the receipt of detailed information has led in some cases to an update and refinement of the predicted Proposal impacts.

4) Residents would be consulted prior to, and during the construction of the Proposal.

5) The RTA has consulted extensively with Nambucca and Bellingen shire councils, agencies, community organisations, property owners and the community during and subsequent to the public exhibition of the environmental assessment. A summary of the community consultation undertaken during the public exhibition period is provided in Section 1.3 of this report.

   There will be ongoing consultation with Nambucca and Bellingen shire councils prior to and during construction. Consultation with councils would include discussions with the local floodplain, and emergency management committees when required.

   There will be ongoing consultation with the community, including directly affected and adjacent property owners, in regard to the likely impacts of the Proposal and possible mitigation measures.

2.6.2 Government stakeholder consultation

Submission numbers

30 – Land and Property Management Authority
35 – Industry and Investment NSW
49 – NSW Office of Water

Issue description

Land and Property Management Authority, Industry and Investment NSW and the NSW Office of Water made submissions regarding consultation with government stakeholders.

Land and Property Management Authority noted that the RTA did not consult with it during preparation of the environmental assessment, and requested that it be included in future consultation regarding the construction environmental management plan and operational environmental management plan.

NSW Office of Water requested that it be included in future consultation regarding the deferral of the water impact assessment.

The Industry and Investment NSW requested consultation be undertaken with them in relation to the destruction or compensation of mangroves.

Response

The RTA consulted all government agencies identified in the Director-General's Requirements for the Proposal, dated 13 October 2009. The RTA has also considered submissions received on the development of the Proposal from the Department of Lands dated February 2006. The development of the Proposal commenced in 2002 as identified in the response to 2.5 of this report. It is noted that the Land and Property Management Authority was formed on 1 July 2009.

Consultation was undertaken with the NSW Department of Lands (which includes the Land and Property Management Authority), the NSW Office of Water and Industry and Investment NSW, (previously the Department of Primary Industries) during development of the route options and as part of the environmental assessment. Further consultation would occur with relevant government agencies during preparation of the detailed design and during preparation of environmental management documentation to identify any specific requirements from these agencies in terms of Proposal development, construction or operation.

An assessment of the Proposal's impact on water has been undertaken in accordance with the Director-General's Requirements dated 13 October 2009. The outcome of this assessment is documented in Chapter 16 and working paper 5 of the Warrell Creek to Urunga Environmental Assessment (RTA 2010).

The request from Industry and Investment NSW to discuss mangrove issues has been noted and would be undertaken during the detailed design phase.

2.7 Design and access

2.7.1 Ballards Road interchange

Submission numbers

28 – Urunga-Mylestom Chamber of Commerce

Issue description

The Urunga-Mylestom Chamber of Commerce considers that the Ballards Road interchange should be redesigned.

Response

The Chamber's suggestion is noted; however, based on currently predicted traffic volumes and road safety requirements, roundabouts are not considered warranted at the proposed Ballards Road interchange.

The design of the interchange will be further refined during the detailed design phase of the Proposal.

2.7.2 Nambucca River crossing

Submission numbers

22 – Nambucca Shire Council
36 – Department of Environment, Climate Change and Water
42 – Individual

Issue description

The three submissions stated that the bridge option for traversing the floodplain north of the proposed bridge crossing of the Nambucca River and over the existing Pacific Highway (option 2) was preferable for the Nambucca River crossing, as it would have a lesser flood impact than the earth embankment (option 1). Department of Environment, Climate Change and Water suggested that confirmation of the preferred option should be provided.

Response

In response to submissions received, the RTA has selected the bridge option (identified as option two in the environmental assessment) as the preferred option for traversing the floodplain north of proposed bridge crossing of the Nambucca River to the existing Pacific Highway.

For an expected marginal increase in cost, the bridge option would provide:

- Reduced potential flooding impacts with and without climate change consideration.
- Further contingency for climate change effects.

The bridge option would be further refined as part of the detailed design in accordance with the performance criteria identified in the environmental assessment.

2.7.3 Drainage system

Submission numbers

1 – Individual
19 – Individual
24 – Individual
36 – Department of Environment, Climate Change and Water

Issue description

These four submissions raised concerns about the design of the road drainage system.

1) One community submission expressed concerns about the capability of the stormwater drainage system in Macksville to handle the additional water runoff from the Proposal and other new developments in the area. Two other submissions highlighted the need for the design to be able to cope with water runoff from extreme rainfall events.

2) Department of Environment, Climate Change and Water stated that the criteria for sediment basin sizing for all basins in the environmental assessment is the 80th percentile, but that many of the sediment basins on the Proposal would need to be sized at the 85th percentile. It recommended that table 7-2 documenting basin dimensions be updated to accommodate 85th five-day rainfall events, with the commensurate areas required for sediment basins reflected in the environmental assessment.

3) Department of Environment, Climate Change and Water also requested clarification regarding the design parameters, capacities, performance and maintenance of longitudinal drains as proposed in section 18.3.6. It recommended that the revised environmental assessment make reference to standard design and operation of these controls.

Response

1) Modelling indicated that the Macksville central business district would be unaffected by the Proposal. The cross drainage system design for the Proposal was designed to allow the passage of a 1 in 100 year flood event.

2) Sizing of construction sediment basins would be undertaken during detailed design in accordance with criteria laid down in the *Blue Books – Managing Urban Stormwater: Soils and Construction* (Landcom 2004) and *Managing Urban Stormwater: Soils and Construction* the updated criteria outlined in *Volume 2D – Main road construction Road Construction* (DECC 2008). Where there are sensitive locations, the 85th percentile design criteria would be adopted. Sizing of the basins would

be undertaken using the Coffs Harbour 85th percentile five-day rainfall depth of 55.8 millimetres and a volumetric runoff coefficient (Cv) of 0.74.

The RTA confirms that there is sufficient area within the Proposal corridor to accommodate the 85th percentile sized basins in sensitive areas. Further refinement of the construction basin sizing would occur at the detailed design phase.

3) Parameters for road drainage are identified in the Pacific Highway design guidelines (RTA 2006) and are as follows:
   - Cross drainage is designed for a 1 in 100 ARI storm event. The road drainage is designed for a 1 in 10 year ARI event, with no flooding into traffic lanes.
   - All drainage is maintained as part of standard road maintenance practice with regular inspection of assets and intervention as required. Standard maintenance practices for drainage include:
     - Regular inspection of drainage assets.
     - Cleaning open drains, table drains, pipe culvert inlets and drainage structures from debris and vegetation.
     - Mowing grass in median.
     - Effecting repairs to any damage to drainage features (eg repair lining of drains, replace damaged covers or gratings).

2.7.4 General

Submission numbers

5 – Individual
7 – Individual
9 – Individual
14 – Individual
28 – Urunga Mylestom Chamber of Commerce
38 – Individual

Issue description

Six community submissions made comments about the general Proposal design.

One submission noted that the existing highway has no provision for pedestrians or cyclists, while another stated that it is too dangerous for cars to do a U-turn at Upper Warrell Creek Road to travel north along the upgrade.

Several submissions made design suggestions. These included:

1) Provide access to the new highway from East West Road.

2) Provide an exit ramp at Browns Crossing Road with a roadside stop off for south-bound traffic and a connection to the old Pacific Highway.

3) Amend the design of the new highway around Valla Beach so it uses land that is already owned by the RTA.

4) Close off the old Pacific Highway, south of the Waterfall Way intersection to prevent the potential rat run along the old Pacific Highway at Raleigh. A turning circle could also be included to allow buses to turn around.

5) Reinstate access from the old Pacific Highway to the Pacific Highway to permit northbound vehicles from Urunga to turn right onto the old Pacific Highway.

6) Replace the Driver Reviver stop as the existing Driver Reviver would need to be demolished to construct the Proposal.

7) Convert a directly affected property to a tourist information centre and to save trees and vegetation on the property including a jacaranda tree.

Response

The existing highway has no specific provision for pedestrians and cyclists, however, it can be used by cyclists. Current pedestrian use of local roads is low, but in incidences where there would be pedestrian usage, such as access to school buses or recreational areas, access would be provided for pedestrians on local road bridges, for example, where school children require access to existing bus routes. Such areas include Mattick Road, East West Road and Nambucca interchange. Further bridge design refinements would occur at the detailed design phase and would include consideration of pedestrian footpaths.

On the new highway, cyclists would be provided for on the 2.5 metre shoulder and footpaths on overbridges. Cycle access would be available on the existing highway which is presently used by cyclists, as this would be retained as a local access road.

For vehicles accessing the upgrade from the Warrell Creek area to travel north, it would be quicker and more direct to travel north along the existing highway to the Bald Hill Road interchange than to travel south to Upper Warrell Creek Road to do a U-turn. Consequently, very few, if any, vehicles from the Warrell Creek area would do U-turns at Upper Warrell Creek Road.

Regarding the specific design requests:

1) The Proposal was designed to meet the specifications of a motorway style (class M) upgrade and, as such, access to the new highway would only be provided at grade separated interchanges. East West Road would pass over the new highway to provide access to the existing Pacific Highway, which would become a local access road. Road users would then access the new highway at the Nambucca or Ballards Road interchange. Current and predicted traffic volumes on East West Road are not sufficient enough to warrant a grade separated interchange.

2) There is no exit ramp proposed at Browns Crossing Road as an exit ramp to Warrell Creek has been provided for at the proposed Bald Hill

interchange which would provide access to the old Pacific Highway. A roadside stop off would not be necessary at the Warrell Creek interchange.

3) One of the key reasons for not relocating the new highway on the eastern side of the existing highway to RTA land in the Valla Beach area is to enable the existing highway to serve as a local access road. This also allows the RTA to build the new highway without interrupting the flow of the existing traffic.

4) No enhancements to the old Pacific Highway are proposed as part of the Proposal. The proposed refinements to the existing Waterfall Way interchange at Raleigh would divert traffic back into Urunga along the bypassed section of the existing Pacific Highway, not the old Pacific Highway through Raleigh. The proposed modifications to the Waterfall Way interchange would not result in additional traffic volumes on the old Pacific Highway and this road would not become a rat run as a result of the Proposal.

5) Northbound vehicles travelling from Urunga would be able to access the old Pacific Highway through Raleigh the same way as the existing arrangements at the Waterfall Way interchange at Raleigh.

6) Land would be available at the Waterfall Way interchange that could be used for a tourist information centre and Driver Reviver. The RTA would hold further discussions regarding this issue with Bellingen Shire Council and the Urunga Mylestom Chamber of Commerce.

7) As the property suggested as a Driver Reviver stopping point is not located near any proposed highway interchange, it would not be a desirable site. In addition consideration needs to be given to providing Macksville every opportunity to act as a service town for passing highway traffic. Opportunities for retention of the Jacaranda tree within the future road reserve are being investigated.

2.7.5 Maintenance

Submission numbers

3 – Individual
9 – Individual
31 – Individual

Issue description

Three community submissions raised concerns regarding the ongoing maintenance of the new highway and associated infrastructure. The issues raised included:

1) Culverts, which could become blocked by fallen trees and vegetation.

2) School Hill Road, which is currently maintained by Forests NSW, but would be cut off from the highway.

3) Roadside vegetation along the Pacific Highway service road, near Valla.

Response

1) The Proposal (including pavement, culverts and drains etc) would be subject to regular maintenance by the RTA.
2) School Hill Road is located on Crown land and a right of carriageway exists across it. The road is periodically maintained by Forests NSW. Current ownership and existing maintenance responsibilities would be retained.
3) Maintenance responsibility of bypassed sections of the existing highway would be subject to further discussions with Nambucca or Bellingen shire council at the construction stage of the Proposal.

2.7.6 Property access

Submission numbers

3 – Individual
8 – Individual
16 – Individual
19 – Individual
30 –Land and Property Management Authority
34 – Individual
45 – Individual

Issue description

Several submissions included issues regarding the impact of the Proposal on property access, including heavy vehicle access, during construction and operation.

Several submissions made direct reference to access arrangements at particular properties, both from the highway and between severed portions of land.

1) One submission noted that the Proposal would cut off Ainsworth Road and Moyles Road, which provide emergency access during times of flood, and enquired as to what alternative access would be provided.

2) Another submission enquired as to access for properties on Martells Road, as the Proposal would change the existing access arrangements through School Hill Road.

Response

The existing level of access to all privately owned properties would be maintained throughout construction and operation of the Proposal. There may however, be some refinements to existing access arrangements, which would be decided in consultation with property owners in the detailed design

phase. Where there is severance of a property, the existing stock underpasses would be extended under the new highway.

1) To gain access, including emergency access, vehicles heading south would have two options to gain access to the Ainsworth Road and Moyles Road. The first option is that they would be able to enter the existing highway at the Raleigh interchange and travel south along the existing Pacific Highway. An overbridge would be provided at the intersection of Martells Road and the proposed highway upgrade, which would give access to Ainsworth Road and Moyles Road. Alternatively, access would be provided at the proposed grade-separated interchange at Ballards Road.

2) From the highway, local residents accessing Ainsworth Road, Moyles Road, and Martells Road would be able to head west along Ballards Road and continue to Ainsworth Road via Range Road, or travel east along Ballards Road, left onto the existing highway, and then left into Martells Road. Two properties along Martells Road are accessed from School Hill Road. The ownership of the altered section of School Hill Road would be unchanged.

2.8 Construction

2.8.1 Construction compounds

Submission numbers

4 – Individual
8 – Individual
36 – Department of Environment, Climate Change and Water
41 – Individual

Issue description

A number of submissions queried the location of construction compounds.

1) Department of Environment, Climate Change and Water noted that the location of construction compounds, concrete batch facilities, pre-cast yards, bitumen facilities or work methods were not identified in the environmental assessment.

2) The community submissions raised concerns regarding the proposed locations of construction compounds in Donnellyville, Urunga and Macksville as they would impact on the land use and amenity of nearby residences.

Response

1) Section 7.3.7 and figure 1-1 in the environmental assessment identified a number of possible locations for ancillary facilities including construction compounds. The location of ancillary facilities must allow for efficient and cost effective construction of the Proposal. Potential options for ancillary facilities were identified in the environmental assessment. The

location of the ancillary facilities would be finalised during the detailed design phase, and would be sited to minimise biophysical and social impacts. These sites (including the proposed work methods) would need to conform to criteria identified in section 7.3.7 of the environmental assessment.

2) The final decision on the location and design of compounds would not be finalised until the detailed design phase. Selection of construction compounds locations would be undertaken in accordance with the criteria shown in section 7.3.7 of the environmental assessment. This states that construction, batching plant and stockpile sites are not to be located within 200 metres of a dwelling.

   The construction contractor would be required to specify management measures for ancillary sites within the construction environmental management plan and sub-plans to be consistent with the conditions of approval.

2.8.2 Construction management

Submission numbers
22 – Nambucca Shire Council
27 – Individual
35 – Industry and Investment NSW
36 - Department of Environment, Climate Change and Water
41 – Individual
43 – Individual

Issue description
These five submissions raised issues regarding construction management.

1) Industry and Investment NSW noted the substantial quantity of materials required for highway construction, particularly sand. It stated that there may be increased difficulty in obtaining construction materials to meet the quantity, quality and timeframe requirements of the Proposal and suggested that regional supplies may need to be augmented by more distant sources.

2) The community submissions raised concerns that Proposal construction would impact on power supply to nearby residences and requested information on the construction timeframe and the health and safety provisions for nearby residents.

3) The potential for construction impacts in the future from expansion of the highway to six lanes was also raised.

Response

1) The requirement for construction materials for the highway upgrade and possible material shortfalls has been recognised. The objective of the environmental assessment concept design was to provide a cut to fill

balance to minimise the requirement for importation of raw materials. The exact quantities and source of raw materials would be determined by the construction contractor at the detailed design stage of the Proposal. It is acknowledged that where local supplies cannot be obtained (e.g. sand) they would be sourced from more distant locations.

2) During utilities adjustments there may be some interruption to services. Adequate notice would be provided and specific requirements would be discussed with individual property owners. Residents would be consulted before construction commences. The Proposal would be constructed to minimise health and safety impacts on residents. A 24 hour complaints line would be advertised before the start of construction, so that any issues that arise can be quickly addressed.

3) Possible expansion of the highway in the future to six lanes is not part of this current project application and would require a separate environmental assessment process. Construction environmental management measures would be developed and implemented to address identified impacts.

2.9 Flora and fauna

2.9.1 Aquatic habitats

Submission numbers

35 – Industry and Investment NSW
36 – Department of Environment, Climate Change and Water

Issue description

The submissions from Industry and Investment NSW and the Department of Environment, Climate Change and Water included comments relating to the impact of the Proposal on aquatic habitats.

The Department of Environment, Climate Change and Water raised concerns regarding the lack of certainty in predicted impacts to freshwater wetland EECs both upstream and downstream of the new highway and the lack of proposed mitigation measures. It stated that it was critical that the road design maintain natural drainage conditions and therefore soil moisture regimes in these sensitive areas.

Industry and Investment NSW's key concerns with the environmental assessment include:

1) Section 10.4.3.6 of the environmental assessment and section 5.2.9 of Working Paper 1, Riparian habitats, stated that "mangroves and swamp oaks are difficult to quantify". Industry and Investment NSW suggested a site inspection and photographs of the impact areas would address the issue of quantification and recommended that these should be conducted.

2) Table 10-13, Indicative fauna crossings, should also specify fish passage requirements. Some of the proposed culvert configurations may have some difficulty in accommodating both fish passage and fauna movements. The culvert structures should be identified as a preliminary subject of negotiation with Industry and Investment NSW Fisheries Ecosystems Unit.

3) Section 10.4.4, Potential impacts to aquatic habitats and biodiversity, fails to identify which structures on waterways would require fish friendly crossings. This should have been addressed in the environmental assessment as specified in section 3 of the Director-General's Requirements (dot point 4).

4) Section 10.5.8, Aquatic disturbance, should include relocation of large woody debris within the waterway if lopping or retention on site is not possible as a measure to manage impacts on aquatic habitats.

5) Section 5.2.9 of Working Paper 1, Riparian habitats, asserted that mangroves are difficult to quantify. Suggested that a site inspection, photographs of the impacted areas and counts of mangrove trees should be conducted at each location where bridge or other works would involve the clearing of mangroves. This should be included and discussed in section 6.2.10.

6) Table 5-7 of Working Paper 1, Aquatic ecology site specific risk assessment and mitigation, should detail the mitigation measures proposed to facilitate fish passage in Cow Creek and Oyster Creek.

7) Table 6-2 in Working Paper 1, which details types of fishways available for use in NSW, should also include the vertical slot fishway.

Response

The Proposal was designed to maintain existing surface and groundwater flow and hydrological regimes. To maintain surface flows, cross drainage structures were co-located with existing structures where the new highway would be located adjacent to the existing highway.

There are several areas in which cutting in gully areas would be required. This has the potential to result in impacts to the ecology of several drainage lines as a result of changes to groundwater flows. Section 16.4.1.3 of the environmental assessment recommended baseline monitoring of groundwater levels and chemical levels at cutting sites near springs, creeks or endangered ecological communities. This requirement has been included in the revised statement of commitments (section 4).

Groundwater monitoring would be undertaken during the detailed geotechnical investigations. Information and baseline data from these investigations would be used to develop mitigation measures in the construction environmental management plan.

In addition, the RTA will submit a precautionary referral to the Commonwealth Department of Environment, Water and Heritage and the Arts as a result of the potential impact of the Proposal on threatened species listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.

In response to Industry and Investment NSW's comments:

1) The approach for quantifying mangroves taken in the environmental assessment involved taking the vegetation mapping layer and then overlaying the design footprint. The result was the area in hectares that would be impacted by the Proposal. The task of quantifying the exact number of mangroves would occur following the physical survey and marking of the road footprint on the ground at the detailed design stage.

2) The recommendation to provide further details on fish passage requirements as they relate to the proposed culverts and crossing structures has been noted. Table 10-13 from the environmental assessment has been updated to identify fauna passage requirements and is included in section 3.1 of this report. Culvert structures would be developed in consultation with Industry and Investment NSW.

3) Refer to the response provided in section 2.9.1 of this report (item 2).

4) Section 6.2.12 of the Flora and Fauna Working Paper included details of how large woody debris within the waterway would be retained. It should be noted, however, the relocation of debris that cannot be retained will be relocated to provide aquatic habitat. The task of quantifying the exact number of large woody debris that would be impacted would occur following the physical survey, at the detailed design phase.

5) Refer to the response provided in section 2.9.1 of this report (item 1).

6) This recommendation has been noted. An amended table that includes the proposed fauna crossings at Cow Creek has been provided in **Table 3-1** of this report. Details of the proposed Oyster Creek culvert are provided in section 3.6.1 and would be designed in accordance with Fairfull and Witheridge (2003).

7) This recommendation has been noted. An amended table which now includes vertical slot fishways has been provided in section 3.4 of this report.

2.9.2 Cumulative impacts

Submission number
36 – Department of Environment, Climate Change and Water

Issue description

The Department of Environment, Climate Change and Water's submission raised issues relating to the cumulative impacts of the whole Pacific Highway upgrade program. It stated that the environmental assessment described only clearing of proposed future projects and did not include current and completed projects in the context of the Pacific Highway upgrade program. The Department of Environment, Climate Change and Water recommended that section 10.4.5.2 identify and assess other factors that contribute to cumulative impacts on a site level and overall Pacific Highway upgrade program level. Cumulative impacts from additional linear barriers should have also been considered.

The Department of Environment, Climate Change and Water also noted that table 5-5 did not include all proposed Pacific Highway upgrade projects or all complete projects. The Department of Environment, Climate Change and Water recommended that the table be updated to include all vegetation losses associated with the Pacific Highway upgrade program.

The Department of Environment, Climate Change and Water also noted that regional scale impacts have only been partially addressed.

Response

Cumulative impacts of the Proposal with other large scale developments in the region

The Proposal is one of many developments planned or underway in the mid-north coast region of NSW.

The Proposal, combined with other large-scale developments in the region, would contribute to cumulative flora and fauna impacts in the region, including loss of native vegetation, loss of threatened species, and loss of fauna habitat. Each of these projects, including the Proposal, would implement mitigation measures at a local level to offset these impacts.

The removal of habitat for the Proposal would add to the cumulative impacts on local fauna populations resulting from development in the area. This would reduce breeding and sheltering habitat and potential food resources including the habitat of prey. Further impacts are associated with cumulative traffic volumes and the increased risk of road fatalities and injuries if mitigation measures are not implemented.

Cumulative impacts of the Proposal with the Pacific Highway upgrade program

The Proposal is part of the Pacific Highway upgrade program that includes several sections of the Pacific Highway that have been upgraded or are currently under construction within the North Coast Bioregion, which the Mid-North Coast Region forms part of. The Pacific Highway upgrade program in this bioregion is ongoing.

While there would be impacts associated with the Proposal on native vegetation, the cumulative impacts of the entire Pacific Highway upgrade program in the north coast bioregion would include a greater extent of

clearing of native vegetation and habitats as well as fragmentation of habitat. Table 2-7 shows the extent of native vegetation disturbance for recently completed projects, projects under construction, and projects in the planning phase under the Pacific Highway upgrade program within the north coast bioregion. The table also shows the endangered ecological community component of the native vegetation disturbance. This updates the information provided in 5.4.1.1 of the Flora and Fauna Working Paper.

Table 2-7 Extent of vegetation disturbance associated with the Pacific Highway upgrade program

Project	**Native vegetation disturbance (hectares)**	**Endangered ecological community disturbance (hectares)**
Projects completed		
Raymond Terrace bypass duplication	5	2
Raymond Terrace to Karuah	37	4
Karuah bypass	36	3
Karuah to Bulahdelah	123	9
Bulahdelah to Coolongolook	106	8
Wang Wauk to Bundacree	10	0
Bundacree Creek to Possum Brush	4	1
Coopernook bypass	2	1
Coopernook to Moorland	8	3
Moorland to Herons Creek	64	5
Lyons to England Road	2	1
Halfway Creek	12	0
Tandy's Lane upgrade	1	1
Brunswick Heads bypass	7	5
Brunswick to Yelgun	49	8
Yelgun to Chinderah	30	12
Sub-total – projects completed	*496 ha*	*63 ha*
Projects recently approved or currently under construction		
Bulahdelah bypass	33	3
Kempsey to Eungai upgrade	286	63
Sapphire to Woolgoolga upgrade	83	18
Wells Crossing to Iluka Road – Glenugie upgrade	65	5
Ballina bypass	11	9
Tintenbar to Ewingsdale (1)	10	2
Banora Point upgrade	8	4
Sub-total – projects recently approved or currently under construction	*496 ha*	*104 ha*
Projects in the planning phase		
F3 to Raymond Terrace (2)	49	Assessment to be completed
Oxley Highway to Kempsey (3)	203	36
Warrell Creek to Urunga upgrade (the Proposal) (4)	255	60
Coffs Harbour Bypass (5)	21	Assessment to be completed

Woolgoolga to Wells Crossing (5)	230	51 (preliminary estimate)
Wells Crossing to Iluka Road – remaining (5)	345	55
Iluka Road to Woodburn – remaining (5)	Assessment to be completed	Assessment to be completed
Iluka Road to Woodburn – Devils Pulpit Upgrade (4)	54	12
Woodburn to Ballina (5)	131	56
Sub-total – projects in the planning phase	*1,288 ha*	*270 ha*
Total – Pacific Highway upgrade program	*2,280 ha*	*437 ha*

Note: (1) This project was recently approved and is currently in the detailed design phase.
(2) The preferred route has been selected for this project.
(3) The environmental assessment is currently being prepared for this project
(4) The environmental assessment display has been completed for these projects.
(5) The concept design has been finalised for these projects.

As part of the Pacific Highway upgrade program, the RTA is mitigating the impacts of vegetation loss from clearing operations by implementing a biodiversity offset strategy. This is in addition to the development of a highway route which avoids or minimises the impacts on sensitive areas of native vegetation where possible.

As part of this biodiversity offset strategy, the RTA purchases land as compensatory habitat, and subsequently transfers ownership of that land to offset vegetation loss across the Pacific Highway upgrade program, the RTA is implementing an offset strategy for the Pacific Highway upgrade program which would contribute to the long term conservation of biodiversity. As part of this offset strategy, the RTA has purchased land as compensatory habitat, and has subsequently transferred ownership of this land to the Department of Environment, Climate Change and Water for ongoing conservation.

To date, about 1200 hectares of land has been acquired by the RTA to offset the clearing impacts of the Pacific Highway upgrade program. This area of compensatory habitat mainly covers those projects in table 2-8 shown as 'projects completed'.

In addition, about 1860 hectares of land is currently proposed as compensatory habitat for native vegetation and endangered ecological community impacts for a number of the projects identified in table 2-8 as currently under construction or still in the planning phase. The RTA is continuing consultation with the Department of Environment, Climate Change and Water and Industry and Investment NSW as appropriate for biodiversity offset packages for the remaining projects that are not covered by the compensatory habitat referred to above.

The actual land exchange ratio agreed with the Department of Environment, Climate Change and Water and the Industry and Investment NSW for the biodiversity offset strategy has varied from project to project over the last 14 years. However, the general land exchange ratio adopted is about 2:1 for native vegetation, and about 4:1 for endangered ecological communities, on a like-for-like basis.

Further to this, the RTA's biodiversity offset strategy also includes revegetation in strategic locations and investment in management research related to the rehabilitation and protection of threatened species. To date, the area of compensatory habitat provided for the Pacific Highway upgrade program is about 1200 hectares. The RTA is continuing to negotiate offset packages for projects that are under construction or in the project planning stage.

2.9.3 Fauna crossings

Submission numbers

20 – Individual
34 – Individual
35 – Industry and Investment NSW
36 – Department of Environment, Climate Change and Water

Issue description
Four submissions, including one each from Industry and Investment NSW and Department of Environment, Climate Change and Water, were made regarding fauna and fauna crossings.

1) One community submission raised concerns regarding the adequacy of fauna studies, as the team did not physically enter properties to conduct the studies, while the other requested information on how wildlife would be impacted by the completed Proposal.

2) Industry and Investment NSW suggested that figure 10-3, indicative fauna crossings, should also specify fish passage requirements. It stated that some of the proposed culvert configurations may have some difficulty in accommodating both fish passage and fauna movements.

The Department of Environment, Climate Change and Water noted that the Director-General's requirements in relation to the interaction of the Proposal with the new highway, and baseline population studies to measure the effectiveness of mitigation strategies had been partially addressed. It also made numerous points on fauna and fauna crossings, including:

3) The effectiveness of proposed mitigation structures under the new highway alignment, which are not adequately matched under the existing alignment, may be significantly impaired. Recommended that the environmental assessment address this issue.

4) Stated that it was not clear from the environmental assessment how information on local fauna populations and their probable movement patterns was used to support the statement that the proposed crossing structures would "ensure movement within the existing wildlife corridors is maintained".

5) Recommended that the environmental assessment address maintenance of connectivity for the additional two east-west koala movement corridors located in the study area.

6) Stated that the barrier impacts to wildlife movement and mortality associated with the new highway are potentially far greater than the status quo. Recommended that all 36 proposed crossing structures be validated.

7) Recommended that to support the connectivity structure selection process and to gain a meaningful understanding of the appropriate placement and design of structure, the environmental assessment needed to demonstrate consideration of the following:

   - A targeted habitat assessment (including a fauna survey) at each crossing site shown in table 10-13, including a description of the species present or likely to be present and the relative abundance if known.
   - Ensure crossing structure was designed for likely species and included design requirements for threatened or target species.
   - Evidence that the target species is likely to use the structure.
   - A description of the minimum level of connectivity required to maintain ecosystem function and connectivity of landscape to the east of the new highway barrier.
   - A statement of the "objective" of each structure and how this would be used in design development and the evaluation of the structure during operation.

8) Stated that in order to adequately address connectivity issues, the concept design should consider areas of "viaducts" over moist gullies in areas of identified high biodiversity and sensitive habitat within wildlife corridors.

9) Recommended the inclusion of a structure such as a gully bridge to facilitate access to a wide area of broad habitat types.

10) Stated that the efficacy of the fauna crossings was not demonstrated, and how data was used to support the decisions made.

11) Recommended that the RTA commit to developing a rehabilitation strategy that identifies and prioritises key rehabilitation sites, including locations, types of planting and objectives of the rehabilitation work.

12) Recommended all key crossing points are spilt in the median to allow penetration of light and moisture to facilitate natural vegetation.

13) Recommended that a targeted survey be conducted during suitable conditions to confirm if individuals or populations are present. If Giant Barred frog populations are confirmed, the RTA should consider designing bridge structures that will not impact on Giant Barred frog habitat and additionally develop a translocation and monitoring program.

14) Disagreed with the environmental assessment's claim that there is little evidence to suggest that koala populations or movements are centred around the Proposal route.

15) Recommended that areas of swamp forest are prioritised in the crossing structure validation process as they contain significant habitat for a large variety of winter-flowering dependent nectarivorous fauna and a high diversity of amphibians.

16) Stated that koala dedicated passages should be of at least 3.6 metres high to provide safety from wild dogs.

17) Stated that of the 36 proposed fauna crossings, only 14 are considered as providing dry fauna passage, one as providing non-riparian passage, and three as being of sufficient height to maintain small mammal use. Apart from large bridges, there are only three potentially functional crossing points under the 42 kilometre upgrade.

18) Stated that not all of the proposed fauna underpass structures fall within ideal or even vegetated habitat and that the environmental assessment does not include any detailed discussion of this.

19) Noted that there are two dedicated fauna crossings at approximate chainages 32800 and 33500 shown in the Visual Amenity and Urban Design Working Paper, which are not listed in table 6-4 or discussed in the text.

20) Suggested the development of a connectivity strategy which will potentially clarify some of these anomalies in the environmental assessment as well as providing validation of a purported process.

Response

1) As detailed in the Flora and Fauna Working Paper, the flora and fauna assessment was rigorous. It included numerous surveys, including on private property in agreement with landowners, to assess the existing populations of flora and fauna, and identify vegetation, fauna habitats and species.

2) The location and specifications of the combined fauna structures were developed in a strategic manner, which captured likely fauna movement corridors and targeted specific fauna species. This strategy considered the location of existing culverts within locations where the new highway runs directly parallel with the existing highway (ie between the Nambucca and Ballards Road interchanges) and matched these locations. The criteria used for selecting fauna crossings included connectivity to the east and west of the Proposal, and the distribution of fauna habitats. A full description of the proposed structures and selection rationale is provided in section 6.2.5.2 of the Flora and Fauna Working Paper.

   A thorough review process between the project team and RTA

environmental specialists was carried out to identify appropriate locations for dedicated (referred to as combined) structures. The approach focused on providing dedicated fauna underpasses for a range of fauna, particularly threatened species, at the following locations:

- Where the highway crosses relatively large areas of native vegetation (ie state forests).
- Identified wildlife crossings (ie regional and local corridors and vegetation patches – refer to figures 3-5 and 3-6 of the Flora and Fauna Working Paper).
- Areas matching records of threatened species such as spotted-tailed quoll and koala.

Data gathered from habitat assessments and detailed fauna surveys conducted in the study area over the years 2003-2008 was also used to identify appropriate placement of underpass structures.

Table 3-1 of this report is an update of table 10-13 of the environmental assessment. This table has been updated following the request by Industry and Investment NSW and the Department of Environment, Climate Change and Water for additional information on the fauna crossings. Table 3-1 provides justification for the selection for each of the crossings, including habitat connectivity, target species and aquatic ecology. It also provides an indication of where new crossings are co-located with existing crossings along the existing Pacific Highway.

3 to 10) Comments 3 to 10 relate to the fauna structures along the length of the Proposal. The response provided in 2.9.2 (item 2) addresses these issues and details the rationale for development of the connectivity strategy and the location of fauna crossing. Further detailed information on fauna movement in the area and details of each of the crossing structures is provided in table 3-1 of this report.

11) The comments within the environmental assessment relate to restoring road side areas and cleared portions adjacent to the new highway. The requirement for rehabilitation would be specified in the construction and operational management plans which would be prepared during detailed design once the final extent of clearing required for the Proposal was determined.

12) Splitting the cells in the median would allow fauna to enter the median, rather than be directed underneath both carriageways. This would require additional fauna exclusion fencing in the median.

13) Targeted surveys for the Giant Barred frog were conducted during the route selection and environmental assessment phases of the Proposal, under optimum conditions (season and rainfall), for a total of 29 hours of spotlighting and four playback sites in potential habitat. The survey effort was considered sufficient for this species. Dry passage has been included for fauna under major bridge crossings. Vegetation would be retained as part of fauna bridge crossings. The requirement for detailed

pre-clearance surveys for threatened species, including threatened frogs, have been included in the revised statement of commitments (section 4). In the event that threatened species were identified, a management strategy would be developed.

14) The location and known records of koalas to the east of the Proposal were considered in the design and placement of the dedicated fauna crossing to target this species. Details of the dedicated crossing were described in section 10.5.3 of the environmental assessment and section 6.2.5 of the Flora and Fauna Working Paper, which explained that the crossing was placed to target habitat dominated by koala food tree species. This location was selected to coincide with several koala records and known koala habitat (ie vegetation communities comprising a high proportion of grey gum (*Eucalyptus punctata*) and swamp mahogany (*Eucalyptus robusta*).

15) This comment has been noted. The crossing of swamp forests would require drainage structures as a matter of course and, where appropriate, these were included in the design as 'combined' structures, meaning they would facilitate drainage and fauna passage by including raised cells and/or raised ledges.

16) Monitoring of underpass use on previous Pacific Highway upgrade projects has indicated that a range of fauna groups will use a 2.4 metre x 1.5 metre structure. The Brunswick Heads Bypass has 2.4 metre x 1.5 metre box culverts in two separate locations. Species recorded using these structures include kangaroos and wallabies, bandicoots, koala, possums and lizards. From this information, it is considered possible that fauna would also utilise the 2.1 metre x 2.1 metre structure discussed above. Recent discussions with an expert on the spotted–tailed quoll, engaged by the RTA to study the species in and around Glenugie State Forest, has indicated that quolls are likely to use much smaller structures than a 2.4 metre x 1.5 metre culvert (Belcher, C. pers.comm.).

17) Dry passage access for fauna would also be provided under six bridge crossings. A minimum bench area of 1.5 metres was designed between the top of the creek bank and the edge of the structure to facilitate fauna movement.

18) The rationale for fauna underpass structures was based on an assumption that only 2.4 metre culverts or larger would be used by fauna. As discussed in section 6.2.5 of the Flora and Fauna Working Paper, culverts as low as 2.4 metres have been shown in the literature to adequately provide passage for smaller macropods. A number of 'dry corridors' to allow dry passage during wet periods via the inclusion of raised outer cells and internal ledges were provided in the concept design. The fauna crossing strategy was developed following field survey, review or aerial photography and Department of Environment, Climate Change and Water mapping of fauna corridors to allow placement of the fauna crossings in locations that were best suited to the species present, taking into consideration fauna movement and habitats present.

19) Indicative fauna crossings listed in table 10-13 of the environmental assessment and table 6-4 of the Flora and Fauna Working Paper were proposed in the concept design. The oversight in updating the urban design and landscape strategy presented in the Visual Amenity and Design Working Paper has been noted. Further targeted survey for the eastern underground orchid (*Rhizanthella slateri*) and other threatened orchid species has resulted in a realignment of the route in this location to minimise potential impacts. The revised alignment and associated fauna crossings is included in section 3.1 of this report.

20) Section 3.1 provides details of the proposed fauna and fish crossings which forms the Proposal's connectivity strategy.

2.9.4 Terrestrial habitats

Submission numbers

9 – Individual
17 – Individual
21 – Individual
22 – Nambucca Shire Council
26 – Individual
30 – Land and Property Management Authority
33 – Northern Rivers Catchment Management Authority
35 – Industry and Investment NSW
36 – Department of Environment, Climate Change and Water
41 – Individual

Issue description

1) Five community submissions raised concerns that the Proposal would impact on terrestrial habitats. Several of these also raised concerns regarding the accuracy of the assessment in the environmental assessment, including the flora surveys, habitat assessments and the mapping of EECs.

2) Nambucca Shire Council noted that the environmental assessment refers to the Macleay coastal floodplain, which is approximately 50 kilometres to the south.

3) The Land and Property Management Authority raised concerns regarding the ongoing environmental degradation to Crown land.

4) The Northern Rivers Catchment Management Authority suggested a review of table 10-10 as the cumulative total of the swamp sclerophyll forest on coastal floodplain and subtropical coast floodplain that would be removed was higher than stated in the text.

5) Industry and Investment NSW stated that the Proposal would impact heavily on the Nambucca, Little Newry and Newry state forests.

Department of Environment, Climate Change and Water made numerous points regarding the impact of the Proposal on terrestrial habitats, including:

6) The results of the *Rhizanthella slateri* (eastern underground orchid) survey/assessment should be included as an attachment to the environmental assessment. Requested that Department of Environment, Climate Change and Water be involved in any mitigation and design refinement decisions.

7) Recommended that additional target population studies be undertaken to thoroughly understand and assess the long term impacts of the Proposal to subsequently fragmented populations.

8) Suggested that further work would be required to identify the impacts to fragmented habitats to the east and the possible improvements that could be gained from mitigation measures such as the use of connectivity structures and linking the landscape by revegetation.

9) Noted that the existing Pacific Highway was very relevant to fauna connectivity and mitigation measures where the new alignment and the exiting alignment run in close proximity to each other. Recommended that the environmental assessment address this issue to enable a full and adequate assessment of the impacts of retention of the existing highway on connectivity and effectiveness of proposed mitigation measures.

10) Recommended that the environmental assessment present a more detailed description of the indirect impacts of the Proposal when discussing private property adjustments.

11) Recommended the development of a strategy for prioritising rehabilitation areas, as a means to adequately assess any biodiversity benefits in the context of the Proposal.

12) Requested clarification regarding whether the fauna rescue framework for clearing mentioned in the environmental assessment is the RTA's "Biodiversity guidelines for road construction and maintenance".

13) Recommended the development of a nest box plan prior to construction to replace hollow resources and provide emergency shelter in areas adjacent to clearing.

14) Recommended that the adaptive monitoring program extend to up to five years, to ensure its success.

15) Recommended that an updated list of threatened species records is generated for the study area from the Atlas of NSW wildlife database and any additional species be included in the assessment of significance of impacts.

16) Stated that the environmental assessment did not adequately assess the extent of the impact of the removal of hollow-bearing trees to the study

area. It suggested that all hollow-bearing tree locations are accurately mapped and the attributes assessed.

17) The Department of Environment, Climate Change and Water suggested that the quantum of offsets for this Proposal might be similar to those that led to agreement to offset ratios of 4:1 for EECs and 2:1 for non-EECs on other projects in the north coast bioregion, thus the total offsets for this Proposal would equate to 693 hectares.

Response

1) Ecological assessments were conducted over the period from 2003-2008 during the route development process and for the environmental assessment. This included survey over both public and private land which was conducted by at least eight ecologists in that time specialising in both terrestrial and aquatic ecology. Large volumes of data were gathered over this time. From this it has been possible to draw conclusions on the vegetation types, fauna habitats and species occurring in the locality. As a result some properties were not visited where these contained vegetation that was already very well sampled. As the Proposal progressed, the surveys concentrated efforts on new landscapes and habitats in order to ensure a complete picture of the biodiversity in the study area. The data collected was used to provide vegetation mapping over all ground-truthed locations. This information was cross referenced with high resolution aerial photography and contour data as it became available. The combined data was used to complete a vegetation map of the entire study area, filling in some small gaps of properties where access was not granted. Access was granted to a number of properties during the route selection phase. Access was later denied on certain properties for the environmental assessment flora and fauna investigations. Where this occurred, the information from the route selection phase was used. This data was sufficiently detailed to determine the potential impacts on these properties and to develop the required mitigation measures. As a result the overall conclusions for the flora and fauna assessment, and the results were not significantly affected where access was later denied for subsequent ecological investigations during the environmental assessment phase. The vegetation map covering locations where property access has been denied is therefore based on extrapolation of contour and vegetation mapping. In other instances predictions of vegetation type were obtained from observations made from outside the property. The RTA would welcome an opportunity to groundtruth the vegetation on property where access has been denied.

   The ecological mapping was developed to determine the extent of significant habitat, vegetation types, sensitive habitats and EECs. At this scale the boundaries of specific habitats may not be exact (with a global positioning system the accuracy can vary between 10-50 metres). Information from the ecological surveys has fed into the route selection and concept design phases. Route options with significant ecological impacts were removed during route options development

and the Proposal was adjusted in a number of locations to avoid or minimise impacts to threatened species or habitats.

2) The Macleay coastal floodplain is associated with the NSW Landscapes dataset (Mitchell 2003). The dataset covers a state-wide map of landscapes, mapped at a scale of 1:250 000, describing land attributes considered to drive ecosystem processes. Definition of the landscapes emphasises geologic, geomorphic and pedologic factors. These landscapes are mapped on Figure 3-3 of the Flora and Fauna Working Paper, which classifies the alluvial floodplains as the Manning-Macleay coastal alluvial plain.

3) Measures in relation to prevention of land degradation, including weed control and rehabilitation were included in section 10.5.1 of the environmental assessment. This included the requirement to prepare a weed management plan to prevent the spread of weeds and plant pathogens during construction. Detailed measures to protect water quality during construction and operation were included in chapter 16 of the environmental assessment.

4) The cumulative figures in table 10-10 have been reviewed and it is determined that the figures within the table are correct.

5) There will be impacts as a result of vegetation loss within Nambucca, Little Newry and Newry State Forests as identified by Industry and Investment NSW. The significance of these impacts was reviewed in terms of vegetation and habitat loss and is addressed in section 10.4.2 of the environmental assessment. A biodiversity offset strategy would be developed in consultation with the Department of Environment, Climate Change and Water during the detailed design phase.

6) Targeted surveys were conducted for the eastern underground orchid (*Rhizanthella slateri*) in January and May 2010. No plants were found during the detailed survey, however, this species is notoriously difficult to locate when not in flower (September). As a result potential habitat has been mapped. The maps showing potential Rhizanthella habitat are included in section 3.2. The route alignment has been adjusted in this location to minimise impact on potential Rhizanthella habitat. The refined alignment is shown in section 3.2. The refined alignment and proposed management measures were discussed with representatives of the Department of Environment, Climate Change and Water in August 2010.

7) The Flora and Fauna Working Paper acknowledged the fragmentation of habitat from roads and discussed other factors of fragmentation including the existing Pacific Highway and extensive clearing on the floodplain. The mitigation measures proposed, such as widening the median and crossing underpass structures were determined by consideration of the larger fragmented habitats and presence and distribution of significant fauna such as koalas and yellow-bellied glider. The reference to population viability assessment was directed at the population of yellow-bellied gliders fragmented to the east of the road

within Nambucca State Forest. The proportion of habitat remaining to the east of the road (c.1000 hectares) is considered sufficiently large to support several family groups to the east of the Proposal. Further measures are required to enhance connectivity to the west. Such measures have been considered in the design of the road by incorporating a wider median through the northern end of Nambucca State Forest. The widened median is predicted to be accessible by yellow-bellied gliders given the narrow carriageway to be traversed on either side (approximately 40 metres).

8) The RTA recognises the benefits of further monitoring of fragmented populations. A targeted, adaptive monitoring program for a minimum of 12 months would be implemented following construction to assess the effectiveness of fauna and flora impact mitigation measures and assess the need for additional measures and/or further targeted monitoring.

9) The assessment considered that the current issue associated with reduced connectivity would be reduced as a result of significantly less traffic on the existing Pacific Highway and the introduction of combined and dedicated fauna underpass structures in the location where the two roads run in close proximity. In relation to indirect impacts, there are no currently used models to assess the cumulative impacts of these types of projects as a result of works such as new fence lines and access roads that are unrelated to the Proposal.

10) Fauna fencing would be installed around fauna crossings throughout the Proposal (as shown in figure 3-2), and clearing for any new access roads would be kept to a minimum. The potential for impacts on biodiversity as a result of clearing new fence lines and the realignment of private and local roads is considered minimal. Fencing would be erected on the road boundary through areas of private property where fauna fencing is not proposed (refer to figure 3-2). This will result in the permanent removal of approximately 6.5 hectares of vegetation, including up to two hectares of EECs. This estimate was based on a five metre corridor being required to gain access to, install and maintain the boundary fence along the road boundary.

    In terms of hydrological changes and impacts to floristic composition, there are several areas where cutting in gully areas would be required and there would potentially be impacts to the ecology of several drainage lines as a result of changes to groundwater flows. However, the Proposal has been designed to maintain existing flow and hydrological regimes. Cross drainage structures have been co-located with existing structures where the new highway is located adjacent to the existing highway.

11) The recommendation for a strategy prioritising habitat rehabilitation is noted. A review of the potential for rehabilitation of habitats and prioritising of identified areas of rehabilitation would be undertaken during preparation of the construction environmental management plan.

12) The fauna rescue frameworks for clearing mentioned in the environmental assessment is the RTA's *Biodiversity guidelines for road construction and maintenance*.

13) The recommendation to develop a nest box plan has been noted. The requirement to introduce appropriate natural and artificial habitat features and resources including nest boxes has been included in the statement of commitments F6 (section 4). The preparation of a nest box plan would be a recommended approach for consideration during the detailed design phase.

14) The RTA has committed to undertake a targeted, adaptive monitoring program for a minimum of 12 months to assess the effectiveness of fauna and flora impact mitigation measures. After 12 months a report would be completed to assess the need for additional measures and/or further targeted monitoring.

15) The threatened species records would be searched during the detailed design phase. This would capture any additional species recorded in the area between the time of the environmental assessment and construction.

16) A survey for hollow bearing trees would be conducted prior to construction. This requirement is included in the statement of commitments (section 4).

17) The Department of Environment, Climate Change and Water's requirement on the quantum for offset is noted and has been included in the revised statement of commitments (section 5).

2.9.5 Vegetation loss

Submission numbers

7 – Individual
33 –Northern Rivers Catchment Management Authority
34 – Individual
35 – Industry and Investment NSW

Issue description

Industry and Investment NSW, the Northern Rivers Catchment Management Authority and two community members made submissions that raised the issue of vegetation loss.

The Northern Rivers Catchment Management Authority stated that the RTA should conduct minimal clearing of vegetation and maximise endemic revegetation in these fragile landscapes to ensure maintenance of biodiversity, water quality and soil on the floodplains.

The community submissions enquired as to whether the RTA has a policy to save as much existing vegetation as possible.

The Industry and Investment NSW submission made a number of points on the environmental assessment relating to the loss of mangroves:

1) Section 10.5.1.1, Flora, did not quantify or mention the destruction of mangroves required for this Proposal.

2) Section 10.5.6, Offsetting environmental impacts, did not mention mangrove offsets or the need for the RTA to develop these offsets in consultation with Industry and Investment NSW Fisheries Ecosystems Unit.

3) Rehabilitation of any mangroves harmed during construction must be negotiated with Industry and Investment NSW Fisheries Ecosystems Unit prior to any construction work occurring that may cause harm to mangroves or other marine vegetation.

4) Section 10.6, Summary, indicates that mangroves would be destroyed by the Proposal. Stated that the summary should include consultation with Industry and Investment NSW Fisheries Ecosystem Unit for mangrove compensation and rehabilitation measures.

5) Section 3.2.4 of Working Paper 1 failed to quantify the area or number of mangroves that would be impacted by the Proposal. It is important to quantify them as compensation would be required by Industry and Investment NSW at a rate of 2:1 for any mangroves destroyed.

6) Any mangroves destroyed would be the subject of compensation and consultation with Industry and Investment NSW Fisheries Ecosystems Unit.

Response

In response to the submissions from community members and the Northern Rivers Catchment Management Authority, every effort would be made to minimise the extent of vegetation clearing necessary for Proposal construction, through planning the road footprint to minimise clearing and through various environmental management measures to be implemented during construction. The location of depots, worksites and ancillary areas required for construction would be planned to be located within existing cleared land near the Proposal where feasible.

Clearing of native vegetation would be restricted to the minimum area necessary for construction. Refer to the revised statement of commitments (F1) in section 4.

In response to Industry and Investment NSW's comments:

1) The task of quantifying the exact number of mangroves would occur when the design is finalised at the detailed design phase. This issue is also addressed in section 2.9.1 (item 1) of this report.

2) The vegetation offset and rehabilitation requirements would be developed following the quantification noted above, in consultation with Industry and Investment NSW.

3) Industry and Investment NSW's requirement to rehabilitate mangroves harmed during construction is noted.

4) Refer to response provided in 2.9.5 (item 3) of this report.

5) Refer to response provided in 2.9.5 (item 1) of this report.

6) Refer to response provided in 2.9.5 (item 2) of this report.

2.10 Land use and property

2.10.1 General

Submission numbers

9 – Individual
12 – Individual
18 – Individual
22 – Nambucca Shire Council
30 – Land and Property Management Authority
34 – Individual
41 – Individual

Issue description

Seven submissions, including from the Land and Property Management Authority, raised general land use and planning issues.

1) Community submissions questioned the accuracy of the property impact ratings provided in the Visual Amenity and Design Working Paper, and raised concerns regarding the impact of the Proposal on the value of neighbouring properties.

2) Other community submissions questioned the logic of placing the Proposal through rural residential land, rather than using land already owned by the RTA.

3) The Land and Property Management Authority noted that a number of Crown roads may be subjected to disposal under the Land and Property Management Authority roads reform project and requested that the RTA clarify the proposed closure and acquisition of these roads.

4) Nambucca Shire Council requested that the upgrade, at least between Warrell Creek and Ballards Road, proceeds as a single stage as soon as possible to minimise uncertainty for residents regarding property acquisition.

Response

1) The property impact ratings provided in Appendix B to the Visual Amenity and Design Working Paper were developed by assessing the visual effect of the Proposal and the visual sensitivity of the residences (ie how much of Proposal would be visible from the said residence). The RTA can only compensate property owners whose land is directly impacted by the alignment of the proposed highway upgrade as assessed and will be compensated in accordance with the *Land Acquisition (Just Terms) Compensation) Act 1991*.

2) The route selection process has been addressed in section 2.5 of this report. Where possible, the Proposal has made use of existing road reserve or publicly owned land. Potential impacts on private property was a key consideration of the route selection process.

3) The environmental assessment recognised that the Proposal would impact on a number of Crown roads. The acquisition and closure of these roads would be negotiated with the Land and Property Management Authority.

4) The Proposal could be constructed in separate stages such as Warrell Creek to Nambucca Heads, or as a single stage. This would be determined based on the availability of funding and priority requirements.

2.10.2 Land use

Submission numbers

8 – Individual
12 – Individual
19 – Individual
35 – Industry and Investment NSW

Issue description

Industry and Investment NSW and four community submissions made comments on the impact of the Proposal on current and future land use in the local area.

1) One submission noted that property acquisition compensation should take into account business interests. Three of the community submissions related to specific property issues.

2) Industry and Investment NSW stated that the description of land use of each property was not adequate as council's zoning of the land is not a description of the actual land use.

Response

1) The Proposal was designed to limit, as far as possible, impacts on property and land use. In rural areas, the Proposal was developed to minimise land acquisition, severance, and fragmentation of properties, by closely following property boundaries where possible. Compensation for property

acquisition including any potential claim for impact on a business operating on the affected property, would be assessed in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991,* which takes into account the highest and best land use. The RTA has responded separately to community members on specific property issues.

2) Figure 11-1 of the environmental assessment shows the generalised land use and was intended to provide a broad assessment of land use through the study area. More detailed information on the land uses along the Proposal can be obtained in figure 11-5 of the environmental assessment which shows the impacted properties along the alignment overlaid on recent aerial photography.

2.10.3 Property acquisition

Submission numbers

8 – Individual
9 – Individual
12 – Individual
18 – Individual
19 – Individual
22 – Nambucca Shire Council
23 – Individual
30 – Land and Property Management Authority
37 – Individual
42 – Individual
43 – Individual

Issue description

Nine community submissions, as well as the submissions from the Land and Property Management Authority and Nambucca Shire Council, included issues regarding property acquisition.

1) A number of community submissions stated opposition to the partial acquisition of specific properties and requested full acquisition. Other community submissions raised concerns regarding the land acquisition process.

2) The Land and Property Management Authority stated that the Proposal would impact on Crown waterways, thus the construction of bridges would require easements over footings in Crown waterways below Mean High Water Mark (MHWM) to be acquired.

Response

1) The RTA has responded to land owner requests for acquisition, either partially or in full, under a programmed acquisition arrangement since May 2010, and under hardship arrangements since November 2005. These acquisitions will be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. While the preference of a total acquisition from some property owners is noted, the RTA would only

acquire land required for the proposed roadworks. All total acquisitions must be fully justified, and in some cases, the RTA may only seek to purchase part of the property. All land acquisitions would be subject to discussions and negotiation with the individual landowner.

2) Land and Property Management Authority's comment regarding the acquisition of easements in Crown waterways has been noted. The RTA would consult with the Land and Property Management Authority and other appropriate Crown authorities to determine the nature and extent of any property licences or acquisitions required. If necessary, acquisition of appropriate interests in land would be negotiated with the Land and Property Management Authority.

2.11 Social and economic

2.11.1 Agricultural impacts

Submission numbers

35 – Industry and Investment NSW

Issue description

Industry and Investment NSW raised a number of points regarding agricultural impact assessment and the Proposal's impact on agricultural land.

The submission questioned the quality of the agricultural impact assessment as it did not include details of the Proposal's impact on regionally significant farmland, individual properties or the local industry. It also raised concerns that it did not detail how water sources, protection of shade trees and access to high ground for stock refuge during flood events would be dealt with at the individual farm level.

Industry and Investment NSW also noted that the Proposal would come close to horticultural crops in the Valla area. It stated that the impact of this encroachment on routine agricultural operations that presently occur on these properties and any proposed mitigation measures should be determined in consultation with the adjoining property owners.

Response

Figure 11-4 of the environmental assessment showed the regionally significant farmland through the study area. The environmental assessment identified that approximately 66 hectares of land classified as 'rural (prime/flooding)' and approximately 38 hectares of land classified as 'rural' would be directly impacted by the Proposal. The current land use on each property and the percentage of each property impacted by the Proposal was provided in table 11-2 and figure 11-5 of the environmental assessment.

The level of detail provided in the agricultural impact assessment was appropriate given the stage of the Proposal. Compensation would be negotiated in consultation with individual property owners following the detailed design phase to determine how best to minimise the impact on the

function and amenity of their land use arising from land sterilisation or severance. Farm access underpasses would be provided where possible to allow stock, machinery and farm vehicles to pass underneath the Proposal.

In the Valla area overbridges and underpasses are proposed to maintain connectivity alongside and across the new highway, which would maintain connectivity for agricultural businesses. Any at-residence mitigation measures would be further discussed with affected landowners prior to construction.

2.11.2 Business impacts

Submission numbers

11 – Saltwater Developments
28 – Urunga-Mylestom Chamber of Commerce

Issue description

The Urunga-Mylestom Chamber of Commerce and one local business made submissions regarding the impact of the Proposal on local businesses.

1) Saltwater Developments, which operates the Nambucca Quarry, stated that the RTA would need to adhere to development assessment conditions imposed on quarrying limits during Proposal construction.

2) Urunga-Mylestom Chamber of Commerce expressed concerns regarding the possible reduction of visitors to Urunga when the Proposal is complete and the potential impact on local businesses. It suggested that the RTA establishes a local signage committee to alert highway users to Urunga.

3) The Urunga-Mylestom Chamber of Commerce also requested information as to whether the RTA planned to make a contribution to the town of Urunga to assist with signage, town entrances, landscaping and general beautification as compensation for the business impacts.

Response

1) The RTA would construct the Proposal, including sourcing of quarry materials, in accordance with any relevant conditions of the project approval. Saltwater Developments' comment regarding adhering to Development conditions on quarrying limits has been noted and it is expected that should material be required from established private quarries outside the scope of the project approval, it would be obtained in accordance with any existing applicable quarry development consents.

2) Section 12.3.2.2 of the environmental assessment detailed the predicted business impacts of the Proposal during construction and operation. To address concerns about the possible reduction of visitors to Urunga, a new interchange was included at Ballards Road. The environmental assessment has also included reference to the use of signage to promote tourist activities, facilities and services for drivers visiting the area. A

detailed signage plan would be developed in accordance with RTA guidelines, and consultation with councils and the Urunga-Mylestom Chamber of Commerce at the detailed design stage, prior to construction. Urunga-Mylestom Chamber of Commerce's suggestion to establish a local signage committee has been noted.

3) A detailed signage plan for the Pacific Highway would be finalised at the detailed design stage in accordance with RTA guidelines and in consultation with the Chamber. The need for an access to Urunga from the south and Valla Beach from the north was identified during consultation with local residents, Bellingen Shire Council, the Urunga Chamber of Commerce, bus companies and local businesses. In response to these concerns an additional interchange was included in the concept design in 2008 at Ballards Road, just to the south of Urunga. This interchange would allow better access to and from Urunga, provide access for emergency services and service the growing community of Valla Beach. In addition, the RTA has acquired sufficient land at the Waterfall Way interchange that may facilitate the location of a tourist information centre. The RTA is not proposing to do any landscaping in Urunga or town entrance treatments as part of the Warrell Creek to Urunga Pacific Highway upgrade.

2.11.3 Impacts on government assets and utilities

Submissions numbers

22 – Nambucca Shire Council
30 – Land and Property Management Authority

Issue description

1) Nambucca Shire Council raised a number of issues regarding the Proposal's impacts on its utilities and assets. It requested that the cost of all changes to Council owned infrastructure arising out of the upgrading of the Pacific Highway, whether direct or indirect, be met by the RTA. Council stated that it would be financially unable to accept responsibility, either in whole or in part, for the existing Pacific Highway and the Macksville Bridge, should the RTA seek to reclassify this as a local or regional road. It also raised concerns about the loss of rateable land in the highway corridor and believes there should be consideration or compensation for the loss of this revenue.

2) The Land and Property Management Authority requested that the RTA transfers any roads required for construction of the Proposal and address maintenance and legal practical access of affected or alienated roads, as required.

Response

1) The RTA would meet all council owned utility relocation costs (except for any increases in capacity or size) affected by the proposed upgrade. Regarding future use of the existing Pacific Highway and Macksville Bridge, further discussions will be undertaken with council should the RTA

reclassify the existing Pacific Highway. RTA would not compensate council for any losses of rateable land.

2) Maintenance and access arrangements for roads to be used for construction purposes would be set out in the construction environmental management plan. Public roads used for construction vehicle movements would remain generally open to the public subject to traffic regulation pursuant to traffic management plans.

2.11.4 Local community impacts

Submission numbers

7 – Individual
8 – Individual
9 – Individual
12 – Individual
15 – Individual
21 – Individual
23 – Individual
24 – Individual
26 – Individual
27 – Individual
41 – Individual
43 – Individual
44 – Individual

Issue description

Submissions from 13 community members raised concerns regarding the past and future impact of the Proposal on the local community.

1) A number of community submissions stated that uncertainty regarding the Proposal had placed significant stress on local residents. Several also stated that the impact of property acquisitions was not adequately addressed in the environmental assessment.

2) Many submissions expressed concerns that the Proposal would dramatically impact on the lifestyle and amenity of local residents as a result of alterations to the local traffic arrangements and changes to the local community due to the relocation of residents.

3) Two community submissions raised concerns that the Proposal would cause the cost of flood insurance to rise so that local residents would not be able to afford the premiums.

4) One submission requested that a garden at a directly affected residence be retained and opened to the public as a roadside rest stop and memorial garden. This also included a request to retain mature vegetation on the property including a jacaranda tree.

Response

1) The RTA acknowledges the uncertainty that the Proposal may have caused local communities. The environmental assessment identified details of the proposed land acquisition and likely impacts on individual properties. Property acquisitions would be subject to negotiation between the landowner and the RTA in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.

2) It has been acknowledged that the composition of local communities would change as a result of the land acquisition process. In terms of community cohesion, interchanges and overpasses/underpasses for local roads would be installed in order to maintain property access. Local access routes across the new highway would maintain connectivity between severed agricultural properties. It has been acknowledged that the movement patterns of local traffic may be altered where new local access roads have been included in the Proposal. However, local traffic is not expected to increase so the community impacts associated with this are considered to be minimal.

3) The purpose of the flood modelling conducted for the environmental assessment was to establish if the Proposal could be developed with manageable impacts on regional flooding. It was determined that the Proposal would have little impact on the flooding of the area relative to the existing flooding risk.

4) The RTA is sympathetic to the sentimental value of the garden to the property owner involved. The property suggested as a memorial garden or Driver Reviver stopping point is not located near any proposed highway interchange, therefore it would not be a desirable site. In addition, consideration needs to be given to providing Macksville every opportunity to act as a service town for passing highway traffic. Opportunities for retention of the jacaranda tree within the future road reserve are being investigated. Opportunities for relocation of other plants and orchids from the garden would be explored following property acquisition.

2.11.5 Property infrastructure

Submission numbers

16 – Individual
23 – Individual
41 – Individual
43 – Individual

Issue description

Four community submissions expressed concerns that the Proposal would impact on their residential water supply through overflow from sediment basins contaminating dams and bores, and air pollutants, such as vehicle fumes and dust, contaminating water harvested from roofs.

Response

The purpose of the sediment basins during construction is to prevent runoff, which may contain sediments, from entering wetlands and waterways. The location of operational sediment basins will be determined at the detailed design stage. Operational sediment basins would be managed throughout the life of the Proposal.

As detailed in section 2.7.3 of this report, construction sediment basins have been sized in accordance with The *Blue Book – Managing Urban Stormwater: Soils and Construction* (Landcom 2004) criteria. The RTA may consider installing first flush systems for tank water at the construction stage to reduce concerns associated with water contamination for residents living adjacent to the Proposal who rely on tank water.

Most emissions from vehicles are not soluble in water. The emissions of concern for water quality would be sulphur dioxide and lead. Sulphur dioxide represents a minor component of vehicle emissions and is expected to decrease as the Commonwealth Government continues to mandate a program of low sulphur content fuels. Lead emissions have nearly been eliminated with leaded fuel being replaced by lead replacement fuels.

As described in section 19.2 of the environmental assessment, air quality monitoring undertaken alongside the Pacific Highway at Kororo has provided information on emissions from road operation on air quality. The monitoring results found that the maximum concentrations of carbon monoxide, nitrogen dioxide and particles did not exceed the air quality National Environment Protection Council of Australia's air quality standards, which are part of the National Environment Protection Measures (NEPM).

During construction, a number of mitigation measures would be implemented through the construction environmental management plan to minimise air quality impacts. These would include dust suppression techniques and controls.

Particle pollution in high quantities has the potential to increase the turbidity of water but is unlikely to in this case as the background particle levels in the study area are quite low.

2.12 Visual amenity and design

Submission numbers

1 – Individual
8 – Individual
15 – Individual
18 – Individual
20 – Individual
23 – Individual
27 – Individual
28 – Urunga-Mylestom Chamber of Commerce
34 – Individual

41 – Individual
43 – Individual

Issue description

Eleven community members and the Urunga-Mylestom Chamber of Commerce made submissions about visual amenity.

1) Community submissions raised concerns that the Proposal would impact on the visual amenity of the local area. Points of particular concern were:
   - Construction compounds.
   - Vehicle lights.
   - Noise walls.

2) Several submissions suggested that the proposed visual mitigation measures were inadequate and requested that additional visual mitigation measures, such as visual barriers and vegetative screening, be installed in particular locations, including on Kalang Bridge and its approaches, and on private properties.

3) The Urunga-Mylestom Chamber of Commerce requested details of the RTA's plan for landscaping at the north and south interchanges to Urunga. It suggested that the roundabout be covered in grass, which is clean, attractive and safe.

Response

1) Section 13.3 of the environmental assessment acknowledged that the Proposal would impact on the visual amenity of the area. A range of measures to mitigate these impacts were detailed in section 13.4.2 of the environmental assessment.

   - Construction batching plants and other ancillary facilities would be located to minimise impacts on sensitive land uses such as residences and community facilities. Appropriate environmental controls would be implemented to maintain the environmental amenity (eg water quality, detention basins, dust mitigation measures, blasting and noise control measures).
   - Headlight screens are proposed where traffic on a local access road has the potential to cause headlight glare to either highway carriageway or vice versa. Headlight screens are proposed at five locations as detailed in section 6.5.9.4 of the environmental assessment. The requirement for further headlight screens would be assessed during the detailed design phase.
   - Noise barriers of up to 4.5 metres (above pavement level) were included in the Proposal. Based on a consideration of urban design principals, noise walls in excess of four metres have been avoided due to potential adverse visual impacts. Preference would be given to noise barriers comprising vegetated earthen mounds over concrete noise walls where land and surplus spoil is available.

2) Requests for visual mitigation measures in specific locations have been noted and would be considered at the detailed design stage.

3) Preliminary landscaping and urban design works are shown in figures 13 to 18 of the environmental assessment. The urban design plan would be finalised at the detailed design stage in accordance with RTA guidelines. The RTA would be pleased to further discuss the proposed landscaping plan with the Urunga-Mylestom Chamber of Commerce at the detailed design stage prior to its completion.

2.13 Noise and vibration

2.13.1 Construction noise

Submission numbers

8 – Individual
15 – Individual
21 – Individual
27 – Individual
29 – Individual
34 – Individual
36 – Department of Environment, Climate Change and Water
41 – Individual

Issue description
Eight community submissions raised concerns regarding construction noise and its impact on nearby residents and its animals. Several submissions requested details of the proposed noise mitigation measures.

The Department of Environment, Climate Change and Water stated that any project approval would require the preparation of a construction noise management plan. The construction hours should comply with the standard hours of work prescribed by the *Interim Construction Noise Guideline* and should be reflected in the environmental assessment and draft statement of commitments.

Response
The assessment for construction noise impacts was undertaken in accordance with the Department of Environment, Climate Change and Water *Interim Construction Noise Guideline* , which specifies noise limits and working hours, amongst other requirements, for construction activities.

The construction noise assessment identified potential noise generating activities and their approximate noise level impact at distances from the construction corridor. Where these impacts are predicted to exceed the guideline noise levels, specific mitigation measures would be required.

To minimise noise impacts, the implementation of noise mitigation proposed for the Proposal, where feasible, may be considered prior to the commencement of construction. Buildings that have the potential to be affected by vibration during construction activities would have a dilapidation

survey completed as a matter of course. The mitigation to buildings would be based on a dilapidation survey prior to the application of any treatments.

The construction activities proposed for the Proposal would be assessed in greater detail during the detailed design phase, when more information on the final alignment and construction requirements are known. These activities would also be licensed by the Department of Environment, Climate Change and Water and monitored for compliance with the licence conditions. Monitoring of noise levels would be a mandatory requirement of the project approval.

Where there are unacceptable noise impacts at residences or other sensitive receivers, affected parties would have the ability to formally register a complaint. Any complaints on the Proposal would be recorded and a process implemented to address and mitigate these issues.

The Department of Environment, Climate Change and Water's requirement for a construction noise management plan has been noted. A key outcome for the Proposal is to minimise construction noise and vibration impact in accordance with the applicable legislation and guidelines. Construction noise and vibration would be managed through the construction environmental management plan to be prepared by the construction contractor. This would typically include sub plans, one of which would cover noise and vibration. Construction hours would conform to the requirements of the *Interim Construction Noise Guideline* and would be included in the applicable construction environmental protection licence to be obtained by the construction contractor.

The environmental assessment outlined proposed working hours which extend beyond the standard construction hours. However, additional mitigation measures have been included which commit the RTA to changing practices where unresolved complaints from the community occur. Refer to the revised statement of commitments (N6) in section 4.

2.13.2 Construction vibration

Submission numbers

27 – Individual
29 – Individual
34 – Individual
41 – Individual

Issue description

Four community submissions raised concerns regarding construction vibration and its impact on nearby buildings and animals. One submission requested details of how impacts on buildings would be mitigated.

Response

The assessment for construction vibration impacts was undertaken in accordance with the Department of Environment, Climate Change and

Water *Assessing Vibration, A Technical Guideline* and *the British Standard 7385*.

The effects of construction vibration on building structures and human comfort are well documented. These impacts would be managed through the application of limits specified in the British Standard for building damage and the Department of Environment, Climate Change and Water vibration guideline for human comfort. The potential for vibration impacts to occur is a function of distance from the works. Possible exceedances would be identified by their proximity to the works. Where buildings are in close proximity to the works, they would be the subject of a detailed dilapidation survey. To ensure that vibration levels do not exceed the guidelines, monitoring of vibration impacts close to buildings would be a mandatory requirement of the project approval.

Blasting may be required for construction of the Proposal. However, the areas where blasting would occur would not be finalised until the detailed design phase. If blasting was required, the effects of fly rock and vibration would be tightly controlled and managed to meet the Australian Standard AS2187.2. The requirement to make all reasonable attempts to contact sensitive receivers within 500 metres of a blast location is included in the revised statement of commitments (section 4).

2.13.3 Noise impact assessment

Submission numbers

22 – Nambucca Shire Council
36 – Department of Environment, Climate Change and Water

Issue description

Nambucca Shire Council and Department of Environment, Climate Change and Water raised issues regarding the noise impact assessment.

The Department of Environment, Climate Change and Water stated that the number of noise monitoring locations (eight) was low given the length of the Proposal. It also stated that additional noise monitoring, for the purpose of noise model calibration, would be required as part of the "review of operational noise mitigation measures" that is generally required as part of project approval.

Nambucca Shire Council made several recommendations, informed by an independent noise report that it commissioned. The report generally supported the RTA's project noise impact assessment. The three recommendations of the report were:

1) Recommended that further details be provided regarding the identification of noise sensitive vacant land within the study area. If noise sensitive vacant land is identified then an assessment of potential noise impacts is recommended at these locations.

2) Recommended that the predicted existing road traffic noise levels (for

current year 2007) be provided within (or as addendum to) the noise and vibration impact assessment report.

3) Recommended that the complete noise modelling results be presented for each scenario to show that the design criteria and allowances have been applied correctly and provide more clarity to the identified residents with regard to whether or not they will qualify for further noise mitigation investigation.

Response

The noise monitoring program and associated number of noise monitoring locations for the Warrell Creek to Urunga upgrade is considered to be adequate for the environmental assessment stage of the Proposal. The monitoring locations were selected to validate the noise model and to provide information on background noise levels for the construction assessment. The number of sites used for the validation reflects the availability of locations that are comparable with the proposed alignment, in terms of speed zones. Monitoring needed to be conducted at houses that were located in these zones and not unduly obstructed by terrain which may reduce noise impacts on the receptors. As a result, there were only a limited number of locations which fulfilled these criteria. Additional monitoring will be undertaken for construction and validation of the detailed design noise model.

There are several further noise monitoring and modelling exercises that would be undertaken prior to and after construction. These include:

- The detailed design refinement and finalisation of mitigation measures in accordance with the conditions of approval.
- Construction noise monitoring.
- Post construction, operational noise monitoring.

For further specific detailed responses to the Department of Environment, Climate Change and Water submission, refer to Appendix A of this report.

In response to Council's comments:

1) The noise impact assessment was undertaken by examining aerial photographs to identify potential noise sensitive receivers. There is therefore potential that some properties were omitted from the assessment. The assessment of vacant land was limited to vacant land that had a current or pending development consent at the time the environmental assessment commenced. In order to capture any properties not identified from the aerial photography or land that has a development assessment at the time of project approval, a reassessment of all receivers along the Proposal route would be undertaken during the detailed design phase.

2) The data included in table 3.5 and 3.6 of this report has been prepared in accordance with *Environmental Criteria for Road Traffic Noise* (EPA 1999) and the *Environmental Noise Management Manual* (RTA).

3) Table 5-4 of the Noise and Vibration Working Paper, and table 3-5 of this report provided details of the noise modelling results for each scenario for properties identified as having noise impacts above the base noise criteria.

2.13.4 Noise mitigation

Submission numbers

1 – Individual
2 – Individual
3 – Individual
6 – Bellbird Park Developments
8 – Individual
13 – Individual
15 – Individual
18 – Individual
19 – Individual
20 – Individual
22 – Nambucca Shire Council
26 – Individual
27 – Individual
31 – Individual
32 – Individual
34 – Individual
36 – Department of Environment, Climate Change and Water
41 – Individual
43 – Individual
47 – Individual

Issue description

Noise mitigation was raised in 20 submissions, including those from the Department of Environment, Climate Change and Water and Nambucca Shire Council. Numerous community submissions stated that noise mitigation measures would be required during Proposal construction and operation and questioned the adequacy and effectiveness of the proposed measures.

Noise barriers

1) Several submissions requested that additional noise barriers be constructed. Suggested locations were:

   - Near the Nambucca River Crossing.
   - Around Valla Beach.
   - Near the Valla Beach turnoff from the old Pacific Highway.
   - Near the Pearl at Valla development.
   - On the Kalang Bridge and its approaches.
   - Near the Bald Hill Road interchange.
   - Near land that is zoned for housing subdivision.
   - Near Old Coast Road.

2) One community submission stated that the environmental assessment was misleading as it stated that "locations identified for noise walls do not have residences directly opposite and therefore the potential for increase in noise are eliminated" whereas sheets 3 and 7 contradict this.

3) Department of Environment, Climate Change and Water stated that it did not accept the application of a 4.5 metre upper barrier height for the Proposal. Recommended that barrier heights should be guided by the RTA *Environmental Noise Management Manual* and should be justified using measures other than the status quo of other projects.

Low noise pavement

4) A number of submissions requested that low-noise pavement be provided in various locations including:

   - Near Macksville.
   - Near the Pearl at Valla development.
   - Near the intersection of Mattick Road.

5) Nambucca Shire Council recommended that information be provided with regard to the level of noise reduction achieved by the low noise road surface and what assumptions were made in the road traffic noise model in this regard.

6) Department of Environment, Climate Change and Water noted that the number of receivers requiring mitigation after the application of low noise pavement (table 5-3, column 4) did not appear to be correct.

At-residence noise mitigation

7) Some submissions questioned the effectiveness of at-residence noise mitigation measures and raised concerns that these may reduce amenity at treated houses, as they would require external doors and windows to be closed.

8) Department of Environment, Climate Change and Water stated that it required a quantitative assessment, based on feasible and reasonable considerations, for cases where clumped residences of more than three are proposed to be mitigated using architectural acoustic treatments in lieu of roadside barriers.

Response

A combination of noise mitigation measures would be implemented for the Proposal. This would include low noise pavement, noise barriers and at-dwelling treatments.

Noise barriers

1) The assessment of noise barriers (either earth mounds or noise walls) was based on the noise reduction benefit they provide to residential/noise sensitive locations. Because the cost of implementing noise barriers is high, they must provide a minimum level of benefit to receiver locations to make their implementation cost effective. The assessment of noise

barrier effectiveness was undertaken for all receivers along the Proposal corridor in accordance with practice note (iv) of the *Environmental Noise Management Manual*. Table 2-8 below provides a response to the suggestions for noise barrier locations.

Table 2-8 Response to noise barrier location suggestions

Location suggestion	**RTA response**
Near the Nambucca River Crossing.	Barriers were modelled but were found not to be effective for noise mitigation in this location.
Around Valla Beach.	The new highway has moved further west away from receivers in this location. The noise impact assessment didn't identify any exceedances in this area. Low noise pavement would be included in this location, therefore noise barriers would not be required.
Near the Valla Beach turnoff from the old Pacific Highway.	The new highway has moved further west away from receivers in this location. The noise impact assessment didn't identify any exceedances in this area. Low noise pavement would be included in this location, therefore noise barriers would not be required.
Near the Pearl at Valla development.	The RTA has prepared a noise impact assessment for the Proposal and has managed the potential noise impacts in accordance with *Environmental Criteria for Road Traffic Noise*. The conditions of approval for the development include the provision of measures to mitigate noise impacts from the existing highway. The RTA would implement feasible and reasonable noise mitigation measures should there be any additional noise impacts from the Proposal.
On the Kalang Bridge and its approaches.	At residence treatments proposed in this area. The position of residential properties overlooks the new alignment making noise barriers ineffective in this location (refer to section 5.5 of the Noise and Vibration Working Paper).
Near the Bald Hill Road interchange.	A noise barrier is proposed in this location (south of Bald Hill Road).
Near land that is zoned for housing subdivision.	The *Environmental Noise Management Manual* does not require review of potential development sites unless there is a development assessment as outlined in Practice Note (ii) (p87 of the *Noise Management Manual*). Therefore only properties with current development assessment s were considered in the noise impact assessment. Final dwelling noise treatment considerations would be made at the time of the detailed assessment. As such noise barriers would not be required.
Near Old Coast Road.	Combination of low noise pavement and at residence treatments is the most cost effective on sections of Old Coast Road. Also proposed is a noise barrier near Mattick Road.

2) Receiver numbers 132, 801, 806 and 812 referred to in this submission, would be considered for any potential increase in predicted noise levels during the detailed design noise modelling. However, it must be noted that:
   - These receivers were identified as requiring noise mitigation treatment in the environmental assessment and this would not be affected by a potential increase of 0.5 to 1.5 dB(A).
   - The noise barrier opposite receiver number 801, 806 and 812 is in cut and fill. Therefore it is likely to be an earth mound or a combination of earth mound and noise wall depending on the availability of fill for the Proposal. An earthmound would not be highly reflective creating minimal secondary noise impacts.
   - In some instances, the assessment indicated that the positive noise-reducing effects of noise barriers would be negated by the position of the barrier in relation to the road and the receiver. Noise barriers are only effective where they break the line of sight to the noise source. Examples and images of where noise walls in certain areas are not effective were provided in the section 5.5 of the Noise and Vibration Working Paper.

3) The reasonable feasible assessment has been followed in establishing barrier heights as per Practice IV of the RTA *Environmental Noise Management Manual*. The upper barrier height of 4.5 metres is consistent with noise walls that have been previously built on the Pacific Highway upgrades, particularly in rural landscapes. It should be noted that there have been no barriers higher than 4.5 metres anywhere along the Pacific Highway upgrade due to visual impacts, wind and solar shielding implications.

Low noise pavement

4) The response in relation to low noise pavement is provided in Table 2-9 below.

Table 2-9 Response to low noise pavement suggestions

Location suggestion	**RTA response**
Near Macksville.	Low noise pavement is included in the Proposal in this area from Warrell Creek to Letitia Close.
Near the Pearl at Valla development.	The RTA has prepared a noise impact assessment for the Proposal and has managed the potential noise impacts in accordance with *Environmental Criteria for Road Traffic Noise*. The conditions of approval for the development include the provision of measures to mitigate the noise impacts from the existing highway. The RTA would implement feasible and reasonable noise mitigation measures should there be any additional noise impacts from the Proposal.
Near the intersection of Mattick Road.	Noise barrier and at-residence treatments are to be provided in this area, therefore low noise pavement is not proposed in this location.

5) The corrections assumed for the modelling of the alignment for tyned asphaltic concrete and low noise pavement are +2.5 dB(A) and -2 dB(A) respectively when compared to dense grade asphalt.

6) The errors within table 5-3 of the Noise and Vibration Working Paper appear to be a formatting error. The corrected table is presented in section 3.5 of this report.

At residence noise mitigation

7) In areas where instances of low noise pavement and or noise barriers located in the Proposal corridor would not provide a benefit to multiple properties, architectural treatments were recommended to mitigate noise impacts. It is acknowledged that architectural treatments of buildings are generally only effective when windows and doors are closed. However, architectural treatments recommended for the Proposal also cover works for local noise barriers and mounds within a property, where building treatments are not preferred. The cost/benefit of these at property treatments would be considered during detailed discussions with individual property owners.

   The implementation of mitigation measures would be scheduled to precede or coincide with construction to provide maximum benefit.

8) All properties were assessed for noise barrier options based on the prediction of benefits that could be achieved at the most affected residence. In the case of residences that are clumped together, a greater benefit is achievable however the minimum performance criteria still apply. Where the minimum performance criteria for a noise barrier cannot be achieved, architectural or at property treatments have been recommended.

2.13.5 Operational noise impact

Submission numbers

2 – Individual
12 – Individual
13 – Individual
15 – Individual
18 – Individual
23 – Individual
26 – Individual
36 – Department of Environment, Climate Change and Water
41 – Individual

Issue description

Nine community submissions raised concerns about noise impacts on nearby residences during Proposal operation.

The Department of Environment, Climate Change and Water stated that it did not support the assessment criteria for the Nambucca Heads rest area and stated that it should be reassessed in the revised environmental assessment.

The Department of Environment, Climate Change and Water also stated that the revised environmental assessment should include confirmation that the traffic noise predictions for the design year (2022) have been included in the cumulative traffic noise, as opposed to only Proposal-related traffic noise.

Response

The noise levels generated from the proposed rest area were assessed in accordance with the *Industrial* Noise Policy (EPA 2000). The monitoring location selected was representative of the receiver nearest to the rest area. The RTA acknowledges that additional monitoring would be necessary at the most affected receivers during the detailed design phase. Further details of the traffic noise predictions at Nambucca Heads rest area are provided in Appendix A. A revised environmental assessment is considered unnecessary and not required.

Additional traffic noise predictions to identify cumulative noise impacts for the design year have been included in Appendix A. Cumulative impacts for these locations would be further assessed during detailed design.

2.14 Aboriginal heritage

Submission numbers

30 – Land and Property Management Authority
36 – Department of Environment, Climate Change and Water

Issue description

The Land and Property Management Authority and the Department of Environment, Climate Change and Water made submissions relating to the impact of the Proposal on Aboriginal heritage.

1) The Land and Property Management Authority noted that the Proposal would affect two land parcels that are subject to Aboriginal land claims. As such, the Land and Property Management Authority cannot enter into any dealings pertaining to the land and the land cannot be compulsorily acquired.

2) Department of Environment, Climate Change and Water stated that all reasonable efforts must be made to avoid impacts to Aboriginal cultural heritage values at all stages of the development proposed works and that a construction heritage management plan be developed in consultation with local Aboriginal stakeholders and Department of Environment, Climate Change and Water.

Response

1) The submission identified land subject to Aboriginal land claims. Specific property negotiations would be undertaken with the Nambucca Local Aboriginal Land Council and the NSW Aboriginal Land Council in relation to these properties prior to construction.

2) The Department of Environment, Climate Change and Water submission identifies the need for considered cultural heritage management in all phases of the proposed upgrade. The proposed design incorporates specific measures to avoid, minimise and mitigate potential impacts to Aboriginal cultural heritage. This has been a key consideration in developing route options, selecting the preferred route and refining the design throughout the environmental assessment process. Prior to construction, the RTA would prepare a cultural heritage management plan in consultation with Department of Environment, Climate Change and Water and Aboriginal stakeholders.

2.15 Water quality and hydrology

2.15.1 Operational water

Submission numbers

27 – Individual
36 – Department of Environment, Climate Change and Water

Issue description
Department of Environment, Climate Change and Water and a community member made comments regarding the management of water during Proposal operation.

1) Department of Environment, Climate Change and Water requested further information regarding the intended number and location of permanent basins proposed and/or the process for determining operational phase water quality requirements, detailing the indicative locations for this Proposal as an end result.

2) The community submission asserted that the environmental assessment did not adequately detail stormwater management measures.

Response
1) Figures 6-1 to 6-4 of the environmental assessment indicated design features of the Proposal, including construction phase sediment basins. Some or all of these could be used as permanent water quality basins during operation. The number of permanent basins would be identified at the detailed design stage of the Proposal and would depend on an assessment of all proposed permanent water quality controls (eg a Modelling Software for Urban Stormwater Improvement Conceptualisation (MUSIC) assessment).

Permanent water quality basins would be required at locations where alternative treatment measures such as vegetated swales cannot achieve the water quality treatment objective and where spill containment measures would be required. The provision of permanent basins would be subject to specific site constraints.

2) Stormwater management measures were detailed in section 6.5.4 of the environmental assessment. The proposed stormwater management measures included major cross culverts and bridges, pavement drainage, sub-surface drainage, open catch drains and cut-off drains and water quality basins. The final design of the system would be determined in the detailed design stage of the Proposal.

2.15.2 Changes to existing flooding regime

Submission numbers

8 – Individual
9 – Individual
10 – Individual
12 – Individual
22 – Nambucca Shire Council
25 – Individual
34 – Individual
35 – Industry and Investment NSW
36 – Department of Environment, Climate Change and Water
42 – Individual
46 – Individual
48 – Individual

Issue description

Eight community members, Nambucca Shire Council, Industry and Investment NSW and the Department of Environment, Climate Change and Water raised concerns about the impact of the Proposal on the existing flooding regime.

Specific issues raised were:

1) Oyster Creek:
   - The type of structure that would be constructed over Oyster Creek as pipes would create a dam effect.
   - Certain culverts would not be joined to natural drainage creeks.
   - A creek at Valla Beach would be buried under the new highway and local service road.
   - Residences to the west of the highway around Valla Beach would be vulnerable to flooding without adequate drainage.
   - The position of the fence alongside Oyster Creek.

2) The proposed earth fill embankment across the floodplain, downstream of Macksville would worsen the flooding. It was questioned how the RTA would ensure the risk of flooding in Macksville is not increased.

3) The proposed earth fill embankment would block a floodway downstream of the junction of Newee Creek and Nambucca River, which would prevent floodwater from Newee Creek access to the floodway and could cause significantly greater flooding impacts for properties on both sides of the Nambucca River.

4) Drawings in the environmental assessment show an increase in water level on the western side of the proposed earth fill embankment across the floodplain.

5) How the Proposal would impact on McGrath Creek.

6) Nambucca Shire Council recommended that the RTA undertake further modelling and design modification to ensure that the proposed highway across the Gumma Floodplain and the northern side of the Nambucca River has no affect on the flood levels upstream from the proposed route.

7) Industry and Investment NSW recommended that the flooding assessment and proposed impacts mitigation measures be presented to the floodplain community and possibly the local emergency management committees (Bellingen and Nambucca) to obtain comment and feedback from people with local knowledge and experience as well as people that may be affected.

8) Two submissions queried why no ground/ floor levels of premises were taken in the methodology of flood assessment.

9) Department of Environment, Climate Change and Water requested clarification on the flood mitigation measures proposed for one residence proposed to be potentially affected by the Kalang River 100 year ARI.

Response

1) Drainage would be provided across the highway through the use of culverts. The creek at Valla Beach is Oyster Creek and its tributaries. A new culvert under the proposed new carriageway and local access road is proposed at Oyster Creek, coinciding with the existing highway culverts. Oyster Creek is to be diverted to the new culvert piping water under the new highway and then into Oyster Creek. The final drainage design would be completed at the detailed design stage. The culvert arrangement in the vicinity of Oyster Creek is shown in section 3.6.1. Members of the project team have inspected the potential drainage issues in this location and the final design would take into consideration the potential impacts on flooding.

   The fencing referred to in proximity to Oyster Creek is a proposed headlight screen. The exact location of which would be determined at the detailed design phase. The headlight screen design would not impede drainage flow.

2) The flood assessment of the Nambucca River for the Proposal environmental assessment found that flood levels in the 100 year ARI flood

event would increase by less than 20 millimetres immediately upstream of the Proposal alignment.

Flood modelling was performed as part of the environmental assessment of the Proposal. The modelling was performed to quantify the likely impact of the Proposal on flooding. The models were calibrated and validated to actual recorded flood events and were found to effectively replicate the flood records from those events. The modelling was reviewed by and endorsed by the Department of Environment, Climate Change and Water. An independent peer review has been undertaken and is included as Appendix B.

The flood modelling indicated that a road embankment could be constructed across Gumma Swamp and cause only minor changes in flood levels (less than 20 millimetres immediately upstream of the Proposal alignment), in a 1:100 year event which is within the target criteria of less than 50 millimetres increase as specified in the environmental assessment.

As part of the detailed design for the Proposal, the RTA will remodel Nambucca River flooding to confirm the impact of the proposed river crossing. The modelling will include flooding events up to and including the 2000 year ARI flood event.

3) In response to submissions received, the RTA has selected the bridge option (identified as option two in the environmental assessment) as the preferred option for traversing the floodplain north of proposed bridge crossing of the Nambucca River to the existing Pacific Highway.

   For an expected marginal increase in cost, the bridge option would provide:

   - Reduced potential flooding impacts with and without climate change consideration.
   - Further contingency for climate change effects.

   The bridge option would be further refined as part of the detailed design in accordance with the performance criteria identified in the environmental assessment.

4) The environmental assessment stated that a number of flood mechanisms operate during a flood into Gumma Swamp from the Nambucca River. The initial mechanism is water backing up Gumma Gumma Creek into Gumma Swamp. In large floods, as the flood water rises, another mechanism commences with water breaching the river banks. Initially this occurs downstream of the Proposal and finally upstream of the Proposal.

   Flood modelling predicted an increase in flood levels upstream of the Proposal when this third mechanism occurs and this outcome was provided as mapping in the environmental assessment.

5) A twin highway bridge would be provided over McGrath Creek. Existing flow patterns would be maintained and fauna passage beneath the

bridge would be provided. Impacts on McGrath Creek would be limited to the construction period. These impacts would be managed and minimised through the contractor's construction environmental management plan.

6) Flood design criteria were set as a part of the environmental assessment. As previously stated, detailed flood modelling was performed to test whether the design for the Proposal could meet the flood design criteria. These models were calibrated, validated, and reviewed by the Department of Environment, Climate Change and Water and an independent peer review was undertaken.

   As part of the detailed design for the Proposal, the RTA will remodel Nambucca River flooding to confirm the impact of the proposed river crossing. The modelling will include flooding events up to and including the 2000 year ARI flood event.

7) Industry and Investment NSW's suggestion that the RTA consult further regarding flood modelling has been noted. It should, however, be noted that the flood modelling process was widely communicated to Department of Environment, Climate Change and Water and the floodplain community during the route selection process and development of the environmental assessment. The floodplain community was very active in guiding the flood modelling and the outcomes of the environmental assessment. It is anticipated that this level of engagement would continue in the detailed design phase.

8) RTA will undertake a detailed floor level survey and assessment of potentially affected properties as part of the detailed design phase for this Proposal.

9) Regarding the Department of Environment, Climate Change and Water's request to clarify flood mitigation measures proposed for the Kalang River, the modelling indicated that there was only one property within the Kalang River floodplain that would be highly vulnerable to flooding. It is recognised that the Proposal would worsen the flooding impacts on this property, however, the increase in flood risk caused by the Proposal would be small in relation to the existing flood risk to the property.

2.15.3 Flood impact assessment

Submission numbers

10 – Individual
21 – Individual
22 – Nambucca Shire Council
24 – Individual
25 – Individual
36 – Department of Environment, Climate Change and Water
37 – Individual
44 – Individual
48 – Individual

Issue description

Six community members, Nambucca Shire Council and Department of Environment, Climate Change and Water made submissions regarding the flood impact assessment.

Seven community submissions raised questions about whether the flood impact assessment had taken into account certain factors, including:

1) Flooding history (including flooding in the following years; 1950, 1962, 1963, 1974).

2) Lowered flood plains.

3) Existing flooding and backwater problems in North Macksville.

4) That the flood waters break over at the southern end of King's Point.

5) Future development, including roads, car parks, the showground and soil mounds.

6) Spill from dams onto private property.

7) Flood levees in Macksville.

8) One community submission questioned the suitability of using data from Bellbrook and Bowraville in the hydrographic model, given that it is 40 kilometres away.

Several community submissions questioned the methods employed to conduct the flood impact assessment. Questions raised included:

9) Why the environmental assessment did not include details of the probable maximum flood (PMF) measure, which describes and evaluates worst-case scenario flooding impacts.

10) Why the environmental assessment did not consider the scenario of 100 year ARI river flood occurring concurrently with the 100 year ARI storm surge of 2.6 metres.

11) Why the Gumma Swamp was required to contain some water at the start of the flood event.

12) Why the environmental assessment did not consider the flooding effects on North Macksville.

13) Whether the flood model accounted for a 40 centimetre rise in sea level.

14) Whether the 0.55 Australia Height Datum is relevant to climate change.

15) Community submissions drew attention to a paper by Drew Bewsher and John Maddocks, of Bewsher Consulting Pty Ltd., "Do we need to consider floods rarer than 1 per cent AEP?"

A number of community submissions disputed the findings of the flood impact assessment. Specific points raised included:

16) Flooding impacts in a worst case scenario, are more likely to be in the order of metres, rather than millimetres as suggested by the environmental assessment.

17) There is evidence to suggest that the depth of water across the Gumma Swamp floodplain is incorrect by 1000 mm, or 5000 per cent.

18) The drawings show an increased water level on the upstream side of the new highway, which indicate that contrary to the environmental assessment's claims, the four culverts under the proposed highway would not allow the free movement of flood water on the Gumma Floodplain.

19) The drawings show that an area to the east of Old Coast Road would not be inundated by water until a 1 in 2000 year flood; however, this area has been flooded each year for the past nine years.

20) Contrary to the claims in the environmental assessment, the Nambucca River flows west up Tilly Willy Creek, flooding low areas.

21) Questioned how the environmental assessment is able to claim that there would be no flooding impacts upstream of the Proposal if the flood model cannot be calibrated.

22) The environmental assessment states that "the majority of the flood volume in Gumma Swamp flowed east to west, towards Macksville"; however, the working drawings showed that the water would build up on the western side of the Proposal.

23) The environmental assessment states that "the river would over top the bank downstream, and well to the east of Macksville at Gumma and then the flood water would move from east to west in an upstream direction as it filled Gumma Swamp"; however, this situation would only occur during a comparatively minor flood and the drawings show a different scenario during a more severe flood.

24) In a severe flood, flood water would not flow from the Nambucca River to fill Gumma Swamp from a westerly direction. It would overtop the riverbank before it reaches Gumma Creek and travel downstream from west to east.

25) One community submission suggested that drawings were omitted from the environmental assessment because they showed the flooding impacts.

26) Two community submissions raised concerns that building the highway in the wetlands would create a dam and cause the flooding of nearby properties, which could potentially threaten lives.

27) One community submission suggested that the RTA develop a means for the water to flow across the floodplain back into the river, like it used to.

28) Nambucca Shire Council noted that there is a difference in the existing 100 year ARI flood level at the site of the proposed new bridge over the Nambucca River between the existing Nambucca River flood study of approximately 3.4 metres AHD and the appropriate level of 3.77 metres AHD in section 2.3.12 of the flood study. Therefore, there is a discrepancy of 370 millimetres in the 100 year ARI event without the new crossing of the Nambucca River Floodplain. The environmental assessment stated that this would further increase flooding by up to 40 mm. Council has used the same 3.4 metre AHD plus a 500 millimetre freeboard for all new dwellings in the flood areas. The environmental assessment flood model would reduce this freeboard by 410 millimetres before the impacts of climate change are taken into account. Council requested that an independent flood modelling expert be engaged to critically review the flood modelling and flood level predictions.

29) Nambucca Shire Council also noted that the flood study discusses the movement of flood water from the east through the floodplain and back to the west, though the modelling figures clearly show that the proposed highway would act as a levee, increasing the floodwaters on Macksville township by up to 40 millimetres whilst the eastern side of the proposed highway decreases by up to 20 mm. It recommended that an independent flood modelling expert be engaged to critically review the flood modelling and flood level predictions so as to confirm the number of properties that would be affected by the identified increase in flood levels.

30) The Department of Environment, Climate Change and Water stated that it would expect refinements to flood modelling and model calibration in the detailed design phase of the Proposal in light of the anticipated changes to Engineers Australia's *Australian Rainfall and Runoff*, which will provide improvements to methods for deriving hydrological estimates.

Response

In response to community concerns that certain factors were not taken into account in the flood modelling

1) The flood history of the area was an important element of the flood model. Any hydrologic modelling process requires calibration to establish if the models can replicate the recorded flow gauges from real floods. The flood model for this Proposal achieved good calibration with recorded historical events, which provided confidence that the flood model gave representative results and modelled the impacts of the Proposal well.

Many rainfall gauges and flow gauges exist in the catchments of the Proposal. Only the most useful gauges were selected and these were commonly the gauges with the longest and most reliable history of data collection.

The events selected for calibration were the ones that had the most reliable record of rainfall and river flow. A range of sizes of flood events was also used to evidence that the models could replicate real flood events of varying sizes.

News reports from the 1977 floods refer to imperial flood measurement of 10'9". It is not accurate to compare it to the findings of the environmental assessment flood reporting. All flood gauges are surveyed to a datum so that a level can be monitored and reported. Almost all current gauges are surveyed relative to the Australian Height Datum . This gauge was not surveyed to Australian Height Datum at the time of the 1977 flood and all levels reported from this gauge are required to be translated. This gauge was surveyed to Nambucca Hydro Datum which requires a conversion of 1.106 metres to be converted to Australian Height Datum.

2) Sound floodplain management requires that new houses are constructed above the 100 year ARI flood level, with an adequate freeboard above that. Relative to the development of the Nambucca floodplains, this requirement is recent and thus there are many dwellings on the floodplain that are flood prone.

   The management of the development of houses on the floodplain is the responsibility of a local council and the Department of Environment, Climate Change and Water, both of which have implemented a Floodplain Management Plan to make sure that this occurs.

   The purpose of the flood modelling for the environmental assessment was to establish if the Proposal could be developed with manageable impacts on regional flooding. The future planning of urban development on the floodplains remains the responsibility of a local council and the Department of Environment, Climate Change and Water.

3) The flooding investigations for the environmental assessment considered the "existing case", which took into account the terrain of the region and existing infrastructure elements such as the existing highway. The investigation then compared the existing case to the flooding conditions with the Proposal in place. It was predicted that the impacts would be limited to the areas as shown in the mapping shown in the environmental assessment. The flow pattern from the Nambucca River up Newee Creek in large floods was a consideration of the flooding investigations and a part of the flood models.

4) The flooding presented in the environmental assessments represents the design flood events. The flooding has predicted that there will be no impact on flood levels at Kings Points due to the development of the Proposal.

5) Nambucca Shire Council participated in the flood modelling process and informed the process with planned future development in the floodplain. It is the responsibility of council to assess any new development of residential, commercial and industrial land uses in the floodplain in accordance with the requirement of numerous state and federal codes and laws. During the environmental assessment process, there were no planned developments in the floodplain that were found to be likely to alter the outcomes of the environmental assessment findings.

   A digital terrain model was used as the basis for the new flood modelling. The digital terrain model was accurate to 100 millimetres in the vertical dimension. The flood modelling was then developed as a grid of 9 metres by 9 metres. As such, many features at the fine resolution stated were a part of the flood model. To make sure that critical features such as levees and roads were a part of the model, they were specifically collected and forced into the flood model to ensure that their effects were replicated.

6) The purpose of the flood modelling was to assess the impact of the new highway relative to the existing environment. It is true that dams overtop in large flood events and it is expected that this would not be different for the Nambucca River floodplain. However, the development of the Proposal would not alter the outcome of a large rainfall event. It is appropriate for this question to be dealt with in the context of a regional flood study or a floodplain management strategy, which is the responsibility of Nambucca Shire Council and the Department of Environment, Climate Change and Water.

7) The flood modelling for the environmental assessment was developed in consultation with the Department of Environment, Climate Change and Water and Nambucca Shire Council. The consideration of levees and other future floodplain management elements were not a part of the scope of this environmental assessment and would not be required as a result of the Proposal.

8) Regarding the suitability of using data from Bellbrook and Bowraville, hydrology is a science of statistical analysis. Long-term gauged data sets, such as rainfall and river flow, are used to predict the rainfall and flows that would occur in a rare flood event, such as a 100 year ARI event. Many rainfall gauges and flow gauges exist in the catchments of the Proposal. However, only the most useful gauges were selected and these were commonly the gauges with the longest and most reliable history of data collection. The hydrologic models methodology and results have been reviewed by and endorsed by the Department of Environment, Climate Change and Water.

9) The probable maximum flood (PMF) is a flood event that is, theoretically, the largest flood event that could occur in a river system. It is not common to consider such events in an environmental assessment and attention is normally given to events that are more likely to occur. As such, modelling of the PMF was not undertaken for the environmental assessment; however, it would be likely that in such a massive event the road embankment would be overtopped. It would also be likely that the embankment would, in hydraulic terms, act as a "drowned weir". That is, upstream and downstream water levels would become almost identical as the flooding through Gumma Swamp and the Nambucca River could not escape due to natural constrictions downstream of Gumma Gumma Creek in the river. In this situation, the presence of the Proposal would not alter the magnitude of the damage that would occur in the flood. The flooding scenarios assessed were in agreement with the Department of Environment, Climate Change and Water requirements.

   It is worth noting that the flooding of such an extremely rare event is well beyond anything that has ever been gauged in Macksville in the history of its development. The damage from such an event would be catastrophic and it is common practice to consider such an event in a floodplain management strategy so that adequate emergency response planning is in place.

10) A 100 year ARI river flood would almost certainly not occur at the same time that a 100 year ARI storm surge occurs. A storm surge occurs when a large, deep low pressure system sweeps in from the coast, pushing up ocean levels. A river flood occurs when a cell of storms within a rainfall depression sit over the catchments for a duration of days.

    It is common practice to predict the impacts of these two different floods as separate model, however, in each model, it is common to assume that a smaller event is happening at the same time. It is therefore, common to look at the impacts of a 100 year ARI storm surge on the assumption that a 10 year ARI river flood is happening at the same time. Conversely, it is common to look at a 100 year ARI river flood while a 10 year ARI storm surge is occurring. This is a conservative approach and was adopted for the flood modelling in the environmental assessment, in agreement with the Department of Environment, Climate Change and Water.

    The likelihood of a 100 year ARI river flood occurring at the exact same time as the peak of a 100 year ARI storm surge occurring is much less likely than 1 in 100 years. To consider this scenario would be an exaggeration of the flooding risk and could lead to poor design outcomes that would be inconsistent with Council's floodplain management planning.

    During the flood modelling there was a sensitivity analysis performed. This analysis looked to see whether a change in the tide level had an influence on the river flood levels. It was found that it did, but this influence did not extend upstream as far as the Proposal or Macksville.

11) In the flood models, it was important to "pre-wet" the Gumma Swamp to achieve a calibration. This was because the area is very close to the regional water table and thus, it was expected that the days of rain that commonly occur prior to a flooding rain event would produce standing water in the swamp.

12) The flood modelling was calibrated to the 1977 flood event and the flood was well replicated by the computer models, especially in the area of the Proposal. Calibration was not as strong upstream of Macksville and the models predicted flood levels higher than those recorded at the time. The environmental assessment resolved that this was most likely due to physical changes across the river and in the floodplain upstream of Macksville since 1977. The flood models for the environmental assessment included North Macksville. The existing flooding problems were determined in the flood modelling. It was determined that the Proposal would have little impact on the flooding of the area relative to the existing flooding risk.

13) Climate change was a strong consideration of the environmental assessment and was specifically addressed in a number of parts of the environmental assessment, including flooding.

    The RTA and the Department of Environment, Climate Change and Water agreed on a number of methods to predict how climate change would affect flooding, based on the most recent estimates of climate change impacts on flooding from the ocean and from rainfall. This included a concurrent increase in rainfall and sea level.

    The RTA adopted an adaptive approach to its climate change response as climate change knowledge is still developing. These adaptive measures were detailed in section 16.4.2.4 of the environmental assessment. The RTA chose to adapt later (meaning that necessary upgrades would be made in the future when the impact of climate change in this location is more certain) to other elements that are easily retrofitted, such as a road surface. Road surfaces degrade with time and need regular replacement. The decision to raise the road could be made in the future and the investment made with more up-to-date estimates of climate change flooding.

14) Refer to the response provided in section 2.15.3 (item 13) of this report.

15) Bewscher and Maddocks' paper, which was referred to in a community submission, relates to practices for development of a floodplain management strategy and not an environmental assessment. The development of such a strategy is the responsibility of council and the Department of Environment, Climate Change and Water, both of which were consulted during the development of the environmental assessment. The paper stated that floods rarer than 100 year ARI are commonly used for the design of infrastructure. This was the case for this environmental assessment, in which the 2000 year ARI was considered.

In response to the community comments regarding the findings of the flood impact assessment:

16) The environmental assessment considered the impacts of the Proposal on theoretical flood events of a range of sizes. The focus of the environmental assessment was the 100 year ARI flood event, as this is of the scale that the road would be expected to have to manage at least once in its design life. It is true, however, that flood events larger than the 100 year ARI flood could occur. The 2000 year ARI flood was also considered in the environmental assessment to establish an embankment design and a bridge design that could withstand the pressures of such an extreme event.

    The basis of the stated 1000 millimetre error in the environmental assessment flood models relates to observations of a terrain depression adjacent to the respondent's property, and his belief that the models are 1000 millimetres in error at this point. This is localised ponding within an area that may have once been a wetland prior to being converted for agriculture. The environmental assessment flood studies were designed for the purpose of assessing the likely impact of flooding in the vicinity of the Proposal and to determine the location and size of proposed drainage structures. The flood model did not endeavour to accurately replicate flood levels in this area as the focus of the assessment is the river flooding from the Nambucca River and its tributaries.

    The reference to a 5000 per cent error is not an accurate depiction of the situation. The respondent suggested that a 1000 millimetre error is 50 times larger than the impact of the road and calculated this to be a 5000 per cent error. This calculation is not correct.

17) The flood models predicted that there would be a small increase in flood levels in Gumma Swamp on the upstream side of the Proposal alignment. A part of this increased flood level relates to flood conveyance, where water passes through a culvert bank where, currently, it flows across a wider floodplain. A separate part of the cause of the increase comes from the volume of fill that is placed in the floodplain to construct the road. This fill removes floodplain storage capacity, thus displacing water. The environmental assessment design considered both aspects in developing a design that minimised the removal of floodplain volume and minimised the alteration of flood flow patterns.

18) The flood modelling for the environmental assessment found that the new road would need four culverts to allow water to flow across the floodplain without impacting flood levels beyond the target of 20 millimetres. Culvert blockage was taken into consideration in the investigation, but it is not expected to be a significant issue as the catchments immediately above the proposed culverts are not heavily wooded and the flow velocities would not be high enough through the culverts for the blockages to greatly vary the outcomes.

Further flood modelling for the design of the culverts (including consideration of culvert blockages) would be undertaken at the detailed design stage.

19) There are a number of terrain depressions on the east side of Old Coast Road and the one referred to in the submission is in the order of 20 hectares in area and 1000 millimetres deep. It is expected that this would be frequently full of water and full in flood events smaller than the 100 year ARI. It may have previously been a wetland before being converted to agriculture.

    The flood model for the environmental assessment focussed on the river flooding of the Nambucca River and its tributaries, with a particular focus on the Proposal. One assumption in the flood model was that water from small, local catchments was modelled to show the flow being delivered directly to the river rather than flowing across minor gullies. This was the case in the Old Coast Road area, in which the local catchment up to Old Coast Road and down to the Watt Creek floodplain was lumped up and delivered to the river.

    It is expected that areas, such around Old Coast Road, would experience regular local flooding from the nearby catchments and that this water would pond, as described by the respondent.

20) The flood modelling replicated the way that a flood would back up out of the Nambucca River into Tilly Willy Creek during flood events. It is true that Tilly Willy Creek would expect a local "first flush" from rain that falls onto its own catchment and every time that a burst of rainfall passes over the catchment, the local creek catchment would respond. However, the worst flood levels would be experienced as water backed up from Nambucca River, especially at the northern end near the mouth of the creek. The flood modelling replicated this mechanism well.

21) The flood modelling was calibrated and validated well in the Nambucca River and floodplains. The calibration methods and the flood records used were, as much as possible, aligned with the approved floodplain management strategy used by Council and the Department of Environment, Climate Change and Water, to make sure that the findings were consistent.

    A strong calibration of the model was achieved. This gave confidence that the models would replicate the flood patterns of design events such as the 100 year ARI and would predict the affects of the Proposal on regional flood levels.

    The models were developed in consultation with Council and reviewed by the Department of Environment, Climate Change and Water.

22) The environmental assessment flooding report described a number of flooding mechanisms that occur during a large event in the Nambucca River. The initial mechanism is water backing up Gumma Swamp, and then the banks east of the Proposal are breached flowing to Gumma

Swamp. At the peak of the flood the banks of the Nambucca River are breached to the west of the Proposal. The flooding investigations and flood modelling considered all of these mechanisms and modelled them in detail to produce the results of the environmental assessment report.

23) Refer to response provided in section 2.15.3 (item 22) of this report.

24) The flooding investigation report outlined the numerous mechanisms that occur during a flood of the Nambucca River into Gumma Swamp. One of these mechanisms is the initial flooding of Gumma Swamp from Gumma Gumma Creek from east to west. Later mechanisms include overbank flow from the Nambucca River both upstream and downstream of the Proposal. The Department of Environment, Climate Change and Water was engaged prior to the commencement of flooding investigations for the environmental assessment and endorsed the methods prior to commencement. The methods used for this study are considered standard practice. An independent peer review of the environmental assessment flood study has been prepared and is included as Appendix B.

25) The flooding impacts for "as predicted" by the flood modelling for the environmental assessment were mapped and figures presenting these impacts are provided in the appendices of Working Paper 5 of the environmental assessment

26) In response to the community concerns that the Proposal would create a dam and cause the flooding of nearby properties, the flood assessment of the Nambucca River for the Proposal environmental assessment found that flood levels in the 100 year ARI flood event would increase by only a small amount. It was found that the Proposal could be developed without altering the existing risk to life and property. This would be investigated further, if the Proposal is approved to proceed to the detailed design phase.

27) The aim of the flooding assessment was to minimise the increase flood levels and limit the alteration of the flooding regime as a result of the development of the Proposal.

28) The 1994 PWD flood study forms part of the floodplain management process and was endorsed to be used by Council to define development controls in Macksville. The 1994 PWD study was used as the basis for comparing the impacts of potential route options for the upgrade of the highway and in the selection of the preferred route. It was recognised that more detail than that available from the 1994 study was needed to accurately assess likely impacts, drainage features and structure sizes for the Proposal. A more detailed model was prepared for the environmental assessment flood studies.

    Available rainfall and flow gauging data to 2009 was included in the environmental assessment flood study.

29) For the 100 year flood the environmental assessment flood study predicted more rainfall and greater flows than the 1994 study. The RTA adopted the greater predicted flows and higher levels for the environmental assessment. Bridges and floodplain structures for the Nambucca River crossing were sized using the higher flows and levels. The Proposal environmental assessment flood studies were developed in consultation with the Department of Environment, Climate Change and Water. The RTA has commissioned an independent peer review of the environmental assessment flood study.

30) It is agreed that changes to hydrologic design standards are anticipated to be recommended by Engineers Australia prior to the commencement of the detailed design phase of the Proposal. The detailed design process would require new flood modelling and this would entail a new calibration and validation of modelling tools and new prediction of design flood levels.

2.15.4 Groundwater

Submission numbers

36 – Department of Environment, Climate Change and Water
49 – NSW Office of Water

Issue description

Submissions from Department of Environment, Climate Change and Water and the NSW Office of Water raised questions about the groundwater impact assessment and requested the inclusion of the term 'minimum design standard drainage structures' for areas adjacent to wetlands and saturated soils.

The NSW Office of Water stated that the environmental assessment should have provided details of bore logs or bore numbers, groundwater locations with respect to cutting locations and water bearing zones taken from bore logs with respect to cutting depths, as these may assist with identifying potential impacts. The NSW Office of Water also raised concerns that acid sulphate soil disturbance may impact on the groundwater quality.

The Department of Environment, Climate Change and Water stated that more detail was required around how groundwater quality impacts and associated changes to hydrological regimes would be mitigated. It also requested clarification regarding whether groundwater monitoring would be undertaken prior to construction to establish suitable baseline conditions.

Response
There are a number of groundwater bores in the study area, however, information on water quality within these bores is limited. Information in relation to groundwater levels and quality has been obtained primarily from information gathered during the preliminary geotechnical investigations for the Proposal. The groundwater drawdown as a result of the Proposal is expected to be greatest in and surrounding cuts where the current groundwater level is greater than three metres above the base of the cut. This

would occur in two cuts in section 4 and four cuts in section 1 and one cut in section 3. To mitigate the potential for impact on groundwater dependent ecosystems, minimum design standard drainage structures would be used in areas adjacent to wetlands and saturated soils, to maintain the hydrological regime.

Section 16.4.1.3 of the environmental assessment acknowledged the need to undertake baseline monitoring of groundwater levels and quality at selected cuttings in advance of construction.

There is the potential for acid sulphate soil to impact on groundwater quality. Sediment basins are not proposed on floodplains due to the potential risks to ground and surface water.

If acid sulphate soils were disturbed, any acid produced would be neutralised, and acid waste leaving the site would be prevented using appropriate measures in accordance with the *Acid Sulphate Soil Manual* (ASSMAC 1998). Monitoring of water downstream of acid risk soils would also be undertaken to allow early identification of potential risks from acid sulphate leachate and to ensure mitigation measures are implemented in a timely manner.

2.15.5 Impact of climate change on flooding

Submission numbers

12 – Individual
20 – Individual
21 – Individual
22 – Nambucca Shire Council
25 – Individual
44 – Individual
48 – Individual

Issue description

Five community submissions and the submission from Nambucca Shire Council raised concerns regarding the impact that climate change and rising sea levels would have on the Proposal, specifically in relation to flooding.

Several community submissions stated that the impact of climate change on flooding was not adequately considered in the environmental assessment. Points of particular concern made in this regard were that the environmental assessment did not:

1) Evaluate the impact of sea level rise and increased rainfall together.

2) Use the PMF measure.

3) Take into account increased shoaling in the entrance to the bay and specify whether it was modelled to be open or closed.

4) One submission questioned the accuracy of the flood modelling results as there is a significant (20 millimetre or 150 per cent) reduction in impacts compared to those presented during the route selection phase.

A number of community submissions requested additional information, including:

5) Quantification of flood heights, velocities and flood hazards for a 1 in 100 year flood event, taking into account climate change.

6) Detail of how far under water the proposed Macksville Bridge would be in the event of increased rainfall and sea level rise in a PMF.

7) Quantification of number of residences and businesses that would flood in the event of a 1 in 100 year flood that takes into account climate change.

8) Detail of why the Proposal would not be flood-free when it has been designed to last 100 years.

9) Nambucca Shire Council recommended that the RTA undertake further modelling and design modification to ensure that the height of the roadway would be well clear of the estimated height of a 1 in 100 year flood and the forecast 2050 sea level rise. The environmental assessment indicated that the Proposal would provide flood immunity for at least one highway carriageway for a 1 in 100 flood event, but did not indicate whether this standard takes into account climate change. If it does not take into account climate change then a higher road surface may require additional culvert capacity.

Response

In response to community comments regarding factors that weren't considered in the environmental assessment:

1) Refer to response provided in section 2.15.3 (item 30 of this report.

2) Refer to response provided in section 2.15.3 (item 9) of this report.

3) Nambucca Shire Council is undertaking an investigation of the effects of shoaling on flood levels in Nambucca. A sensitivity analysis was performed in the models to see if flood levels at the Proposal would be affected by a blocked entrance. It was found to be significant in the lower reaches of the river but at the Proposal, the model found that the condition of the river mouth had little effect on the flood levels for the large flood events as they are dominated by the flow in the river. Also, in a 100 year ARI flood, it would be expected that the shoaling at the mouth would be washed out during the flood event before the peak flood levels are reached at the Proposal.

4) The flood modelling for the environmental assessment was updated from the route selection phase. More detailed flood modelling was undertaken as part of the environmental assessment process. The waterway openings for the culverts were increased from the route selection phase to minimise the impact on the flooding regime as a result of the Proposal.

In response to the requests for additional information:

5) Modelling was undertaken for the 1 in 100 year and climate change scenarios to a methodology endorsed by the Department of Environment, Climate Change and Water.

6) As stated in section 2.15.3 (item 8) of this report, the PMF was not considered for this environmental assessment. The bridges were designed to withstand the impacts of flood waters and debris and relative to the maximum velocities expected in the life of the structure. The designers considered the 2000 year ARI flood, which is a common design standard.

7) Refer to the response provided section 2.15.3 (item 12) of this report.

8) Refer to the response provided section 2.15.3 (item 12) of this report.

9) Regarding Nambucca Shire Council's comment, the design of the Proposal for the environmental assessment took into consideration the latest knowledge on the hazards and likelihood of climate change impacts on the basis of various published sources and in agreement with Department of Environment, Climate Change and Water.

   For the environmental assessment, RTA adopted an adaptation approach to climate change risk (refer to response in 2.15.3 (item 13)).

   The design process recognised that climate change was likely to occur and considered what the most probable impact of climate change would be, on the basis of current knowledge. Finally, the design process considered when this impact would occur, relative to the delivery schedule for the Proposal.

   Climate change risk considerations would be reviewed as a part of the detailed design phase of the Proposal. At that time, the latest knowledge on climate change science would be used as the foundation of the study, as will the latest techniques for climate change adaptation for major infrastructure.

2.15.6 Impact on waterways

Submission numbers

9 – Individual
10 – Individual
30 – Land and Property Management Authority
36 – Department of Environment, Climate Change and Water
46 – Individual

Issue description

1) Land and Property Management Authority and three community submissions raised general concerns regarding the impact of the Proposal on local waterways, including contamination of Teagues Creek and the potential for impact on creeks feeding into Oyster Creek.

2) One community submission requested clarification of works at Oyster Creek.

3) Department of Environment, Climate Change and Water requested clarification of how boundaries of wetlands were determined and that actual wetland boundaries be verified. It also requested the provision of alternative mitigation measures for cut areas near groundwater-dependant ecosystems.

Response

1) Proposed management measures for the construction stage were detailed in section 16.4.1.1 of the environmental assessment and included the provision of diversion drains, straw bales, silt fences, gravel filters and sediment basins designed to intercept dirty runoff from disturbed areas. These would be implemented to reduce the risk of contamination of Teagues Creek and the creeks feeding into Oyster Creek. The RTA would implement and maintain a water quality monitoring program to assess the effects of construction until all affected areas have been fully stabilised and revegetation work has resulted in the establishment of sustainable vegetation cover. Proposed management measures for the operational stage are detailed in section 16.4.2.1 of the environmental assessment, and included permanent water quality basins, vegetated swales and spill containment basins which would be designed to meet the water quality objective and to protect sensitive waterways.

   Detailed water quality modelling to provide final locations and dimensions for all proposed water quality controls would be undertaken at the detailed design phase when more detailed information would be available on the final road design and geometry (horizontal and vertical) and detailed contours. The design would include provision for water to pass through a water quality control measure before entering the receiving water. The environmental assessment proposed three sedimentation basins (No 64, 65, 66, as per figure 6-3 of the environmental assessment) for the Proposal, which would assist in the protection of the creeks feeding into Oyster Creek.

2) There would be a bank of culverts crossing the proposed highway and local access road in the vicinity of Oyster Creek. These would line up with the culverts that cross the existing Pacific Highway. There would be local diversions of the two tributaries that run into this culvert which are tributaries of Oyster Creek. Further details of activities in the vicinity of Oyster Creek are provided in section 2.15.2 (item 1) and section 3.6.1.

3) The Department of Environment, Climate Change and Water's SEPP14 wetland boundaries were used to determine the location and extent of the SEPP14 wetlands. The boundaries were then verified using aerial photography.

   Impacts of the Proposal on the wetlands were assessed in section 16.3 of the environmental assessment. These assessments concluded that, with appropriate mitigation measures the impacts would not be significant.

   Any flows from groundwater would be captured and directed into sediment basins before being discharged into the environment.

   Cut areas in close proximity to wetlands and groundwater-dependent ecosystems would be monitored prior to construction to understand groundwater behaviour and potential impacts on environmental features. Proposed monitoring was outlined in section 16.4.1.3 of the environmental assessment.

   In cuts where the groundwater level is above the base of the excavation, a drainage blanket would need to be constructed to prevent build up of water within the pavement layers. Therefore as a precautionary measure drainage blankets are recommended for all of the cuttings, with the exception of cut 1.7 which is only five metres deep. The requirement for drainage blankets would be further investigated as part of the detailed design phase.

   Localised groundwater seepage of groundwater inflows to cuttings due to the intersection of perched water tables and springs are expected to manifest in the form of localised seepages. These would be managed during construction through measures that transfer the seepage water into the ground ecosystem immediately down-slope of the cut. The collected water could then be returned to the ground through absorption trenches or discharged directly to the surface water system.

2.15.7 Impact on wetlands

Submission numbers

16 – Individual
26 – Individual
46 – Individual
49 – NSW Office of Water

Issue description

Three community submissions and the submission from the NSW Office of Water included issues regarding the impact of the Proposal on wetlands.

1) The community submissions raised concerns that the SEPP14 wetlands would be impacted by the Proposal during construction and operation.

2) The NSW Office of Water expressed concerns regarding the impacts of acid sulphate soil (ASS) disturbance on the water quality of wetlands.

Response

1) Potential impacts of the Proposal on SEPP14 wetlands during construction would be managed by locating the compound, batching plant and stockpile sites more than 100 metres from SEPP14 wetlands as described in table 7-8 of the environmental assessment.

   Permanent sediment basins and spill containment devices were incorporated into the concept design so that any impacts as a result of the operation of the Proposal would be minimised.

   The proposed highway would be located approximately 180 metres from the SEPP14 wetland number 388, 900 metres from SEPP14 wetland number 386, 70 metres from wetland numbers 351 and 353, and would be adjusted in the detailed design phase to pass 70 metres from SEPP14 wetland number 383.

   These distances between the Proposal and the SEPP14 wetlands, together with mitigation measures, is considered appropriate in minimising impacts associated with the construction and operation of the Proposal.

   Sedimentation basins for retention of storm events would be developed and maintained in accordance with *Managing Urban Stormwater: soils and construction* (Landcom 2004), which recommended higher levels of protection around sensitive receiving waters. As such, a number of sediment basins would be installed adjacent to SEPP14 wetlands, as shown figure 6-1 and figure 6-4 of the environmental assessment.

2) The Proposal would avoid or minimise excavation and lowering of the water table in areas known to contain ASS. Swale drains instead of sediment basins would be used on floodplains where ASS may be encountered and water quality monitoring downstream of ASS risk areas would allow early detection of potential risk from ASS and ensure mitigation measures are implemented in a timely manner. Mitigation measures were outlined in section 6.5.4 of the environmental assessment.

   An ASS management sub plan would be prepared with specific management strategies and construction measures prior to the commencement of construction works and be consistent with the *Acid Sulphate Soils Manual* (ASSMAC 1998).

2.15.8 Additional submissions provided by Nambucca Shire Council

Three submissions were received by the RTA as late submissions to the environmental assessment. The submissions were from three individual community members, one author had previously provided a submission to the Department of Planning.

The issues listed below are additional to those which have been addressed throughout section 2.15.

Issue description

1) Two submissions questioned whether RTA would provide assurance to insurance companies that flood levels would not increase outside the study area by more than RTA has predicted, after the highway is completed, to allow owners get affordable insurance cover.

2) On submission questioned why RTA did not include flooding in the cost benefit analysis.

3) One submission queried why there are no drawings showing the impacts of probable maximum flooding; changed conditions; existing conditions and changed climate; changed conditions and changed climate or data/ drawings showing the combined impacts of a 2000 year flood in combination with a 2000 year storm surge, and probable maximum flood.

4) One submission queried the number of homes that would be flooded at Kings Point.

5) Two submissions questioned why the future South Macksville urban and industrial area wasn't included in the modelling.

6) Several submissions specifically questioned documentation (Working Paper 8, figure 3.2.2.) in regards to whether the high discharge velocities of 1.83 metres per second at the bridge site was in reference to:
   - Climate change
   - The velocities with climate change
   - How far up River Street these high velocities would extend
   - What other areas of the flood plain become a flood way with climate change and highway completed.

Response

1) The purpose of the flood modelling for the Proposal environmental assessment was to establish if the Proposal could be developed with manageable impacts on regional flooding. It was determined that the Proposal would have little impact on the flooding of the area relative to the existing flooding risk.

2) The flooding impact assessment has identified minimal flooding impacts as a result of the Proposal.

3) The figures were not included as the reasons for modelling the 2,000 year event was to ensure the structural integrity and the design of the bridges rather than to assess the impacts of flooding.

4) There is predicted to be no increase in flood levels in Kings Points as a result of the development of the Proposal.

5) The flooding assessment was focused on assessing the impacts of the development of the road. The assessment was based on the existing conditions in the catchment at the time of the assessment. However the development of the future South Macksville urban and industrial area will require local stormwater runoff management, but would have negligible impact on the flood flows in the river for the assessment of the development of the Proposal.

6) Figure 3.2.2 of Working Paper 8 is not part of the environmental assessment report, rather a reference to the draft route options development report from November 2004. The velocity of 1.83 metres per second quoted in this report is based on the hydrologic and hydraulic assessment undertaken for the options investigation phase of the Proposal. A velocity of 1.83 metres per second is not considered to be high. In terms of the erosion potential for this magnitude of velocity a waterway vegetated with grass would be able to withstand this velocity.

   The assessment of the velocity at structures is important in order to design appropriate scour protection for the structure to prevent erosion. The detailed design of the structures for the Proposal will include an assessment of velocity and erosion potential at the structures and also the design of protection as required.

2.16 Traffic and transport

Submission numbers

23 – Individual
27 – Individual
28 – Individual
38 – Individual
41 – Individual

Issue description

Five community members made submissions about the current traffic situation and the potential impacts of the Proposal on local traffic.

1) One submission raised a number of concerns about existing heavy vehicle traffic. It claimed that heavy vehicles often flout the road rules and that heavy vehicle traffic through the area had escalated since the speed zones north of Macksville were increased and the opening of the Chinderah bypass.

2) A number of submissions suggested that the local road between Nambucca and Urunga would become a thoroughfare for local traffic and that vehicles travelling from Bellingen to Urunga would rat run along the old Pacific Highway, instead of going through Waterfall Way.

3) A submission also requested information regarding how an accident with a truck carrying dangerous goods would be managed.

Response

1) Local traffic volumes have been forecast in line with projected population growth, and intersections and access roads designed accordingly. Traffic volumes on local roads are not expected to increase significantly, as the majority of vehicles would utilise the upgraded highway as their main route.

   Heavy vehicle volumes are forecast to increase in the future. However, as the highway will be dual carriageway, with no at-grade intersections, the amount of braking required is expected to be minimised. There is no evidence to suggest that heavy vehicle numbers had increased since the speed zones were increased. A review of police operations on the highway is outside the scope of this report.

   The improvements to the Pacific Highway and changes in road network accessibility since 2002 have allowed freight to be transported in B-doubles on the full length of the Pacific Highway from Hexham to Queensland. The final approval to the B-double route was granted with the opening of the Chinderah to Yelgun section of the Pacific Highway in August 2002. This approval made the highway available for use by all B-Double vehicles.

   Since August 2002, from the opening of the Chinderah to Yelgun section of the Pacific Highway, there has been a noticeable increase in B-double traffic on the Pacific Highway. The increase in B-double use has also arisen due to changes in the transport industry.

   The number of heavy vehicles on the highway has been growing at between three and five per cent per annum.

2) The existing highway would become a local access road that would be used by local traffic, school buses and cyclists. Vehicles travelling from Bellingen are likely to use either the new Short Cut Road underpass, or continue along Waterfall Way, turn right at the existing interchange, then continue along the existing highway to Urunga. Following the upgrade, Waterfall Way would still provide access to the Waterfall Way interchange for vehicles using the northbound on-ramps to the Pacific Highway. The number of additional vehicles that would utilise Waterfall Way instead of Short Cut Road is expected to be minimal.

3) The responses to a hazardous substances accident are covered in the RTA's Incident Management Plan for the Pacific Highway. The Emergency Services would also have response procedures for this and other types of incident on the Pacific Highway. The potential for a spill of hazardous substances from a vehicle transporting dangerous goods along the upgraded section of the Pacific Highway is considered to be low, due to the following factors:

   - Dangerous goods vehicle movements along the upgraded section of highway are expected to account for only 0.2 per cent of total daily

traffic movements, hence the likelihood of an accident involving a truck containing dangerous goods is very low.
- The high road design standards proposed, which would reduce the potential for road accidents relative to the existing situation.
- The stringent legislative controls on the transport of dangerous goods.
- With the implementation of the proposed impact mitigation and management measures, the impacts of the operation of the Proposal on water quality are not expected to be significant

2.17 Soil and fill

2.17.1 Fill

Submission numbers

9 – Individual
10 – Individual
42 – Individual

Issue description

Three community submissions expressed concerns about the use of fill material for Proposal construction. Specific issues included:

1) The amount of fill material required to fill in the valley beside East West Road.

2) The environmental impacts of using fill.

3) One submission requested that the amount of fill required under the railway bridge be re-evaluated.

Response

1) It is acknowledged that there will be a substantial fill of up to 9.65 metres in height at the intersection of East West Road and the Pacific Highway. This fill is required to facilitate the construction of the East West Road overbridge. The RTA investigated opportunities to minimise property impacts in this area, however the design is constrained by constructability of the bridge crossing (ie the ability to keep East West Road in operation during construction) and a large dam on the southern side of the existing intersection of East West Road and the Pacific Highway.

2) The impact of fill depends on the nature of the fill used, and particularly the management and storage of materials during the construction phase. The quantities and source of fill would be recalculated following detailed design and any fill imported to the site would comprise virgin excavated materials or approved recycled materials. Environmental management measures would be implemented during construction to minimise the risks to the environment, watercourses and local ecology.

3) If a road is graded over the rail line it has to have 5.3 to 5.6 metres clearance, depending on applicable RailCorp requirements. Appropriate clearances are provided in the concept design. Following detailed design the volumes of fill required would be recalculated.

2.17.2 Geological characteristics

Submission numbers

1 – Individual
10 – Individual
36 – Department of Environment, Climate Change and Water

Issue description

Two community submissions and the Department of Environment, Climate Change and Water submission included issues regarding geology.

1) One community submission suggested that slope and slip impacts in the Nambucca area would be more pronounced than stated in the environmental assessment. The submission stated that the Phyllite bedrock at Nambucca and the less foliated and folded argillaceous bedrock rock around the Waterfall Way interchange was prone to slips during periods of heavy rainfall. It recommended less-than-normal gradient cuts and batters, and use of reinforcing products on cuts assessed during construction to be of concern.

2) Another community submission raised concerns about construction of the highway on top of the "blue clay".

3) The Department of Environment, Climate Change and Water asserted that it would expect acid sulphate soil treatment areas would meet construction requirements and that there would be an acceptable distance between designated treatment areas.

Response

1) During the preferred route site investigations, it was recognised that the foliated weathered Phyllite rocks have the potential to result in slope instability if batters are excavated "over-steep". Therefore a conservative approach was adopted for the concept design. It features average design batter slopes of 2(H):1(V), which is considered "flatter" than what might normally be expected for a weathered rock profile. More detailed site investigation and slope stability analyses carried out through the detailed design stage of the Proposal may result in design of individual batters, some of which may require flattening or slope reinforcement.

2) Constructing a road on soft soils, such as the "blue clay" around Oyster Creek, may present difficulties in construction. The issues associated with construction on soft soils (additional construction and maintenance costs and longer construction periods) were considered during the selection of the Proposal route. Proven techniques are available for

construction on soft soils. With construction on soft soils, there is always a balance between allowing for settlement to occur prior to opening and demands to open a road to traffic as soon as possible.

3) The construction environmental management plan (CEMP) would include provisions for the management of acid sulphate soils. This would include measures for identification, handling and management of acid sulphate soils and potential acid sulphate soils. This document would be prepared in consultation with the relevant government agencies prior to the commencement of construction and *Acid Sulphate Soils Management Advisory Committee* (ASSMAC) guidelines. Acid sulphate soil treatment areas would be treated as ancillary facilities if necessary. These facilities would be located more than 40 metres from waterways, in cleared areas and away from dwellings as detailed in section 7.3.7 of the environmental assessment.

2.17.3 Land contamination

Submission numbers

46 – Individual

Issue description

One community submission raised concerns regarding the proximity of the Proposal to the old rubbish tip sites, as the boundaries of the old rubbish tip sites are not well documented. It suggested that it may be better to give the area a wider buffer than 40 metres. The submissions also requested confirmation that water quality monitoring would commence before the project plans are finalised and that nearby residents would be kept informed of the findings and rehabilitation measures.

Response

Historical aerial photographs were inspected and discussions were held with Nambucca Shire Council to delineate the boundary of the old municipal tip site in Nambucca State Forest. The Proposal was subsequently realigned to the west to avoid disturbing the tip site. Any groundwater quality monitoring requirements would be included in the conditions of approval. Monitoring against these conditions would be made publicly available through the compliance reporting process.

2.18 Air quality

2.18.1 Construction air quality

Submission numbers

19 – Individual
21 – Individual
27 – Individual
29 – Individual
34 – Individual
36 – Department of Environment, Climate Change and Water

Issue description

Six submissions pertained to construction air quality, including the Department of Environment, Climate Change and Water submission and five submissions from community members.

1) The community submissions expressed concerns about the impact of dust on nearby residences during construction, including two submissions that were concerned that dust would contaminate household water tanks.

2) The Department of Environment, Climate Change and Water disputed the findings of the construction air quality assessment and suggested that construction dust would be visible to and impact on nearby residences. It stated that further detail is required regarding dust monitoring locations and proposed mitigation measures during construction.

Response

1) The RTA acknowledges that dust may be generated during construction activities. Dust monitoring would be one part of the overall dust management strategy that would be implemented during construction. The strategy would also 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.

2) Dust would be created during construction, however, these impacts would be managed through standard mitigation and management measures. As such the assessment of construction air quality impacts undertaken for the environmental assessment was considered appropriate. Construction air quality management measures (including dust monitoring locations) would be developed by the construction contractor during detailed design through the construction environmental management plan. This would typically include details of monitoring locations and specific as well as site specific mitigation measures.

2.18.2 Operational air quality

Submission numbers

12 – Individual
18 – Individual
19 – Individual
23 – Individual
34 – Individual
41 – Individual

Issue description

1) A number of community submissions raised concerns regarding the impact on air quality during operation and how these impacts would be managed.

2) Three submissions were received regarding the impact of decreased air quality on residents' health.

Response

1) The RTA acknowledges that air pollutant levels would increase at locations where the highway does not currently exist. However, as stated in section 19.2.1 of the environmental assessment, dispersion would reduce pollutant levels significantly as the distance from the road increases, such that at 100 metres from the highway, levels would be close to ambient levels and well within Department of Environment, Climate Change and Water guidelines.

   Overall, the improved motoring conditions resulting from the design of the upgrade of the highway will lead to reduced emissions of most traffic related pollutants including particulate matter from diesel fuelled vehicles. The improved motoring conditions would result in fuel being burned more efficiently at higher temperatures which in turn would result in less particulate emissions than in stop start traffic.

   Additionally, the implementation of stricter emission standards for all vehicles, including trucks, and improvements in vehicle technology as the fleet is modernised will result in lower emissions leading to improved air quality.

   Revegetation and rehabilitation of the disturbed areas associated with construction of the Proposal would be conducted progressively (refer to section 10.5.1.1 and 16.4.1.1 of the environmental assessment). No dust-related operational impacts are anticipated.

2) As stated in section 19.2.2.2 of the environmental assessment, potential operational impacts of the proposed highway upgrade would be within Department of Environment, Climate Change and Water guidelines and would further diminish with distance from the Proposal, resulting in negligible operational impacts. A study conducted by 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. No significant impacts on human health are anticipated as a result of vehicle emissions from the Proposal.

2.19 Clarifications to the environmental assessment

Submission numbers

3 – Individual
11 – Saltwater Developments
12 – Individual
17 – Individual
25 – Individual
26 – Individual
27 – Individual
30 – Land and Property Management Authority
35 – Industry and Investment NSW
36 – Department of Environment, Climate Change and Water
45 – Individual
48 – Individual

Issue description

The Department of Environment, Climate Change and Water, Industry and Investment NSW, and the Land and Property Management Authority and eight submissions from the local community members and businesses requested clarification of, or amendment to, particular sections of the environmental assessment, including:

1) Saltwater Developments stated that table 7.4 is incorrect and should be amended to accurately reflect development assessment limits imposed on local quarries.

2) A local community member suggested that the term "upgrade" is misleading as it suggests that an existing highway is being upgraded, not a completely new highway corridor.

3) A local community member suggested that the term "bypass" is misleading. It should be used in reference to a highway located five kilometres from a township. In this case it refers to a bridge over the Nambucca River one kilometre from town.

4) A local community member stated that the environmental assessment does not meet all of the Director-General's requirements and contains inaccurate information.

5) A local community member raised questions regarding the contents of Working Paper 4 and why it was not made publicly available.

6) A local community member questioned why the environmental assessment includes the Nambucca River existing conditions 2000 year ARI flooding but not the developed conditions 2000 year flooding existing climate and/or the worst case scenario developed conditions 2000 year flooding changed climate.

7) A local community member stated that there are a number of errors in the land use classification, which has resulted in the RTA misrepresenting the types of land that would be impacted by flooding.

8) A local community member noted that there is a reference error in section 14.6.

9) A local community member disagreed with the statement in the environmental assessment that "it is not expected that acquisitions would result in long-term changes in land use".

10) A local community member suggested that the environmental assessment omits to mention the impacts of the Proposal on Nambucca State Forest and the 14.24 hectares of "environmental protection - special emphasis" land and does not take into account the amount of residual land that would be sterilised by the Proposal.

11) A local community member stated that community consultation was not sufficient as RTA only provided information to those properties that would be acquired.

12) A local community member noted that tables 14-4 and 14-3-4-2 show conflicting work hours.

13) The Lands and Property Management Authority suggested that the differentiation between Crown public roads and council public roads should be addressed in the environmental assessment.

14) Industry and Investment NSW stated that the reference to "unprocessed construction material" in section 11.3.9 incorrectly describes the predominant product range from Nambucca Valley Quarry.

15) The Department of Environment, Climate Change and Water noted that there appears to be numerous errors in tables 5-4 and 5-5 of the environmental assessment and table 4-4 of Working Paper 4, with values and text placed in the wrong columns. Requested that these tables be reviewed and amended for accuracy prior to further assessment.

16) A local community member requested clarification of the meaning of the two parallel lines shown on sheets 6 of 7 and 7 of 7 of figure 2.1 of the Noise and Vibration Working Paper.

17) A local community member requested a copy of drawing ENO2286-SK-C-191 be supplied.

Response

1) Comments in relation to extraction limits at quarries within 100 kilometres of the Proposal have been noted. In sourcing quarry material for the construction of the Proposal, the RTA would confirm approved extraction limits for suppliers during contract negotiations. The RTA and its contractors would expect that suppliers of quarrying material for the Proposal would operate within the limits of their development consent.

2) The term "upgrade" refers to improving the standard of the current transport situation. The Pacific Highway through this area requires

upgrading to improve the level of service, reduce accidents and injuries and improves the efficiency in terms of reducing travel times and costs.

3) The term "bypass" is used to describe a highway or a section of a highway that passes around an obstructed or congested area. The proposed Pacific Highway upgrade would include local bypasses of the townships of Warrell Creek, Macksville, Bellwood and Urunga.

4) The environmental assessment meets the Director-General's Requirements and satisfied an "adequacy review" by the Department of Planning prior to public display.

5) Working Paper 4 contains the Aboriginal heritage assessment, which was not released publicly due to sensitivity of information to the Aboriginal community. This was noted in the Table of Contents of Volume 1 of the environmental assessment. The introduction to Chapter 15 of the environmental assessment notes that the recommendations included in the working paper have been incorporated into the environmental assessment, and that copies of Working Paper 4 were provided to the Department of Planning, Department of Environment, Climate Change and Water and the Aboriginal Focus Group.

6) The figures were not included as the reasons for modelling the 2,000 year event was to ensure the structural integrity of the road and the design of the bridges rather than to assess the impacts of flooding.

7) High resolution aerial photography was used to determine the land uses for the hydrological assessment. This provides the most accurate and up to date insight into land uses within the study area. The assessment did not rely on council zoning data.

8) The error reference was an oversight in the final formatting of the report. The cross reference within the text related to the proposed sections of low noise pavement for the Proposal identified in table 14-16, which followed on the same page. The cross reference was correctly included in the preceding paragraph.

9) The comment within the environmental assessment in relation to change in land use as a result of the Proposal related to land acquired for the Proposal, but not within the proposed road corridor.

10) Internal access routes through the Nambucca State Forest would either be maintained or modified in consultation with Forests NSW to avoid sterilisation of forestry resources. The Proposal has been designed to minimise impacts on sensitive forestry management zones including the environmental protection (special emphasis) land and to minimise severance of state forest land. Access to land within the state forest would be retained as part of the Proposal design and it is not anticipated that there would be any substantial impact on timber production activities of the viability of forestry businesses as a result of the Proposal.

11) Consultation undertaken for the environmental assessment is identified in section 1.3 of this report. Members of the project team also met with directly affected landowners, landowners who lived near the Proposal and interested community members during the route selection and preferred route phases of the Proposal. During January 2010, directly affected property owners were provided with a letter and plan indicating the extent of how their land was affected by the Proposal. Those previously identified as being directly affected, but now no longer directly affected, were also advised at this time. However, the RTA acknowledges that some superseded information may still be circulating within the community.

12) Table 14-4 presents the recommended standard hours for construction work as stated within the *Interim Construction Noise Guideline* (Department of Environment, Climate Change and Water). Section 14.3.4.1 indicates that these hours may be varied where necessary to undertake work for safety or accessibility reasons. Section 14.3.4.2 indicates the hours that construction would normally be limited to for this Proposal, and the circumstances under which work outside of these hours would be undertaken. It is further noted here that construction hours would be dictated by the conditions of approval and would be managed by the construction contractor through the construction environmental management plan.

13) Crown public roads are public roads that lie on Crown land.

    Council public roads are all public roads within a council's local government area, with the exception of freeways for which the RTA is the appropriate roads authority.

14) This comment has been noted and further details of the construction materials would be sought during the detailed design phase.

15) The errors within tables 5-4 and 5-5 of Working Paper 3 - Noise and Vibration were an error in the final formatting of the report in preparation for printing. The corrected tables are included in section 3.5 of this report.

16) The two lines shown on Sheets 6 of 7 and 7 of 7 on Figure 2-1 of Working Paper 3 - Noise and Vibration were an error in the final formatting of the report in preparation for printing. The lines have no bearing on the Proposal.

17) Maps indicating the proposed extent of impacts to properties are presented in Section 6 of the environmental assessment. Additionally, during January 2010, directly affected property owners were provided with a letter and plan indicating the extent of how their land was affected by the Proposal.

2.20 Statement of commitments

Submission numbers

22 – Nambucca Shire Council
35 – Industry and Investment NSW
36 – Department of Environment, Climate Change and Water
49 – NSW Office of Water

Issue description

The Department of Environment, Climate Change and Water noted that many commitments in the environmental assessment were not carried forward to the statement of commitments and that in many cases the statement of commitments would be improved with the provision of adequate and sufficient detail to gain an understanding of the actions and measure that would be undertaken to avoid, minimise, manage, mitigate, offset and/or monitor impacts. It stated that the extent to which the statement of commitments is meaningful is impacted by the deferral of matters such as offsetting and monitoring and that wording in the statement of commitments such as "feasible and reasonable" did not clearly articulate the desired environmental outcome of the commitment, thus raising doubt about the extent to which the environmental assessment commitments will be delivered upon. The Department of Environment, Climate Change and Water recommended all significant commitments made in the environmental assessment are summarised in the statement of commitments table.

Nambucca Shire Council requested that additional information in relation to agricultural issues should be included in the statement of commitments.

Response

Table 2-10 below provides a response to the issues raised and suggestions in relation to the statement of commitments.

Table 2-10 Response to suggested statement of commitments amendments

Agency	Suggested statement of commitment amendment	Response
Flora and fauna		
Department of Environment, Climate Change and Water	Fauna viaducts will be located in three locations throughout the 21.6 kilometres of bisected regional corridors, one in each Nambucca State Forest and Newry State Forest and one in high quality habitat north of the Kalang River. The viaducts will be designed in agreement with Department of Environment, Climate Change and Water and to facilitate koala and other arboreal fauna passage. The viaducts shall be split in the media to allow light and moisture penetration to facilitate low vegetation growth.	There are fauna crossings proposed in these locations which are considered adequate and suitable for the target species. Details of the fauna crossings including the target species are provided in section 3.1 of this report. All fauna crossings will be confirmed with the DECCW and the I&I (Fisheries) during detailed design. The statement of commitments (F8 and F9) has been updated.
Department of Environment,	The RTA develop a strategy for prioritising rehabilitation areas for inclusion as a mitigation measure for consideration of the overall impacts	Opportunities for rehabilitation would be investigated as outlined in section 10.4.5.2 of the environmental assessment. Habitat

Climate Change and Water	of the upgrade.	rehabilitation measures would be developed with DECCW during the detailed design phase as outlined in section 10.6 of the environmental assessment.
Department of Environment, Climate Change and Water	A targeted survey be conducted during suitable conditions to confirm if individuals and/or populations of Giant Barred frog are present. If Giant Barred frogs are found, the RTA should design bridge structures that will not impact on Giant Barred frog habitat and additionally develop a translocation and monitoring program in consultation with Department of Environment, Climate Change and Water.	Although potential habitat was present for the Giant Barred frog, no individuals were identified during detailed fauna survey. Commitment F5 has been amended to include specific reference to threatened frog species.
Department of Environment, Climate Change and Water	A nest box plan is developed prior to construction to replace hollow resource and to provide emergency shelter in areas adjacent to clearing.	Commitment F6 has been amended to include a nest box plan.
Department of Environment, Climate Change and Water	A minimum of 693 hectares of native vegetation is required to offset direct and indirect impacts of the Proposal.	Commitment F11 includes for the development of an offset strategy with DECCW.
Department of Environment, Climate Change and Water	An adaptive monitoring program will extend for up to five years, but may be reduced in consultation with Department of Environment, Climate Change and Water and if outcomes from monitoring demonstrate design objectives are met.	The RTA has committed to undertake a targeted, adaptive monitoring program for a minimum of 12 months to assess the effectiveness of fauna and flora impact mitigation measures. After 12 months a report will be completed to assess the need for additional measures and/or further targeted monitoring. This has been included in commitment F12.
Department of Environment, Climate Change and Water	The upgrade is designed to maintain natural drainage conditions and soil moisture regimes in areas of freshwater for EEC.	Commitment W6 includes this requirement.
Department of Environment, Climate Change and Water	All hollow bearing trees and habitat tree locations are accurately mapped and attributes (size, fauna suitability) assessed and recorded.	F5 of the statement of commitments includes provision for a suitably qualified ecologist to undertake pre-clearance surveys. Searches will include nests and hollow bearing trees. F5 has been amended to specifically include survey for threatened frog species.
Department of Environment, Climate Change and Water	All combined fauna crossing points from table 6-4, Working Paper 1 shall be a minimum of 2.4 metres in height and 2.4 metres in width and split in the median.	The proposed dimensions of the fauna crossings are provided in section 3.1. Further justification for the size of culverts included in the concept design is included in section 2.9.3 (item 16 and 10) of this report.
Department of Environment, Climate Change and Water	Dedicated fauna crossing structures shall be constructed in the locations shown in Appendix D D.2 Urban Design and Landscape Strategy: sheets 1 to 9 and shall be a minimum of 3.6 metres in height and split in the median.	Refer to section 3.1 which provides a justification for the proposed sizing of fauna crossing.
NSW Office of Water	All disturbed areas must be revegetated and rehabilitated immediately after works are completed.	This requirement is covered by the existing mitigation measures in 10.5.2 of the environmental assessment. It is normal practice to progressively rehabilitate

		disturbed areas.
NSW Office of Water	Works within riparian areas must be undertaken in accordance with the requirements outlined in the Department of Water and Energy "Guidelines for Controlled Activities 2008".	All necessary approvals under the *Water Act 1912* would be obtained if required.
Aboriginal heritage		
Department of Environment, Climate Change and Water	The proponent shall develop a construction Heritage Management Plan (CHMP) for the Proposal area. The CHMP is to be developed and implemented in consultation with the relevant Aboriginal stakeholders. The plan must include procedures for ongoing Aboriginal consultation and involvement, management of any recorded sites within the Proposal area, details of proposed mitigation and management strategies; including additional investigation, salvage activities, monitoring, procedures for the identification and management of previously unrecorded sites (excluding human remains), identification and management of any proposed cultural heritage conservation area(s) and details of an appropriate keeping place agreement with local Aboriginal community representatives for any Aboriginal objects salvaged through the development process.	The RTA anticipates that there will be a condition of approval requiring the preparation of an Aboriginal Heritage Management Plan.
Department of Environment, Climate Change and Water	If Aboriginal cultural objects are uncovered due to the development activities, all works must halt in the immediate area to prevent any further impacts to the find or finds. A suitably qualified archaeologist and Aboriginal community representative must be contacted to determine the significance of the find(s). The site is to be registered in the AHIMS (managed by Department of Environment, Climate Change and Water) and the management outcome for the site included in the information provided to AHIMS. It is recommended that the Aboriginal community representatives are consulted in developing and implementing management strategies for all sites, with all information required for informed consent being given to the representatives for this purpose.	This is included in commitment AH2.
Department of Environment, Climate Change and Water	If human remains are located during the project, all works must halt in the immediate area to prevent any further impacts to the find or finds. The local NSW Police, the Aboriginal community and Department of Environment, Climate Change and Water are to be notified. If the remains are found to be of Aboriginal origin and the police consider the site not an investigation site for criminal activities, Department of Environment, Climate Change and Water should be contacted and notified of the situation and works are not to resume in the designated are until approval in writing is provided by Department of Environment, Climate Change and Water. In the event that a criminal investigation ensues, works are not to resume in the designated area until approval in writing is obtained from the local NSW Police and Department of Environment, Climate Change and Water.	This is included in commitment AH2.

Department of Environment, Climate Change and Water	An Aboriginal cultural education program must be developed for the induction of personnel and contractors involved in the construction activities on site. The program should be developed in collaboration with the Aboriginal community.	This is included in commitment AH4.
Water quality and hydrology		
Department of Environment, Climate Change and Water	Groundwater monitoring will be undertaken prior to construction to establish seasonal baseline groundwater table conditions. Investigation of the potential for changes in the groundwater table will take place before starting any major earthworks. Where a potential for change is identified, the significance of the change with respect to baseline condition and any resultant impacts will be determined and measures to manage the changes will be designed and implemented as necessary.	The recommendation to conduct baseline and ongoing monitoring of groundwater at selected cutting sites is included in section 16.4.1.3 of the environmental assessment and included in the statement of commitments (W6).
NSW Office of Water	The proponent must ensure all monitoring bores are licensed with the NSW Office of Water. All Form As must be submitted to NSW Office of Water at the time drilling is undertaken.	The requirement for a review of groundwater monitoring is included in the statement of commitments (W6) RTA will obtain all necessary licenses and approvals prior to commencing works.
NSW Office of Water	The proponent must ensure a licence under Part 2 of the Water Act 1912 is obtained to divert a water course should the Proposal involve a permanent changing of the course of any river or stream.	RTA will obtain all necessary licenses and approvals prior to commencing works as detailed in section 8.2 of the environmental assessment.
NSW Office of Water	A dewatering licence must be obtained for all works that intercept the water table. A groundwater management plan must accompany the licence application for approval by NSW Office of Water.	RTA will obtain all necessary licenses and approvals prior to commencing works as detailed in section 8.2 of the environmental assessment.
NSW Office of Water	All sediment basins must be constructed above the water table or lined with impermeable material.	All sediment basins will be constructed in accordance with The Blue Book – Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition 2004 (reprinted July 2006)
NSW Office of Water	A monitoring program must be implemented to monitor impacts of the development on surface water resources, groundwater resources and wetlands.	Specific management measures for monitoring groundwater in the vicinity of cuttings is included in 16.4.2.2 of the environmental assessment. Water monitoring requirements are included in the statement of commitments (W3). This has been amended to include reference to groundwater.
NSW Office of Water	All works within riparian areas must be undertaken in accordance with industry best practice in order to maintain and conserve the geomorphic integrity of the water course and natural hydrological flow regimes.	The Proposal has been designed to minimise impacts in riparian areas. Where impacts are unavoidable, these would be managed in accordance with The Blue Book – Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition 2004 (reprinted July 2006).
Waste and resource management		
NSW Office of Water	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 the works commencing.	Estimated sources of water would include sediment basins, farm dams, creeks and or groundwater which would be licensed as necessary.

Socio economic impacts		
Nambucca Shire Council	Council requested that the statement of commitments include a point to the effect that the cost of all changes to Council-owned infrastructure that arise from the upgrade, whether direct or indirect, be met by the RTA.	This is covered in commitment S2 in socio economic impacts.
Industry and Investment NSW	Industry and Investment NSW noted that the statement of commitments is relatively brief with regard to agricultural issues. It recommended that the key agricultural issues raised in the body of the environmental assessment should be tabulated in the statement of commitments with an action.	The RTA would commit to the mitigation measures in the environmental assessment such as acquisition of land in accordance with the *Land Acquisition (Just Terms) Compensation Act 1991*.
Nambucca Shire Council	Council requested that additional information in relation to the agricultural issues be included in the statement of commitments.	The requirements in relation to agriculture from table 12-1 of the environmental assessment have been included in commitment S4.

2.21 Other

Submission numbers

6 – Individual
14 – Individual
29 – Individual

Issue description

Three submissions raised issues that were not related to the Pacific Highway Upgrade - Warrell Creek to Urunga.

1) A submission from a local business stated that as part of the development assessment approval for the Pearl at Valla development, the developer was required to design and pay for an acceleration and deceleration lane at the entrance to the proposed development, which would be made obsolete by the proposed upgrade.

2) A submission from a community member raised concerns regarding some rock stabilisation works that were conducted by the RTA separately to this Proposal.

Response

1) The Pearl at Valla subdivision was approved by the Department of Infrastructure, Planning and Natural Resources (now the Department of Planning) in July 2002. The subdivision connects directly to the existing Pacific Highway and accordingly a high quality intersection was required to cater for traffic movements on and off the highway.

2) The comments are noted and have been passed on to the appropriate section within the RTA.

3 Preferred Project Report

3.1 Introduction

This section provides details of further investigations undertaken, and changes made to the alignment of the Proposal from that shown in the Warrell Creek to Urunga Environmental Assessment (RTA 2010). The changes to the Proposal have been made in response to information provided or to respond to queries raised in the submissions. Where queries relate to individual properties, contact has been made directly with the property owner.

3.2 Proposed realignment through Newry State Forest

3.2.1 Background

A historical record exists for the Eastern underground orchid (*Rhizanthella slateri*) in Newry State Forest. It was determined that the Proposal as shown in the environmental assessment may impact on the orchid or its habitat.

The Eastern underground orchid (*Rhizanthella slateri*) is listed as threatened by both the NSW and Commonwealth legislation. It is currently only known to occur from Bulahdelah, although historic records also exist for this species at Nowra, Wisemans Ferry, Dharug National Park and a number of sites in the Blue Mountains. With so few records and locations known for this species it is considered important to try to protect this species and its habitat.

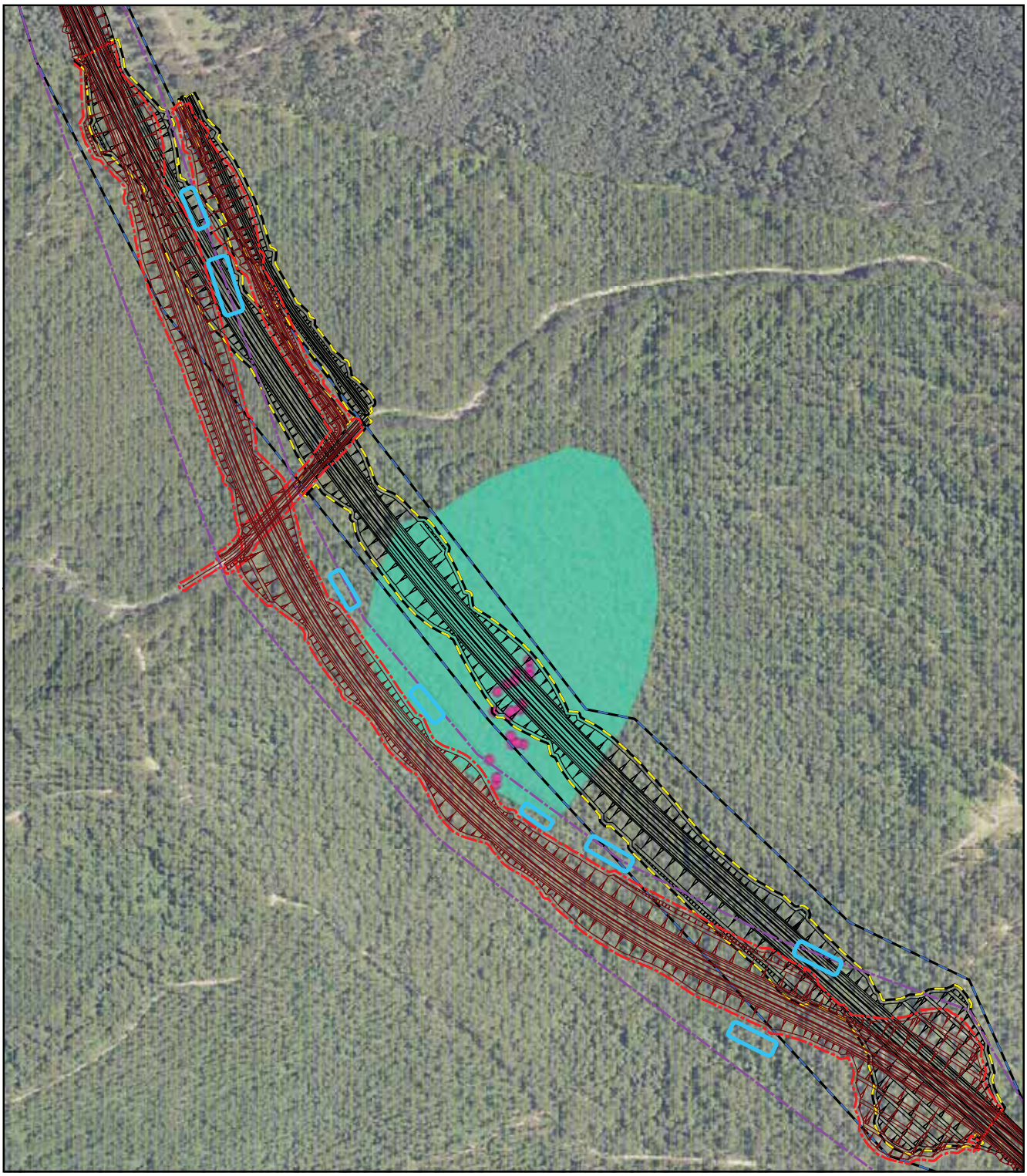
The exact habitat requirement of this species is not known. However, work at Bulahdelah has identified important key components including a relatively undisturbed forest with deep leaf litter. It is also important for this species survival that adequate and consistent rainfall occurs throughout the year so that high soil moisture levels are maintained thus ensuring that the orchid does not desiccate. The exclusion of fire from an area is also important for this species.

Orchid specialists EcoPro undertook targeted orchid surveys for the Eastern underground orchid in Newry State Forest in January and May 2010. No individuals were recorded during the surveys, however, an area of potential habitat was identified. To minimise the impact of the alignment on this species (and other threatened species in the area) a proposed realignment was developed.

3.2.2 Description of the proposed realignment

Figure 3-1 shows the location of the alignment as depicted in the environmental assessment and the proposed realignment through Newry State Forest.

Figure 3-1 - Realignment through Newry State Forest



LEGEND

- Marsdenia longiloba point
- Cryptic orchid (Rhizanthella) habitat
- Newry State Forest realignment road boundary
- Newry State Forest realignment concept design
- Newry State Forest realignment concept design with 5m buffer
- WC2U original concept design
- WC2U original road boundary
- WC2U Original concept design with 5m buffer
- Newry State Forest
- Sedimentation Basins

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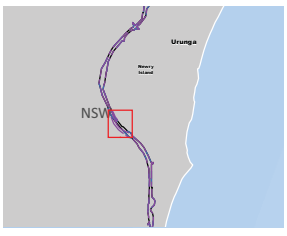

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The proposed realignment commences at approximately chainage 32500 traversing in a north-westerly direction, and is located approximately 150 metres at the furthest point to the west of the alignment shown in the environmental assessment. The proposed realignment is just over one kilometre.

Reverse curves have been introduced to divert the alignment further to the west to avoid the potential orchid habitat. These curves have a radii of 1300 and 1220 respectively, with a straight stretch between them of 135 metres, which is suitable for a design speed of 110 km/h. The alignment has been shifted as far away from the orchid habitat as possible, as the terrain further to the west becomes steeper and more rugged, requiring significant cut and fill, which would increase geotechnical risks, the Proposal footprint and clearing of native vegetation. The refined alignment as shown in Figure 3-1 represents the optimal balance between impacts on potential orchid habitat, private property, road design and engineering risk.

The proposed realignment results in the proposed Martells Road overbridge being shifted approximately 125 metres to the west of the location shown in the environmental assessment. There are no additional changes to property access or state forest access.

The cut and fill balance for the proposed realignment is comparable to that for the alignment shown in the environmental assessment.

Consultation was undertaken with NSW Industry and Investments (Forests), the Department of Environment, Climate Change and Water, and Coffs Harbour Local Aboriginal Land Council during development and survey of the realignment options. The Department of Environment Climate Change and Water endorsed the refined alignment and noted the principals used to avoid and manage impacts.

3.2.3 Impact assessment

Flora and fauna

The total area of potential habitat for the Eastern underground orchid identified near the Proposal is 12.8 hectares. The alignment shown in the environmental assessment would have removed about 4.3 hectares (or 34 per cent) of potential habitat for this species. It would have further indirectly impacted an additional 3.5 hectares or 27 per cent.

The refined alignment only removes approximately one hectare or eight per cent of potential habitat for the Eastern underground orchid. Indirect impacts have been reduced from 3.5 hectares to 1.9 hectares for the proposed realignment. During detailed design, refinements will be investigated to further reduce this figure. Any future design refinement aimed to further minimise impacts at the detailed design stage would not encroach further to the east into potential habitat for Rhizanthella. This level of impact is considered acceptable and would be reduced further with the implementation of mitigation measures included in section 3.2. Minor adjustments to the dedicated fauna crossing through Newry State Forest are required, however, there are no additional changes to fauna connectivity. All

the flora and fauna impacts, mitigation and management measures in the environmental assessment remain unchanged.

The proposed realignment reduces the impact on the Commonwealth listed species *Marsdenia longiloba* and other threatened species.

Land use and property

The refined alignment is contained within Newry State Forest, and is located predominantly within Forestry Management Zone 4. It also passes through narrow sections of Forestry Management Zone 8 and approximately 400 metres of Forestry Management Zone 5 at the northern end. This is the same as the original alignment as shown in the environmental assessment.

The refined alignment would not result in changes to access through this area.

Social and economic

There would be no additional severance impacts for forestry activities and no further impacts on forestry resources.

Visual amenity and design

The realignment would occur within Newry State Forest and would not increase visual impacts compared to the Proposal as identified in the environmental assessment.

Water quality and hydrology

No further impacts are expected in relation to water quality and hydrology. The sedimentation basin numbers 82, 83, 84, 85 and 86 have been remodelled and relocated based on the proposed realignment. All revised sediment basins would be incorporated within the existing road boundary. Drainage across the refined alignment would be maintained.

Traffic and transport

The refined alignment would not result in changed property access. East to west access through this area would remain unchanged. However, Martells Road bridge over the upgrade has moved approximately 125 metres to the west.

Noise and vibration

There are no further impacts on sensitive receivers for either construction or operation of the Proposal.

Aboriginal heritage

Field surveys were undertaken in August 2010 in consultation with representatives of Coffs Harbour Local Aboriginal Land Council. No Aboriginal

heritage sites or areas of potential archaeological deposits were identified on or around the refined alignment.

3.2.4 Management of impacts

Mitigation measures to be implemented to minimise potential impacts on the Eastern underground orchid and threatened species within Newry State Forest would include:

Pre-construction and construction phase:

- Additional survey within and adjacent to the road boundary during the optimum time of year to detect this species (ie September to November). It is considered only a low likelihood that this species would be found on the western edge of its potential habitat, but should individuals be found then mitigation measures should be developed to avoid or mitigate impacts.
- Threatened species surveys to be conducted prior to clearing to identify the location and potential direct or indirect impacts on individuals. The surveys would be used to identify any individuals to be translocated and to confirm the extent of clearing.
- Threatened species directly impacted by the Proposal would be translocated to a suitable location outside the impact zone.
- Installation of exclusion fencing at a distance of 5 metres from the construction footprint to prevent encroachment by construction workers or equipment during construction to the east of the construction footprint.
- A further visual inspection will be conducted post clearance to identify threatened species which may be indirectly impacted outside the cleared zone.
- Standard erosion and sediment controls and sediment basins are to be placed outside of potential habitat if possible to minimise loss of habitat.
- Application of erosion and sediment controls during construction to limit excess nutrients entering the orchid habitat.
- If required, landscape planting along the road boundary, will be initiated as soon as possible during the construction process.

Operation phase:

- Maintenance of drainage flows beneath the new road.
- Placement of any operational water detention basins outside the potential orchid habitat.
- The effectiveness of flora and fauna mitigation measures would be monitored for a period of 12 months following construction completion. Following which the requirement for further monitoring will be reviewed.

The mitigation and management measures for the area of the proposed realignment have been included in the revised statement of commitments (F3) in section 4.

3.3 Fauna crossings

Table 3-1 of this report is an update of table 10-13 of the environmental assessment. This table has been updated following the request by Industry and Investment NSW and the Department of Environment, Climate Change and Water for additional information on the fauna crossings. Table 3-1 provides justification for the selection for each of the crossings, including habitat connectivity, target species and aquatic ecology. It also provides an indication of where new crossings are co-located with existing crossings along the existing Pacific Highway.

Figure 3-2 shows the details of the cross-drainage structures, where there is to be fauna fencing, along the length of the Proposal. The proposed crossings provide for both fish and terrestrial fauna movement. Fauna fencing is proposed to direct fauna to fauna crossing structures and to prevent access to the road corridor.

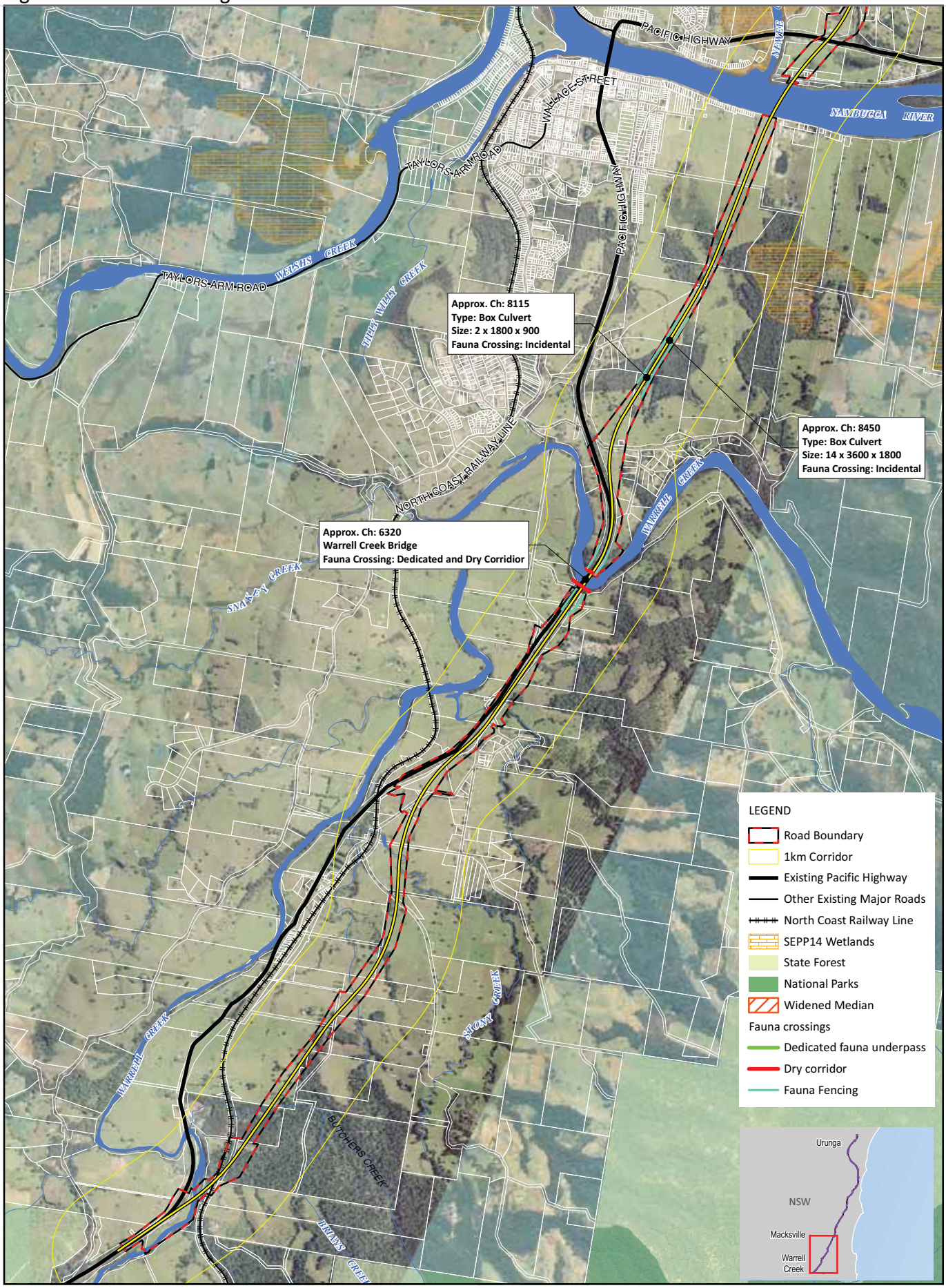
3.3.1 Terrestrial fauna

Table 3-1 of this report includes details of the habitat connectivity and target fauna species that may use the culverts and bridges. It also provides further details of the size of culverts which have been suited to the fauna likely to use them. The dimensions proposed are considered satisfactory for the target species and habitats present.

There are several dedicated fauna crossings within key wildlife corridors. A dedicated fauna underpass is proposed for each Newry and Nambucca State Forests and a dry fauna corridor through vegetated areas to the north of the Kalang River. In addition combined fauna crossings are proposed along the entire length of the Proposal.

Widened medians are proposed throughout the Proposal (including Nambucca State Forest (section 2), Newry State Forest (section 3) as well as private property in section 4). These have been designed to maintain mature vegetation and to facilitate the safer movement of yellow-bellied gliders and other glider species across the upgrade. The length of widened median proposed to assist with fauna crossing totals two kilometres.

Given that there are dedicated and combined fauna crossings, associated fauna fencing (as discussed in table 3.1) as well as the widened medians, the provision of fauna viaducts for arboreal species and koala is not considered necessary.



Note: Fauna fencing locations are indicative to be refined at detailed design in consultation with DECCW

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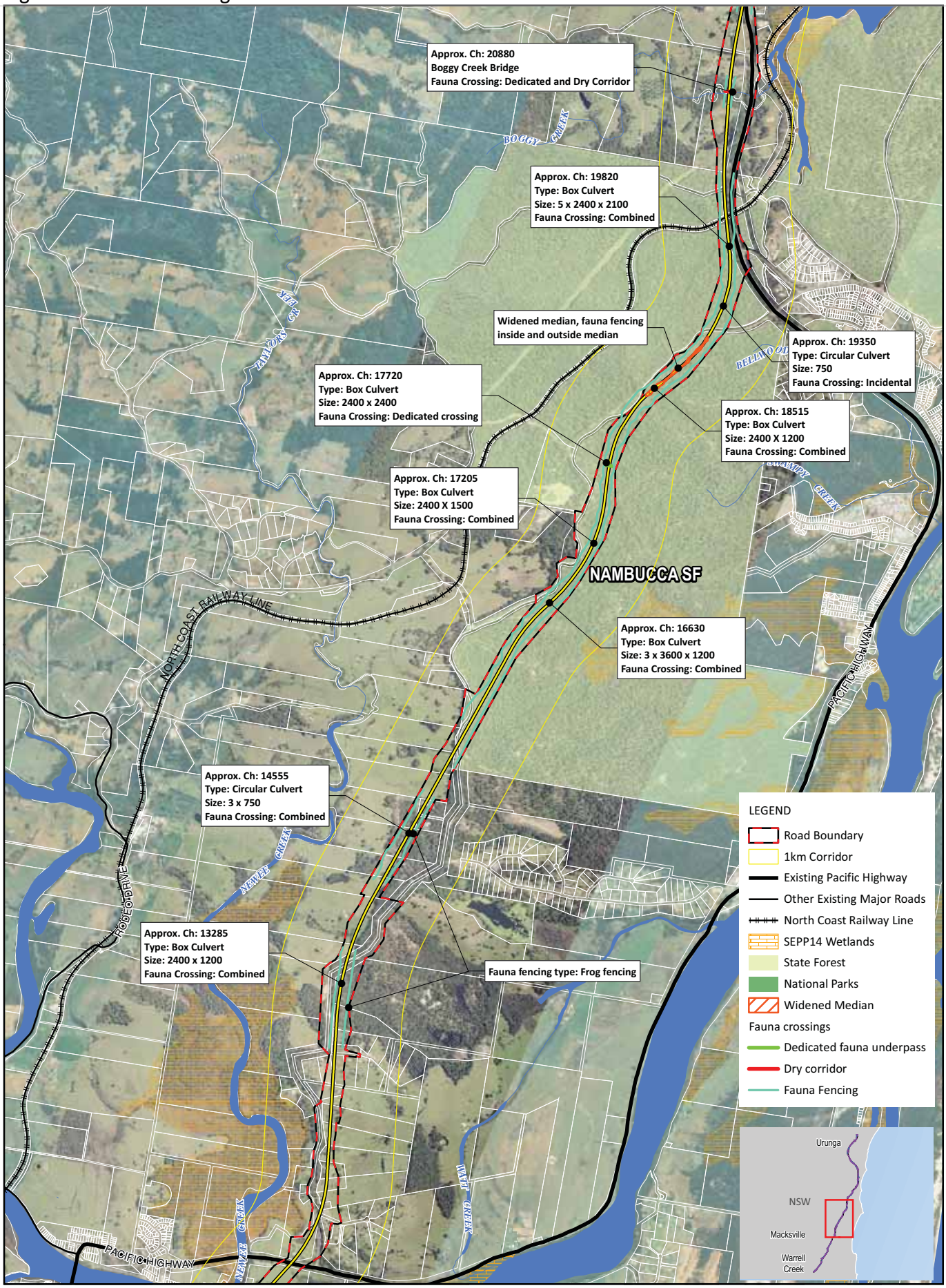

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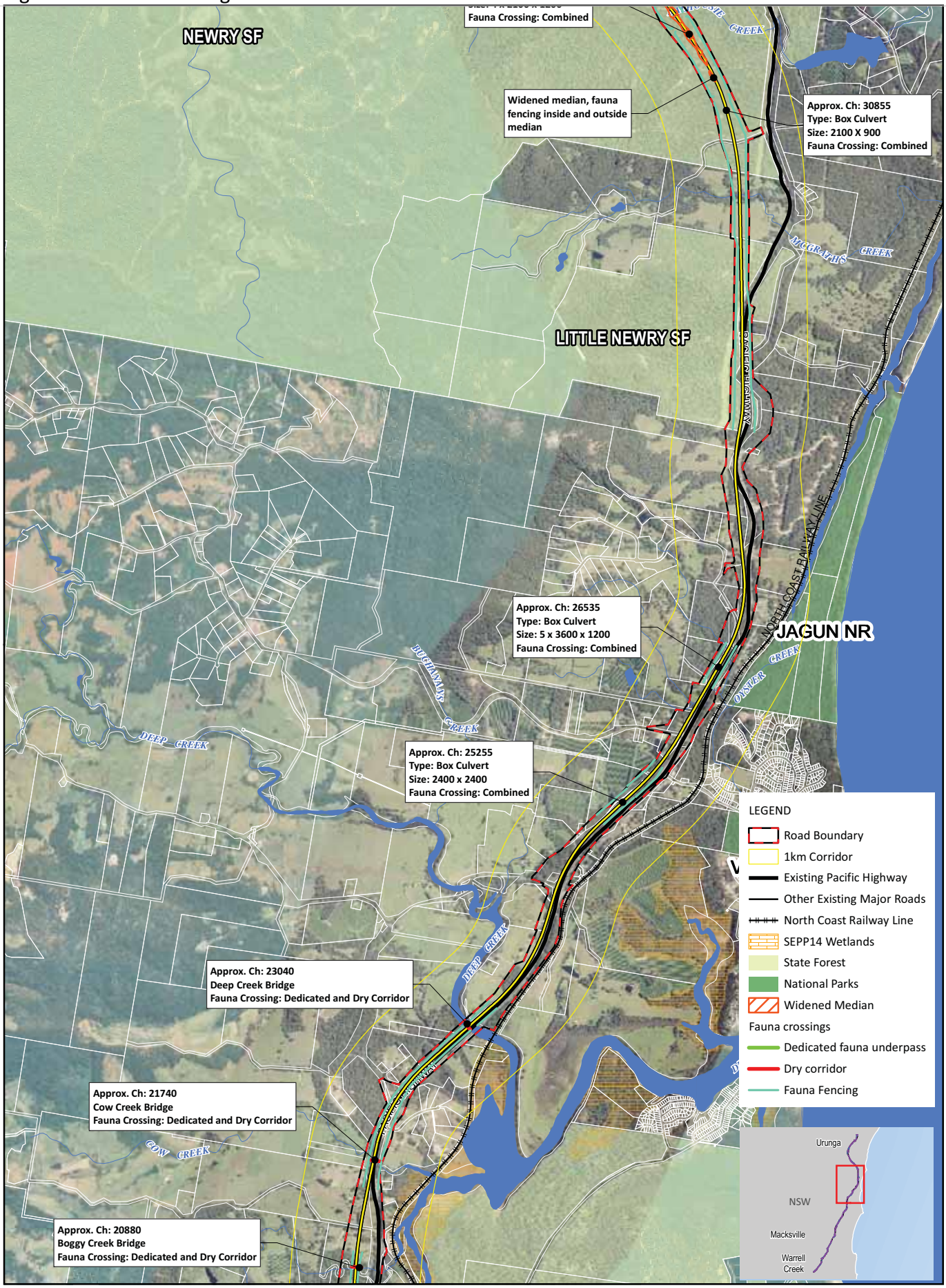

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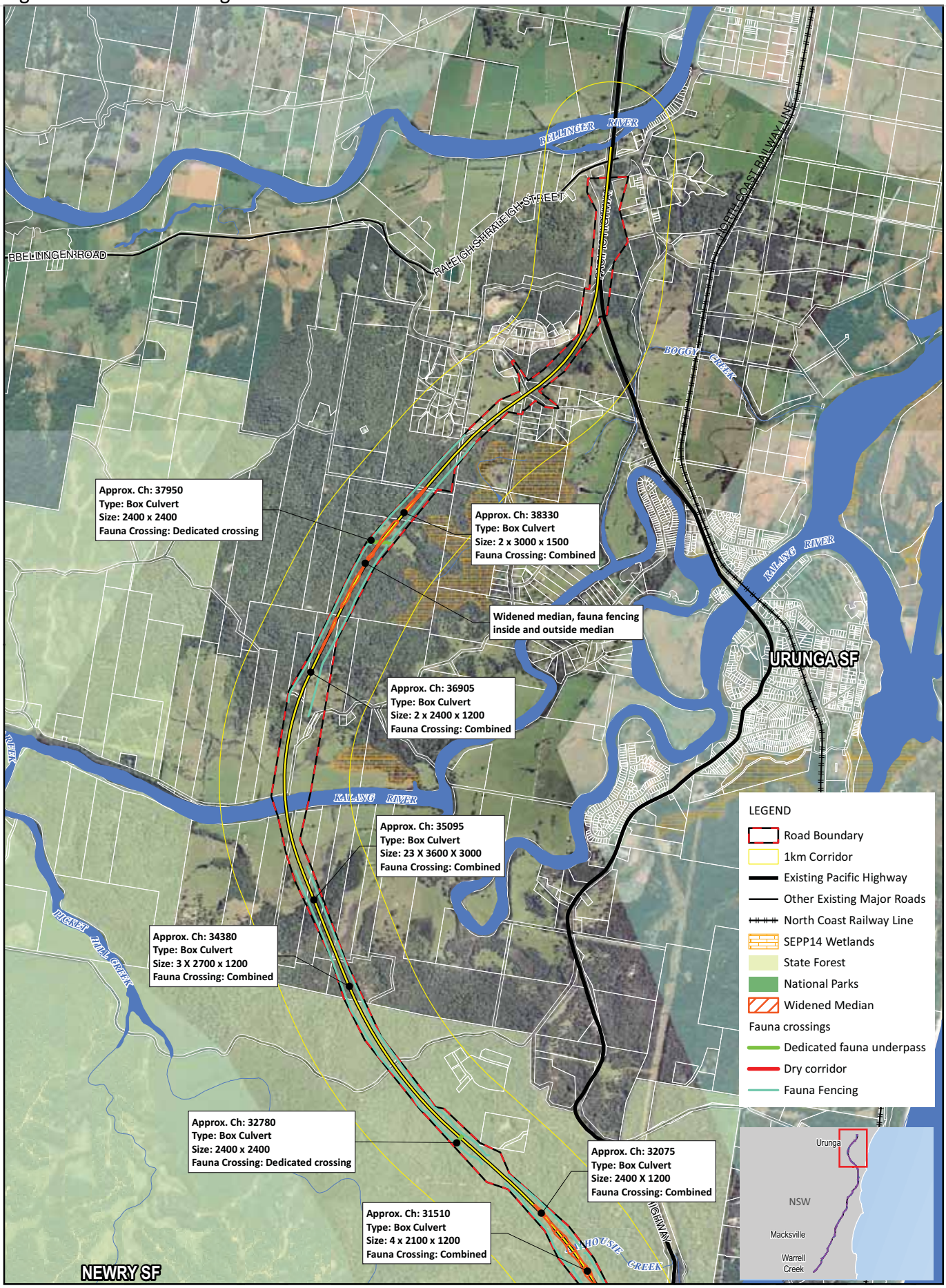

Note: Fauna fencing locations are indicative to be refined at detailed design in consultation with DECCW

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3.3.2 Aquatic fauna

Table 3-1 provides details of the fish species that may use the culverts and crossings beneath bridges. To aid fish passage, all creek lines that may be used for fish passage would be designed in accordance with Fairfull & Witheridge (2003). Typical fish passage requirements for culverts include minimising changes to the channels natural flow, width, roughness and baseflow water depth. Where feasible, pools would be constructed at both the inlet and outlet of the culvert to assist in the dissipation of flow energy, minimise erosion and to create fish resting areas. Culverts would be designed with debris deflector walls to reduce debris blockages which restrict fish passage and also reduce maintenance costs. Rock protection would be installed at culverts to prevent the formation of perched culverts which can prevent fish migration.

The bridges will be designed in accordance with Fairfull & Witheridge (2003). Typical bridge design considerations include minimising bridge piers or foundations occurring within the waterway channel and maximising light penetration under the bridge to encourage fish passage.

Table 3-1 Indicative fauna crossings (update of table 10-13 of the Environmental Assessment)

Approximate chainage	Proposed structure	Indicative size and configuration	Fauna crossing	Habitat connectivity and target species	Aquatic Ecology	Link with existing highway structure
3760	Culvert over Stony Creek	3 x 3600 x 3600	Incidental	Riparian habitat and Moist Forest habitat, fauna associated with the floodplain and farm land, including several common frog and bird species. Minor Watercourse Crossing.	Culvert to be designed in accordance with Fairfull & Witheridge (2003).	Not adjacent to existing highway
5760	Box Culvert	3000 x 1200	Incidental	Open Dry Forest adjacent to existing quarry operations, targeted small mammals, reptiles and frogs.	n/a	Aligns with culvert under existing highway
6320	Fauna corridor under bridge over Warrell Creek	Bridge	Dedicated fauna passage. Located beneath bridge crossing of Warrell Creek on south bank. Combined with fauna fencing to target both drier forest and riparian passage during most wet and dry periods. Fauna fencing to be installed in the order of 500 m either side of the bridge.	Connects Moist Forest habitat (including riparian) east and west of the existing highway along Warrell Creek. Targets range of species including large and small mammals, birds, frogs and reptiles from a range of habitats for riparian and moist forest habitat.	n/a	Adjacent to existing Warrell Creek Bridge

Approximate chainage	Proposed structure	Indicative size and configuration	Fauna crossing	Habitat connectivity and target species	Aquatic Ecology	Link with existing highway structure
6450	Bridge over Warrell Creek	Bridge	n/a	Major watercourse crossing.	Numerous fish species recorded. Bridge to be designed in accordance with Fairfull & Witheridge (2003). Maximise light penetration to encourage fish passage, minimise installation of piers in waterway.	
6510	Fauna corridor under bridge over Warrell Creek	Bridge	Dedicated fauna passage. Located beneath bridge crossing of Warrell Creek on south bank. Combined with fauna fencing to target both drier forest and riparian passage during most wet and dry periods. Fauna fencing to be installed in the order of 500 m either side of the bridge	Connects Moist Forest habitat (including riparian) east and west of the existing highway along Warrell Creek. Targets range of species including large and small mammals, birds, frogs and reptiles from a range of habitats for riparian and moist forest habitat.	n/a	Adjacent to existing Warrell Creek Bridge
8450	Box Culvert	14 x 3600 x 1800	Incidental	Connects Swamp Forest on Gumma Floodplain. Fauna identified within this habitat included a diversity of frog, bird and reptile species and the common brushtail possum.	n/a	Not adjacent to existing highway
9220	Box Culvert	14 x 3600 x 2100	Incidental	Connects Swamp Forest on Gumma Floodplain. Fauna identified within this habitat included a diversity of frog, bird and reptile species and the common brushtail possum.	Culvert to be designed in accordance with Fairfull & Witheridge (2003).	Not adjacent to existing highway

Approximate chainage	Proposed structure	Indicative size and configuration	Fauna crossing	Habitat connectivity and target species	Aquatic Ecology	Link with existing highway structure
13285	Box Culvert	2400 x 1200	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Swamp Forest and Dry Open Forest. Targets frogs, small mammals and reptile species.	n/a	Not adjacent to existing highway
14555	Box Culvert	2400 x 1200	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Moist Forest and Dry Open Forest of Nambucca State Forest. Targets frogs, small mammals and reptiles.	n/a	Not adjacent to existing highway
16630	Box Culvert	3 x 3600 x 1200	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Moist Forest and Dry Open Forest of Nambucca State Forest. Targets frogs, small mammals (rodents, bandicoots, dasyurids) and reptiles.	n/a	Not adjacent to existing highway
17205	Box Culvert	2400 x 1500	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Moist Forest and Dry Open Forest of Nambucca State Forest. Targets small to medium sized mammals (rodents, bandicoots, dasyurids), frogs and reptiles.	n/a	Not adjacent to existing highway
17720	Box Culvert	2400 x 2400	Dedicated fauna crossing structure through Nambucca State Forest.	The structure was placed to capture an east-west corridor connecting from the Bellwood Road and Swampy Creek area in the east through Nambucca State Forest and continuing northwest to Boggy Creek through a range of moist and dry sclerophyll habitats. Designed to minimise east-west fragmentation through Nambucca State Forest and combined with fauna fencing up to 500 m either side of the underpass. Targets all fauna and to include furniture.	n/a	Not adjacent to existing highway
18515	Box Culvert	2400 x 1200	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Dry Open Forest of Nambucca State Forest. Targets small mammals (bandicoots, rodents and dasyurids) and reptiles.	n/a	Not adjacent to existing highway

Approximate chainage	Proposed structure	Indicative size and configuration	Fauna crossing	Habitat connectivity and target species	Aquatic Ecology	Link with existing highway structure
19350	Circular Culvert	750	Incidental	Within Nambucca State Forest.	n/a	Not adjacent to existing highway
19820	Box Culvert	5 x 2400 x 2100	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Moist Forest and Dry Open Forest of Nambucca State Forest. Targets frogs, small mammals (rodents, bandicoots, dasyurids).	n/a	Aligns with culvert under existing highway
20880	Fauna corridor under bridge over Boggy Creek	Bridge	Dedicated fauna passage. Located beneath bridge crossing of Boggy Creek.	Dry corridor connecting Moist Forest habitat. Combined with fauna fencing to target both drier forest and riparian passage during most wet and dry periods. Target all fauna, in particular bandicoots which were common at this location. Fauna fencing to be installed in the order of 500 m either side of the passage.	Modified freshwater habitat. Low abundance and diversity of fish habitats and modified water quality conditions. Bridge to be designed in accordance with Fairfull & Witheridge (2003). Maximise light penetration to encourage fish passage, minimise installation of piers in waterway.	Not adjacent to existing highway
20880	Bridge over Boggy Creek	Bridge	Dedicated fauna passage. Located beneath bridge crossing of Boggy Creek.	Minor waterway crossing.	Bridge to be designed in accordance with Fairfull & Witheridge (2003). Maximise light penetration to encourage fish passage, minimise installation of piers in waterway.	
21740	Fauna corridor under bridge over Cow Creek	Bridge	Dedicated fauna passage. Located beneath bridge crossing of Cow Creek.	Dry corridor connecting Moist Forest habitat. Combined with fauna fencing to target both drier forest and riparian passage during most wet and dry periods. Target all fauna. Fauna fencing to be installed in the order of 500 m either side of the passage.	n/a	Adjacent to existing Cow Creek crossing

Approximate chainage	Proposed structure	Indicative size and configuration	Fauna crossing	Habitat connectivity and target species	Aquatic Ecology	Link with existing highway structure
21740	Bridge over Cow Creek	Bridge		Minor waterway crossing.	Numerous fish species recorded. Bridge to be designed in accordance with Fairfull & Witheridge (2003). Maximise light penetration to encourage fish passage, minimise installation of piers in waterway.	
23040	Fauna corridor under bridge over Deep Creek	Bridge	Dedicated fauna passage. Located beneath bridge crossing of Deep Creek.	Dry corridor connecting Swamp Forest habitat on southern bank of Deep Creek. Combined with fauna fencing to target both drier forest and riparian passage during most wet and dry periods. Target all fauna. Fauna fencing to be installed in the order of 500 m either side of the passage.	Diverse fish population. High abundance and diversity of fish species recorded. Bridge to be designed in accordance with Fairfull & Witheridge (2003). Maximise light penetration to encourage fish passage, minimise installation of piers in waterway.	Adjacent to existing Deep Creek bridge
24305	Box Culvert	2700 x 900	Incidental	Connecting Dry Open Forest and Swamp Forest habitat.	n/a	Aligns with culvert under existing highway
25255	Box Culvert	2400 x 2400	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Larger structure selected with raised benches given the location of Valla Nature reserve to the east. Designed to target east west corridor connecting the coastal Swamp Forest habitat with the drier habitats to the west. Target all fauna, in particular bandicoots which were common at this location.	n/a	Aligns with culvert under existing highway

Approximate chainage	Proposed structure	Indicative size and configuration	Fauna crossing	Habitat connectivity and target species	Aquatic Ecology	Link with existing highway structure
26535	Box Culvert	5 x 3600 x 1200	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connecting Moist Forest habitat associated with Oyster Creek and Jagun Nature Reserve, targeted small mammals (rodents, bandicoots and dasyurids), frogs and reptiles.	Oyster Creek Minor watercourse crossing. Numerous fish species recorded. Culvert to be designed in accordance with Fairfull & Witheridge (2003). Ensure continuity of flow upstream and downstream of culvert.	Aligns with culvert under existing highway
27845	Circular Culvert	4 x 1200	Incidental	Connecting Swamp Forest habitat. Incidental structure in frog habitat.	n/a	Not adjacent to existing highway
28275	Circular Culvert	3 x 1200	Incidental	Connecting Dry Open Forest habitat at south eastern extent of Little Newry State Forest.	n/a	Not adjacent to existing highway
28565	Box Culvert	2 x 2400 x 1200	Incidental	Connecting Dry Open Forest habitat at south eastern extent of Little Newry State Forest.	n/a	Aligns with culvert under existing highway
29215	Circular Culvert	2 x 1200	Incidental	Connecting Dry Open Forest habitat in Little Newry State Forest.	n/a	Aligns with culvert under existing highway
30855	Box Culvert	2100 x 900	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connecting Moist Forest habitat. Smaller design targeting frogs, small mammals (rodent and dasyurids) and reptiles.	n/a	Not adjacent to existing highway

Approximate chainage	Proposed structure	Indicative size and configuration	Fauna crossing	Habitat connectivity and target species	Aquatic Ecology	Link with existing highway structure
31510	Box Culvert	4 x 2100 x 1200	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connecting Moist Forest habitat within Little Newry State Forest. Targeted frogs in particular which were common at this location following high rainfall. Also target small mammals (rodents, bandicoots and dasyurids), and reptiles.	Minor watercourse drainage line. Culvert to be designed in accordance with Fairfull & Witheridge (2003).	Not adjacent to existing highway
32075	Box Culvert	2400 x 1200	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Dry Open Forest habitat. Targeted small mammals (rodents, bandicoots and dasyurids) and reptiles.	n/a	Not adjacent to existing highway
32780	Box Culvert	2400 x 2400	Dedicated fauna underpass through Newry State Forest	Included in key and regional wildlife corridor (as identified by DECCW) within Newry State Forest. To link coastal forests north of Valla with forests to the west of the route. The location coincides with several koala records and known koala habitat. Other threatened species in the area include the brush-tailed phascolage and the spotted-tailed quoll. The underpass provides passage for non-riparian terrestrial fauna as an alternative passage to the combined culverts. Fauna fencing would be provided to direct fauna passage through this underpass.		
33395	Circular Culvert	3 x 1200	Incidental	Connects Moist Forest habitat. Targets small mammals (rodents, bandicoots and dasyurids), frogs and reptiles.	n/a	Not adjacent to existing highway
33880	Box Culvert	2400 x 1200	Incidental	Connects Dry Open Forest habitat. Targets small mammals (rodents, bandicoots and dasyurids), and reptiles.	n/a	Not adjacent to existing highway

Approximate chainage	Proposed structure	Indicative size and configuration	Fauna crossing	Habitat connectivity and target species	Aquatic Ecology	Link with existing highway structure
34380	Box Culvert	3 x 2700 x 1200	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Swamp Forest habitat. Targets small mammals (rodents, bandicoots and dasyurids), frogs and reptiles.	n/a	Not adjacent to existing highway
34615	Box Culvert	3 x 2700 x 1200	Incidental	Connects Dry Open Forest habitat.	n/a	Not adjacent to existing highway
35095	Box Culvert	23 x 3600 x 3000	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects aquatic habitat. Targeted frogs in particular which were common at this location following high rainfall. Also small, medium and large mammals up to Eastern Grey Kangaroo and Koala.	n/a	Not adjacent to existing highway
36905	Box Culvert	2 x 2400 x 1200	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Moist Forest habitat. Targets small mammals (rodents, bandicoots and dasyurids), frogs and reptiles.	n/a	Not adjacent to existing highway
37950	Dry corridor	2400 x 2400	Dedicated fauna passage. through vegetation to the north of the Kalang River.	Dry corridor connecting Moist Forest and riparian habitat. Combined with fauna fencing to target both drier forest and riparian passage during most wet and dry periods. Target all fauna, in particular bandicoots which were common at this location. Fauna fencing to be installed in the order of 500 m either side of the passage.	n/a	Not adjacent to existing highway
38330	Box Culvert	2 x 3000 x 1500	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.	Connects Moist Forest habitat. Targets small mammals (rodents, bandicoots and dasyurids), frogs and reptiles.	n/a	Not adjacent to existing highway

Approximate chainage	Proposed structure	Indicative size and configuration	Fauna crossing	Habitat connectivity and target species	Aquatic Ecology	Link with existing highway structure
39990	Box Culvert	17 x 3300 x 2100	Incidental	Connects Swamp Forest on either side of unidentified habitat.	n/a	Not adjacent to existing highway
40500	Box Culvert	9 x 3000 x 21000	Combined fauna structure with raised benches added for fauna passage. Fauna exclusion fencing.			

The indicative size and configuration of culverts would be further refined during the detailed design phase.

3.4 Types of fishway for NSW

Table 6-2 of the Flora and Fauna Working Paper has been updated to include information in relation to vertical slot fishways. The updated information is provided in Table 3-2.

Table 3-2 Types of fishway for NSW (NSW DPI 2009)

Type of Fishway	Description
Pool-type	A series of interconnected pools bypassing an obstruction.
Denil	A series of symmetrical close-spaced baffles in a channel to redirect the flow of water, allowing fish to swim around the barrier.
Lock	Fish are attracted to an entrance and accumulate in a holding area at the base of the lock. This is then sealed, filled with water to reach a level equal to the water upstream of the barrier. Fish then swim out of the lock.
Trap and Transport	Fish are attracted below a barrier then physically transported over the barrier by road, rail or car. Currently no fishway of this type is operating in NSW.
Rock Ramp	Large rocks and timbers are used to create pools and small falls that mimic natural structures.
Bypass	Low-gradient earthen or rocky channels that mimic the structure of natural streams and are often described as 'nature-like' fishways. Currently no fishway of this type has been built in Australia, however it may provide a cheaper alternative to more technical fishway designs.
Eel and elver pass	A small-diameter pipe or channel lined with materials such as coarse brushes that provide migrating juvenile eels with a damp, complex surface over which to wriggle.
Vertical slot fishway	Vertical-slot fishways are generally used on medium sized weirs. They have a concrete channel divided into a series of pools with evenly spaced baffles. The vertical slot runs the full depth of the baffle and angles the jet of water across the pool to the opposite side, dissipating the energy of water in each pool.

3.5 Noise and vibration

Tables 3-3 to 3-14 below provide corrections for the formatting errors which appeared in the printed Noise and Vibration Working Paper.

The residence on property 125 and 126 as shown in Figure 11-5 of the environmental assessment was incorrectly identified as ineligible for architectural treatment. This property is eligible for at property acoustic treatment to be developed in consultation with the property owner during detailed design.

Table 3-3 Predicted number of exceedances – no mitigation (Corrected PDF file table 4-10 of Noise and Vibration Working Paper)

Exceedance Range dB(A)	Number of Receivers
1-2	170
3-5	100
6-10	89
Greater than 10	15
Total	374

Table 3-4 Predicted rest area vehicle usage (Corrected PDF file table 4-12 of Noise and Vibration Working Paper)

	Vehicle Movements	
Assessment period	Cars	Trucks
Day	5	9
Evening	3	12
Night	6	14

Table 3-5 Mitigation requirements – redeveloped road criterion (corrected PDF file table 5-4 of Noise and Vibration Working Paper)

Receiver number	ECRTN L_{Aeq} 9hr base criterion dB(A)	Future existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with barrier	Meets ECRTN base criterion	Does allowance 1 apply Y/N	Does allowance 2 apply Y/N or acute	Predicted maximum internal level, windows open	Requires architectural treatments	Is level within 1 dB(A) of Criterion
5	55	54	67	67	No	No	Acute	81	Yes	-
8	55	61	66	66	No	No	Acute	78	Yes	-
11	55	59	59	59	No	No	Yes	65	No	-
116	55	54	58	57	No	No	No	64	Yes	-
124	55	55	59	57	No	Yes	Yes	71	No	-
128	55	54	58	56	No	Yes	Yes	70	No	-
130	55	58	63	59	No	No	Yes	77	No	-
132	55	61	61	61	No	No	Acute	72	Yes	-
139	55	59	62	62	No	No	Acute	69	Yes	-
140	55	54	57	57	No	No	No	64	Yes	-
157	55	53	58	56	No	No	No	67	Yes	Yes
162	55	53	58	57	No	No	No	66	Yes	-
1629	55	55	61	61	No	No	Acute	66	Yes	-
1630	55	51	59	59	No	No	No	66	Yes	-
1632	55	58	60	60	No	No	Acute	63	Yes	-
1634	55	55	61	61	No	No	Acute	69	Yes	-
1635	55	58	59	59	No	No	Yes	65	No	-
1636	55	61	64	64	No	No	Acute	72	Yes	-
1637	55	50	56	56	No	No	No	63	Yes	Yes
1639	55	53	59	59	No	No	No	64	Yes	-

Receiver number	ECRTN L_{Aeq} 9hr base criterion dB(A)	Future existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with barrier	Meets ECRTN base criterion	Does allowance 1 apply Y/N	Does allowance 2 apply Y/N or acute	Predicted maximum internal level, windows open	Requires architectural treatments	Is level within 1 dB(A) of Criterion
1640	55	54	60	60	No	No	Acute	64	Yes	-
1642	55	55	61	61	No	No	Acute	67	Yes	-
1643	55	55	61	61	No	No	Acute	66	Yes	-
1644	55	52	57	57	No	No	No	61	Yes	-
1647	55	52	61	61	No	No	Acute	71	Yes	-
1649	55	48	57	57	No	No	No	66	Yes	-
1650	55	57	65	65	No	No	Acute	72	Yes	-
1651	55	51	59	59	No	No	No	66	Yes	-
1652	55	58	61	61	No	No	Acute	69	Yes	-
1653	55	50	57	57	No	No	No	66	Yes	-
1654	55	61	63	63	No	No	Acute	72	Yes	-
1655	55	57	63	63	No	No	Acute	68	Yes	-
1656	55	49	56	56	No	No	No	62	Yes	Yes
1659	55	53	58	58	No	No	No	63	Yes	-
1663	55	52	58	58	No	No	No	65	Yes	-
1666	55	53	59	59	No	No	No	65	Yes	-
1669	55	55	61	61	No	No	Acute	68	Yes	-
1677	55	61	62	62	No	No	Acute	70	Yes	-
1682	55	57	59	59	No	No	Yes	67	No	-
1714	55	52	58	58	No	No	No	66	Yes	-
1722	55	52	58	58	No	No	No	66	Yes	-
1734	55	61	59	59	No	No	Yes	68	No	-
1755	55	54	57	57	No	No	No	68	Yes	-

Receiver number	ECRTN L_{Aeq} 9hr base criterion dB(A)	Future existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with barrier	Meets ECRTN base criterion	Does allowance 1 apply Y/N	Does allowance 2 apply Y/N or acute	Predicted maximum internal level, windows open	Requires architectural treatments	Is level within 1 dB(A) of Criterion
1762	55	53	56	56	No	No	No	63	Yes	Yes
1766	55	55	57	57	No	Yes	Yes	65	No	-
1770	55	53	56	56	No	No	No	63	Yes	Yes
1771	55	54	57	57	No	No	No	64	Yes	-
1782	55	54	56	56	No	Yes	Yes	62	No	-
1788	55	55	57	57	No	Yes	Yes	68	No	-
1791	55	59	61	61	No	No	Acute	71	Yes	-
1794	55	56	61	61	No	No	Acute	72	Yes	-
1795	55	59	60	60	No	No	Acute	71	Yes	-
1799	55	54	56	56	No	Yes	Yes	63	No	-
1800	55	56	63	63	No	No	Acute	73	Yes	-
1805	55	53	56	56	No	No	No	62	Yes	Yes
1809	55	54	61	61	No	No	Acute	67	Yes	-
1810	55	50	56	56	No	No	No	62	Yes	Yes
1816	55	56	59	59	No	No	No	69	Yes	-
2837	55	51	56	56	No	No	No	63	Yes	Yes
2851	55	46	56	56	No	No	No	65	Yes	Yes

Table 3-6 Mitigation requirements – new road criterion (corrected PDF file table 5-5 of Noise and Vibration Working Paper)

Receiver Number	ECRTN L_{Aeq} 9hr Base Criterion dB(A)	Future Existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with Barrier	Meets ECRTN Base Criterion	Does Allowance 1 Apply Y/N	Does Allowance 2 Apply Y/N or Acute	Predicted Maximum Internal Level, Windows Open	Requires Architectural Treatments	Is Level Within 1 dB(A) of Criterion
6	50	54	60	60	No	No	Acute	66	Yes	-
10	50	54	62	62	No	No	Acute	69	Yes	-
191	50	55	54	54	No	No	-	61	Yes	-
192	50	46	55	55	No	No	-	60	Yes	-
194	50	54	54	54	No	No	-	61	Yes	-
197	50	50	56	56	No	No	-	64	Yes	-
198	50	52	56	56	No	No	-	62	Yes	-
199	50	59	52	52	No	Yes	-	52	No	-
201	50	49	56	56	No	No	-	63	Yes	-
203	50	58	52	52	No	Yes	-	54	No	-
204	50	56	52	52	No	Yes	-	55	No	-
205	50	54	57	57	No	No	-	64	Yes	-
15	50	57	59	59	No	No	-	65	Yes	-
16	50	58	55	55	No	No	-	61	Yes	-
20	50	55	52	52	No	Yes	-	56	No	-
29	50	44	54	54	No	No	-	58	Yes	-
31	50	51	55	55	No	No	-	62	Yes	-
46	50	45	52	52	No	No	-	61	Yes	-
48	50	50	54	54	No	No	-	62	Yes	-
56	50	46	55	54	No	No	-	64	Yes	-
57	50	50	56	56	No	No	-	65	Yes	-
65	50	57	51	51	No	Yes	-	57	No	-

Receiver Number	ECRTN L_{Aeq} 9hr Base Criterion dB(A)	Future Existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with Barrier	Meets ECRTN Base Criterion	Does Allowance 1 Apply Y/N	Does Allowance 2 Apply Y/N or Acute	Predicted Maximum Internal Level, Windows Open	Requires Architectural Treatments	Is Level Within 1 dB(A) of Criterion
69	50	59	51	51	No	Yes	-	58	No	-
71	50	59	51	51	No	Yes	-	57	No	-
75	50	60	51	51	No	Yes	-	56	No	-
77	50	52	56	56	No	No	-	66	Yes	-
83	50	57	52	52	No	Yes	-	58	No	-
86	50	47	51	51	No	No	-	58	Yes	Yes
88	50	46	52	51	No	No	-	61	Yes	Yes
89	50	56	53	53	No	No	-	61	Yes	-
94	50	48	52	51	No	No	-	58	Yes	Yes
96	50	49	52	52	No	No	-	53	Yes	-
98	50	56	56	56	No	No	-	68	Yes	-
103	50	50	53	53	No	No	-	52	Yes	-
111	50	53	57	56	No	No	-	69	Yes	-
156	50	51	55	53	No	No	-	62	Yes	-
172	50	47	54	54	No	No	-	59	Yes	-
184	50	46	53	53	No	No	-	59	Yes	-
373	50	47	51	51	No	No	-	57	Yes	Yes
375	50	47	52	52	No	No	-	58	Yes	-
379	50	48	53	53	No	No	-	59	Yes	-
381	50	48	53	53	No	No	-	60	Yes	-
385	50	48	54	54	No	No	-	61	Yes	-
388	50	47	56	56	No	No	-	64	Yes	-
389	50	48	56	56	No	No	-	63	Yes	-
393	50	48	58	58	No	No	-	67	Yes	-

Receiver Number	ECRTN L_{Aeq} 9hr Base Criterion dB(A)	Future Existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with Barrier	Meets ECRTN Base Criterion	Does Allowance 1 Apply Y/N	Does Allowance 2 Apply Y/N or Acute	Predicted Maximum Internal Level, Windows Open	Requires Architectural Treatments	Is Level Within 1 dB(A) of Criterion
415	50	49	61	61	No	No	Acute	72	Yes	-
416	50	49	60	60	No	No	Acute	71	Yes	-
417	50	49	60	60	No	No	Acute	70	Yes	-
419	50	49	59	59	No	No	-	69	Yes	-
422	50	49	59	59	No	No	-	68	Yes	-
423	50	49	58	58	No	No	-	67	Yes	-
424	50	49	58	58	No	No	-	66	Yes	-
425	50	49	57	57	No	No	-	66	Yes	-
426	50	49	57	57	No	No	-	65	Yes	-
428	50	49	56	56	No	No	-	64	Yes	-
430	50	49	56	56	No	No	-	64	Yes	-
431	50	49	53	53	No	No	-	60	Yes	-
434	50	49	55	55	No	No	-	63	Yes	-
436	50	49	55	55	No	No	-	63	Yes	-
437	50	49	55	55	No	No	-	62	Yes	-
439	50	49	54	54	No	No	-	62	Yes	-
441	50	50	54	54	No	No	-	61	Yes	-
445	50	50	54	54	No	No	-	61	Yes	-
446	50	50	53	53	No	No	-	60	Yes	-
447	50	50	53	53	No	No	-	60	Yes	-
449	50	50	52	52	No	Yes	-	59	No	-
452	50	50	52	52	No	Yes	-	59	No	-
461	50	50	51	51	No	Yes	-	58	No	-
472	50	51	51	51	No	Yes	-	57	No	-

Receiver Number	ECRTN L_{Aeq} 9hr Base Criterion dB(A)	Future Existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with Barrier	Meets ECRTN Base Criterion	Does Allowance 1 Apply Y/N	Does Allowance 2 Apply Y/N or Acute	Predicted Maximum Internal Level, Windows Open	Requires Architectural Treatments	Is Level Within 1 dB(A) of Criterion
581	50	52	61	61	No	No	Acute	71	Yes	-
597	50	53	53	53	No	No	-	59	Yes	-
600	50	54	52	52	No	Yes	-	59	No	-
601	50	54	53	53	No	No	-	59	Yes	-
604	50	54	53	53	No	No	-	60	Yes	-
605	50	54	53	53	No	No	-	60	Yes	-
608	50	54	53	53	No	No	-	60	Yes	-
609	50	54	54	54	No	No	-	61	Yes	-
610	50	54	52	52	No	Yes	-	59	No	-
612	50	54	52	52	No	Yes	-	58	No	-
613	50	54	54	54	No	No	-	61	Yes	-
616	50	54	52	52	No	Yes	-	58	No	-
617	50	54	54	54	No	No	-	61	Yes	-
618	50	54	54	54	No	No	-	62	Yes	-
624	50	55	56	56	No	No	-	63	Yes	-
639	50	55	54	54	No	No	-	61	Yes	-
666	50	56	59	59	No	No	-	65	Yes	-
701	50	52	54	54	No	No	-	60	Yes	-
711	50	47	57	57	No	No	-	59	Yes	-
729	50	52	54	53	No	No	-	60	Yes	-
745	50	51	53	52	No	Yes	-	59	No	-
758	50	50	52	51	No	Yes	-	59	No	-
775	50	42	55	53	No	No	-	63	Yes	-
780	50	43	54	52	No	No	-	62	Yes	-

Receiver Number	ECRTN L_{Aeq} 9hr Base Criterion dB(A)	Future Existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with Barrier	Meets ECRTN Base Criterion	Does Allowance 1 Apply Y/N	Does Allowance 2 Apply Y/N or Acute	Predicted Maximum Internal Level, Windows Open	Requires Architectural Treatments	Is Level Within 1 dB(A) of Criterion
783	50	47	52	51	No	No	-	60	Yes	Yes
785	50	47	57	57	No	No	-	67	Yes	-
786	50	47	57	57	No	No	-	65	Yes	-
788	50	46	55	55	No	No	-	56	Yes	-
790	50	45	58	58	No	No	-	69	Yes	-
798	50	44	55	52	No	No	-	61	Yes	-
801	50	44	52	52	No	No	-	52	Yes	-
806	50	40	56	56	No	No	-	67	Yes	-
809	50	43	56	51	No	No	-	66	Yes	Yes
810	50	43	58	53	No	No	-	68	Yes	-
811	50	42	60	54	No	No	-	72	Yes	-
812	50	41	62	62	No	No	Acute	72	Yes	-
813	50	42	54	52	No	No	-	58	Yes	-
815	50	41	55	54	No	No	-	64	Yes	-
822	50	40	57	57	No	No	-	65	Yes	-
825	50	40	60	60	No	No	Acute	68	Yes	-
964	50	34	63	63	No	No	Acute	73	Yes	-
966	50	37	54	54	No	No	-	58	Yes	-
974	50	38	51	51	No	No	-	50	Yes	Yes
1007	50	38	53	53	No	No	-	61	Yes	-
1107	50	38	52	52	No	No	-	58	Yes	-
1825	50	58	57	57	No	No	-	64	Yes	-
1841	50	54	57	57	No	No	-	56	Yes	-
1859	50	38	51	51	No	No	-	53	Yes	Yes

Receiver Number	ECRTN L_{Aeq} 9hr Base Criterion dB(A)	Future Existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with Barrier	Meets ECRTN Base Criterion	Does Allowance 1 Apply Y/N	Does Allowance 2 Apply Y/N or Acute	Predicted Maximum Internal Level, Windows Open	Requires Architectural Treatments	Is Level Within 1 dB(A) of Criterion
1860	50	44	52	52	No	No	-	58	Yes	-
1922	50	43	54	54	No	No	-	58	Yes	-
1958	50	38	56	56	No	No	-	62	Yes	-
2117	50	37	51	51	No	No	-	56	Yes	Yes
2137	50	37	51	51	No	No	-	55	Yes	Yes
2200	50	41	54	54	No	No	-	60	Yes	-
2221	50	41	53	53	No	No	-	59	Yes	-
2260	50	42	56	56	No	No	-	60	Yes	-
2267	50	42	55	55	No	No	-	56	Yes	-
2268	50	39	59	59	No	No	-	64	Yes	-
2294	50	34	55	55	No	No	-	63	Yes	-
2318	50	39	62	62	No	No	Acute	67	Yes	-
2736	50	45	53	53	No	No	-	60	Yes	-
2741	50	44	59	59	No	No	-	65	Yes	-
2744	50	45	53	53	No	No	-	59	Yes	-
2751	50	45	52	52	No	No	-	58	Yes	-
2752	50	44	59	59	No	No	-	64	Yes	-
2754	50	43	51	51	No	No	-	52	Yes	Yes
2759	50	46	58	58	No	No	-	71	Yes	-
2762	50	44	54	54	No	No	-	59	Yes	-
2763	50	47	51	51	No	No	-	55	Yes	Yes
2764	50	46	58	58	No	No	-	62	Yes	-
2766	50	47	56	56	No	No	-	59	Yes	-
2768	50	43	53	53	No	No	-	59	Yes	-

Receiver Number	ECRTN L_{Aeq} 9hr Base Criterion dB(A)	Future Existing 2012 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A)	Design 2022 L_{Aeq} 9hr dB(A) with Barrier	Meets ECRTN Base Criterion	Does Allowance 1 Apply Y/N	Does Allowance 2 Apply Y/N or Acute	Predicted Maximum Internal Level, Windows Open	Requires Architectural Treatments	Is Level Within 1 dB(A) of Criterion
2771	50	50	52	52	No	Yes	-	53	No	-
2772	50	48	56	56	No	No	-	65	Yes	-
2775	50	47	57	57	No	No	-	63	Yes	-
2776	50	43	54	54	No	No	-	54	Yes	-
2778	50	43	54	54	No	No	-	61	Yes	-
2779	50	50	55	55	No	No	-	61	Yes	-
2782	50	52	55	55	No	No	-	63	Yes	-
2783	50	49	57	57	No	No	-	62	Yes	-
2785	50	56	51	51	No	Yes	-	57	No	-
2786	50	59	51	51	No	Yes	-	57	No	-
2788	50	55	54	54	No	No	-	57	Yes	-
2789	50	53	56	56	No	No	-	63	Yes	-

Table 3-7 Visual barrier locations (corrected PDF file table 5-7 of Noise and Vibration Working Paper)

Location	Type	Chainages
Rosewood Rd to Albert Drive Visual Mound with some noise benefits	Mound	3550-4300
Letitia Close Visual mound with possible noise benefits	Mound	11500 - 11800
Mattick Road	Mound	12400-12650 western side
Ridgewood Drive Visual mound with possible noise benefits	Mound	39100-39650 (to Short Cut Road bridge) western side
South Arm Road	Mound	39200-39600 eastern side
Short Cut Road	Mound	39700-39900 eastern side

Table 3-8 Project-specific construction noise objectives (corrected PDF file table 6-4 of Noise and Vibration Working Paper)

Location	Setback from existing highway (m)	Standard hours 7:00 am – 6:00 pm M-F 8:00 am – 1:00 pm Sat		Extended hours 6:00 am – 7:00 am M-F 7:00 am – 8:00 am Sat		Extended hours 6:00 pm – 7:00 pm M-F 1:00 pm – 4:00 pm Sat	
		RBL dB(A)	Noise objective	RBL dB(A)	Noise objective	RBL dB(A)	Noise objective
1	620	39	49	42	47	41	46
2	400	42	52	41	46	40	45
3	80	49	59	47	52	44	49
4	250	48	58	45	50	40	45
5	380	41	51	38	43	34	39
6	200	43	53	39	44	32	37
7	160	39	49	41	46	37	42
8	1300	37	47	41	46	40	45

Table 3-9 Equipment expected to be utilised during each construction stage and estimated associated sound power levels (corrected PDF file table 6-6 of Noise and Vibration Working Paper)

Activity Description	Plant Noise Source	L_{Aeq} Sound Power Level re: 1pW, dB(A)
Stage 1 - Clearing and Grubbing	30t Excavator	103
	Rigid Trucks	107
	Bulldozer	110
	Chainsaws	114
	Tub Grinder	109
Stage 2 - Drainage, Earthworks	Excavator	105
	D11 Bulldozer	114
	D9 Bulldozer	113
	Compactor	112
	Grader	111
	Water Cart	107
	Haul Truck	112
	Dump Truck	110
	651 Scraper	108
	637 Scraper	107
	Backhoe	110
	Vibrating / Compaction Roller	113
	Front End Loader	114
Stage 3 - Bridgeworks	Impact Piling Rig	121
	Bored Piling Rig	114
	Pneumatic Hammer	113
	Excavator	112
	Haul Truck	112
	Generator	111

Activity Description	Plant Noise Source	L_{Aeq} Sound Power Level re: 1pW, dB(A)
	Mobile Crane	110
	Concrete Truck	110
	Concrete Pump	107
	Compressor	105
Stage 4 - Paving & Asphalting	Generator	111
	Backhoe	110
	Asphalt Paver	111
	Concrete Paver	111
	Pneumatic-tyred Roller	111
	Concrete Truck	110
	Concrete Vibrator	105
	Concrete Saw	109
	Concrete Batch Plant	111
	Bobcat	104

Table 3-10 Limiting criteria for the control of blasting impact at residences (corrected PDF file table 6-8 of Noise and Vibration Working Paper)

Day	Time of Blasting	Blast Over Pressure Level, dB (linear)	Ground Vibration, Peak Particle Velocity, (mm/sec)
Monday to Saturday	9am-5pm	115	5
Sunday, Public Holiday	Anytime	0	0

Table 3-11 Minimum distances to comply with blasting vibration and over-pressure limits for various MIC values (corrected PDF file table 6-9 of Noise and Vibration Working Paper)

Maximum Instantaneous Charge (MIC)	Minimum Distance Limits (metres)	
	Vibration	Over-Pressure
5	70	290
10	100	350
20	140	430
50	220	560
100	300	670
200	430	750

Table 3-12 Potential site compound locations (corrected PDF file table 6-10 of Noise and Vibration Working Paper)

Chainage	Eastern/Western side	Location
1800	Eastern side	North of Upper Warrell Creek and the North Coast Railway
2800	Western side	Between the North Coast Railway and Rosewood Road
4200	Western side	Albert Drive
5050	Eastern side	Albert Drive
7800	Western side	Bald Hill Road
9800	Eastern side	South of River Street
11150	Eastern side	North of existing Pacific Highway

11100	Western side	North of existing Pacific Highway
11900	Eastern side	Off Old Coast Road
21050	Eastern side	Nambucca interchange
22200	Western side	Valla Road
26200	Western side	North of East West Road
29800	Split both sides	South of Ballads Road
30200	Split both sides	South of Ballads Road
35550	Eastern side	South of Kalang River
35600	Western side	South of Kalang River
35900	Eastern side	North of Kalang River
36700	Eastern side	North of Kalang River
40400	Western side	Adjacent to Raleigh Industrial Estate

Table 3-13 Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration (m/s^2) 1-80Hz (corrected PDF file table 6-11 of Noise and Vibration Working Paper)

Location	Assessment period	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous Vibration					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or Night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or Night-time	0.04	0.029	0.080	0.058
Impulsive Vibration					
Residences	Daytime	0.30	0.21	0.60	0.42

Location	Assessment period	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
	Nighttime	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or Night-time	0.64	0.46	1.28	0.92
Workshops	Day or Night-time	0.64	0.46	1.28	0.92

Note: Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am, in accordance with *Assessing Vibration; a technical guideline* (DECC 2006)

Table 3-14 Acceptable VDV for intermittent vibration (m/s$^{1.75}$) impacts (corrected PDF file table 6-12 of Noise and Vibration Working Paper)

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note: Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am, in accordance with *Assessing Vibration; a technical guideline* (DECC 2006)

3.6 Road boundary adjustments

3.6.1 Oyster Creek

A number of community submissions (in section 2.9.1, 2.15.2, 2.15.6 and 2.17.2) queried the potential impacts of the Proposal on Oyster Creek and requested further information on the culvert design in this location. This section provides further details of the concept design in and around Oyster Creek and its tributaries.

The local service road on the western side of the highway upgrade was modified so that the earthworks batters interface with those for the proposed northbound carriageway. This alignment shift permits the diversion of Oyster Creek to be maintained within the proposed road boundary.

The realignment geometry extends the R1000 curve at the intersection with East West Road and introduces an additional curve with R2000 radius at approximately the mid-point between the East West Road and the northern end of the local road upgrade.

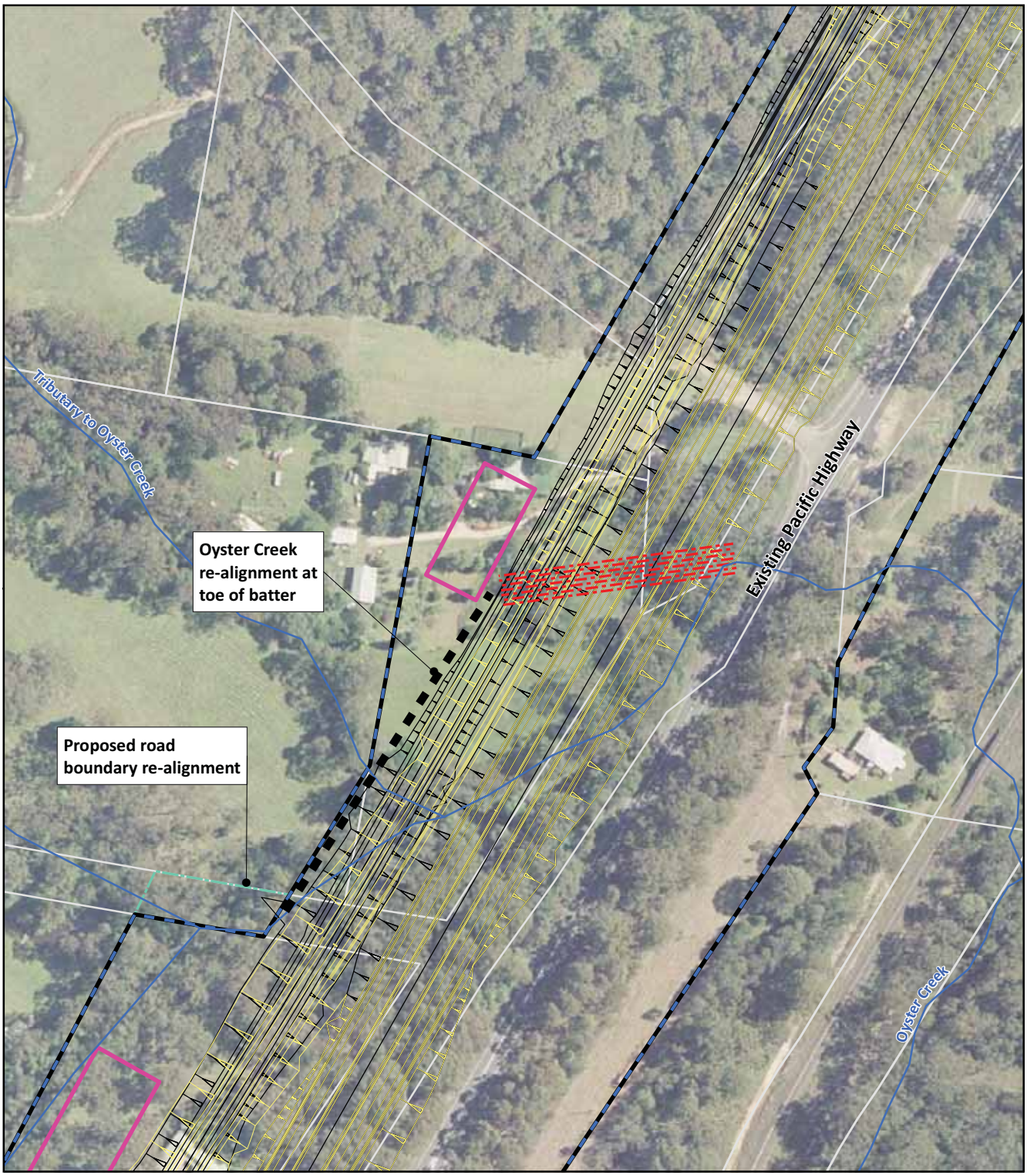
The road boundary has also been adjusted to incorporate acquisition of an additional area of Crown road to avoid the need to acquire additional land from property 137 (see figure 11-5g of the environmental assessment). Figure 3-3 shows the adjustments in relation to the Oyster Creek crossing.

3.6.2 Quarry access

Concerns were raised by a community member regarding the potential shared access with quarry trucks in the vicinity of Nambucca Quarry. As a result the design was modified to include a bitumen sealed access track and guard rail on the western side of the access track.

Figure 3-4 shows the refined design in this location.

Figure 3-3 - Oyster Creek crossing



LEGEND

- Concept design at Oyster Creek
- WC2U original concept design
- WC2U original road boundary as shown in the EA
- Sedimentation Basin
- Drainage culvert

GDA 94 MGA Zone 56

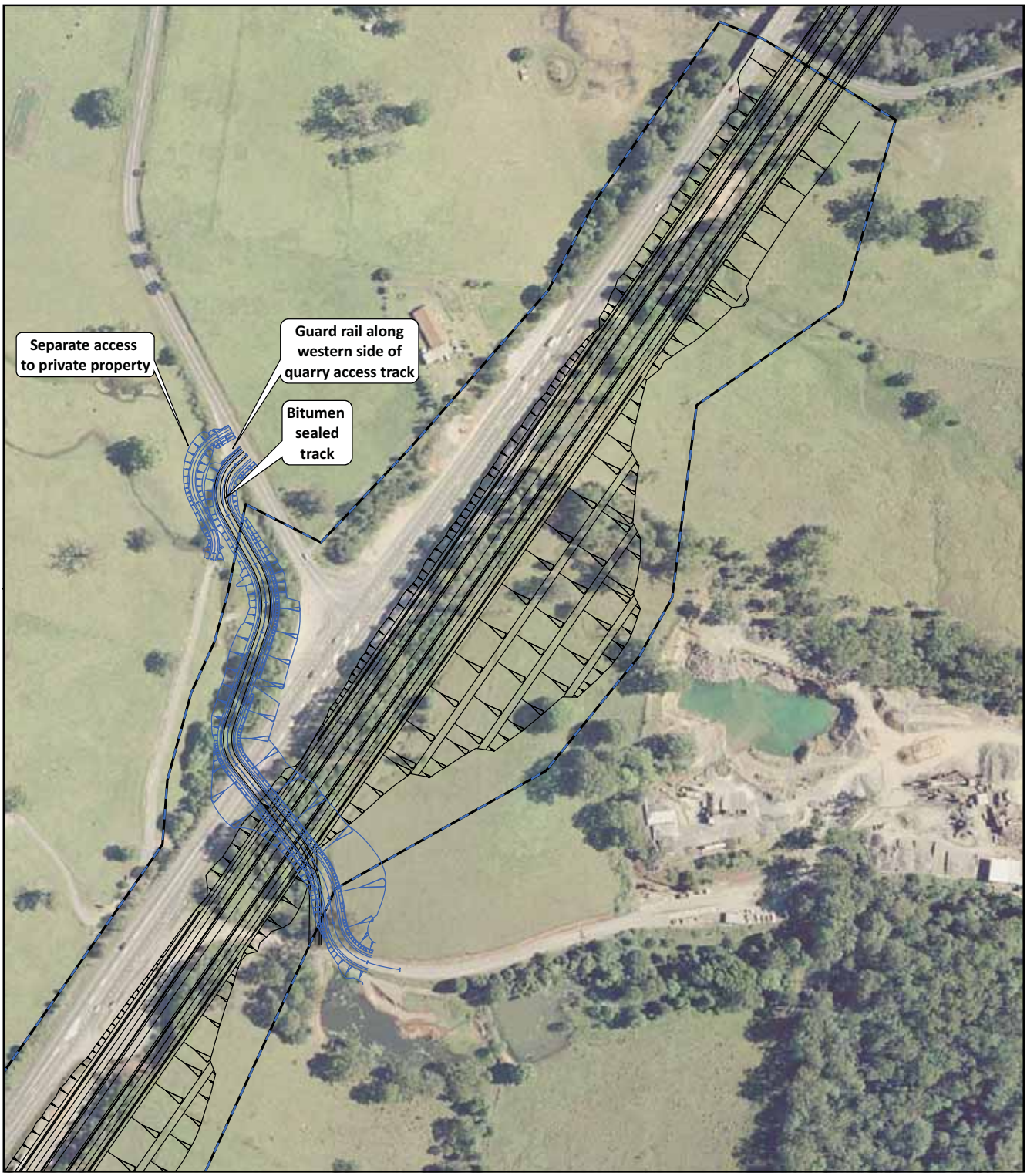
A4 1:2,500

0 100

Metres

September 1, 2010 | I:\ENVR\Projects\EN02286\Technical\GIS\Template\WC2U_SubReport_Fig004.mxd
Sydney Spatial Team - Prepared by : AA
Checked by : JN

Figure 3-4 - Quarry access



LEGEND

- Quarry access
- WC2U original concept design
- WC2U original road boundary

GDA 94 MGA Zone 56

A4 1:3,500

0 100

Metres

August 19, 2010 | I:\ENVR\Projects\EN02286\Technical\GIS\Template\WC2U_SubReport_Fig002.mxd
Sydney Spatial Team - Prepared by : AA
Checked by : JN

3.7 Additional Studies

3.7.1 Peer review of hydrology for Nambucca River Crossing

The RTA engaged WMAwater to undertake a review of the hydrology, flooding and river crossing aspects of the proposed Nambucca River Crossing for the Warrell Creek to Urunga Pacific Highway upgrade. The review included consultation with Nambucca Council and residents who have raised issues regarding the impact of the upgrade on flooding in their submissions. This review is attached in Appendix B.

The purpose of the review was to assess the technical suitability of the work carried out in the environmental assessment for quantifying the impacts of the proposed upgrade on Nambucca River flood levels.

The review found that despite some technical issues the work undertaken for the environmental assessment is suitable for assessing the impact of the upgrade on flooding for events up to and including the 100 year event and for determining conceptual bridge sizes as part of an environmental assessment. The review recommended that a more detailed assessment be undertaken in the detailed design phase to confirm culvert and opening sizes.

The main conclusions of from the review are:

- The impact of the proposed upgrade seems reasonable (afflux of approximately 20 millimetres).
- An afflux impact of 20 millimetres is a relatively low impact for a major river/floodplain crossing.
- The reviewers are unable to conclusively say whether the 100 year ARI flood level in the environmental assessment is a 100 year ARI flood level. It is of the right magnitude and suitable for the purpose of assessing the impact of the upgrade.
- The impacts of the flood in the environmental assessment are probably slightly conservative. If the 100 year flow defined in the Department of Public Works 1994 report were used the impact would be less.
- While the study is suitable for assessing the impacts of the upgrade, it is not suitable for setting new 100 year flood levels. A more detailed study in accordance with the NSW floodplain Development Manual and under the NSW flood program, would be required in order to set new flood levels for the Nambucca River.

As part of the detailed design for the Proposal, the RTA will remodel Nambucca River flooding to confirm the impact of the proposed river crossing. The modelling will include flooding events up to and including the 2000 year ARI flood event.

The purpose of the modelling would be to assess the impacts of the upgrade on flood levels and to locate and size the flood structures for the crossing of the Nambucca River and floodplain. It would not be the intent of the modelling to set new 100 year flood levels for the Nambucca River.

4 Revised statement of commitments

The environmental assessment for the proposed upgrade of the Pacific Highway between Warrell Creek and Urunga identified a range of environmental outcomes and management measures that would be required to avoid or reduce the environmental impacts.

After consideration of the issues raised in the public submissions, the draft statement of commitments for the proposed upgrade of the Pacific Highway between Warrell Creek and Urunga (refer to Appendix D of the environmental assessment) has been revised. Should the Proposal be approved, the revised commitments will guide the subsequent phases of the proposed upgrade.

The following definitions apply in relation to the revised statement of commitments:

Pre-construction	Work in respect of the Proposal that includes design, survey, acquisitions, fencing, investigative drilling or excavation, building/road dilapidation surveys, minor clearing (except where threatened species, populations or ecological communities would be affected), establishing ancillary facilities such as site compounds in locations which meet criteria identified in the environmental assessment, or other relevant activities determined to have minimal environmental impact (eg minor access tracks and adjustments to services/utilities etc).
Construction	All work in respect of the Proposal other than that defined as a pre-construction activity/work.
Operation	The operation of the Proposal, but not including commissioning trials of equipment, or temporary use of parts of the Proposal during construction.

The revised statement of commitments, including commitments relating to the key issues described in the Director-General's environmental assessment requirements is provided in table 4.1. Additional and/or modified commitments to those presented in the draft statement of commitments have been italicised and deleted commitments, or parts of commitments, have been struck out.

Table 4-1 provides an update of the statement of commitments provided in the environmental assessment. New commitments are shown in italics.

Table 4-1 Revised statement of commitments

Outcome	*Ref No.*	*Key action*	*Timing*	*Reference document*
Environmental management				
Compliance and continuous improvement in environmental management.	M1	The head contractor for the project will have an environmental management system.	Pre-construction and construction	*ISO14001:2004.* *RTA QA Specification G36 – Environmental Protection.*
	M2	Suitably qualified and experienced personnel will develop and implement project specific environmental management plans and procedures, incorporating as a minimum the mitigation and management measures in the environmental assessment.	Pre-construction and construction	*RTA QA Specification G36 – Environmental Protection.* *All relevant RTA policies, specifications, guidance notes and environmental directions.*
	M3	RTA and the contractor will implement a performance and compliance program.	Pre-construction and construction	
Community consultation				
Informed community.	CC1	Keeping the community informed will include: ▪ *regular project updates.* ▪ *prior notice of project activities.* ▪ *changes to traffic and access and works outside standard working hours.* ▪ *contact details for enquiries.* Targeted consultation with affected individuals or groups will occur as necessary (e.g. waterway users, farmers, noise affected residents, etc.).	Pre-construction and construction	*RTA Community Involvement and Communications Manual (RTA 2008).* *AS 4269 Complaints Handling.*
	CC2	Complaint management will include: ▪ *A published 24 hour toll free complaints number.*	Pre-construction and construction	*RTA Community Involvement and Communications Manual (RTA 2008).* *AS 4269 Complaints Handling.*

Outcome	Ref No.	Key action	Timing	Reference document
		▪ *Directions on how to register a complaint.* ▪ *Acknowledgment of complaints within eight working hours.* ▪ *Complaint recording.* ▪ *Tracking of complaints until resolution.*		
Traffic and transport				
Minimise impacts on traffic.	T1	Construction vehicle movements and work programs will incorporate traffic control measures to minimise traffic and transport impacts on local roads and the existing Pacific Highway.	Pre-construction and construction	*RTA Traffic Control at Work Sites (RTA 2003).* *RTA QA Specification G10 Control of Traffic.* *RTA Community Involvement and Communications Manual (RTA 2008).*
	T2	Any use of non-arterial roads by construction traffic will require the preparation of pre-construction and post-construction dilapidation reports, with copies to go to the relevant roads authority. Repair of any damage resulting from construction (normal wear and tear), will occur, unless there are alternative arrangements with the relevant roads authority.	Pre-construction and operation	*RTA QA Specification G10 Control of Traffic*.
Minimise impacts on local traffic movement, pedestrians and public transport.	T3	Construction vehicle movement arrangements will limit impacts on other road users (including pedestrians, vehicles, cyclists and disabled persons), having regard to other road works in the area, local traffic movement requirements, and peak traffic volumes, including those during long weekends and holiday periods.	Pre-construction and Construction	*RTA Traffic Control at Work Sites.* *RTA QA Specification G10 Control of Traffic.*
Maintaining access to private properties and state forest resources.	T4	Where the Proposal temporarily or permanently affects any legal property access, the provision of feasible and reasonable alternative access to an equivalent standard will be necessary, unless a property owner agrees to alternative arrangements.	Pre-construction, construction and operation	*RTA Traffic Control at Work Sites.* *RTA QA Specification G10 Control of Traffic.* *Land Acquisition (Just Terms Compensation) Act* 1991. *RTA Land Acquisition Policy.*

Outcome	Ref No.	Key action	Timing	Reference document
	T5	Construction vehicle movements and work programs will incorporate traffic control measures to maintain access to state forests.	Construction	Chapter 5 and Chapter 11 of the environmental assessment (EA). *RTA Traffic Control at Work Sites* (RTA 2003). *RTA QA Specification G10 Control of Traffic*.
Noise and vibration				
Minimise construction noise and vibration impacts.	N1	Further investigation of all feasible and reasonable mitigation and management measures to minimise construction noise at sensitive receivers will occur as part of detailed design (including consideration of early implementation of operational noise mitigation measures). Noise and vibration monitoring will measure against predicted levels and assess effectiveness. Implementation of further feasible and reasonable mitigation measures will occur where necessary.	Pre-construction and construction	RTA *Environmental Noise Management Manual (2001).* *Practice Note VII.* *Interim Construction Noise Guideline* (DECCW) *NSW Industrial Noise Policy (EPA 1999).* *Chapter 14 of the EA.*
	N2	Consultation with affected education institutions during construction works in their vicinity will attempt to limit audible construction works during important events, such as examination periods.	Pre-construction	
	N3	Best practice mitigation and management measures will be used to minimise construction noise and vibration at sensitive receivers.	Construction	*Section 9.5 of the environmental assessment* *Interim Construction Noise Guideline (DECCW 2009).* *Assessing Vibration: A Technical Guide (DEC 2006).* *NSW Industrial Noise Policy (EPA 2000).* *RTA Environmental Noise Management Manual (2001).* *NSW Government's Environmental Criteria for Road Traffic Noise (EPA 1999).*

Outcome	Ref No.	Key action	Timing	Reference document
	N4	Construction would normally be limited to the following hours: ▪ *Between 6am and 6pm Monday to Friday.* ▪ *Between 7am and 4pm Saturday.* There would be no works outside these hours or on Sundays or public holidays except: *a) Works that do not cause construction noise to be audible at any sensitive receivers.* *b) For the delivery of materials required outside these hours by the Police or other authorities for safety reasons.* *c) Where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.* *d) Any other work as agreed through negotiations between the RTA and potentially affected sensitive receivers. Any such agreement must be recorded in writing and a copy kept on site for the duration of the works.* *e) Where the work is identified in the CNVMP and approved as part of the Construction Environmental Management Plan.* *f) As agreed by Department of Planning and or Department of Environment, Climate Change and Water in an EPL for the construction of the Proposal* Local residents and the Department of Environment, Climate Change and Water must be informed of the timing and duration of work approved under items (d) and (e) at least	Construction	RTA *Environmental Noise Management Manual (2001).* *Interim Construction Noise Guideline* (DECCW) Chapter 14 of the EA. AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites.*

Outcome	Ref No.	Key action	Timing	Reference document
		48 hours before that work commences.		
	N5	All reasonable attempts will be made to contact sensitive receivers located within 500 metres of a blast location. The contact will be at least 48 hours before a blast and will include a schedule of blast time(s), and a telephone contact name and number.	Construction	*Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC). German Standard *DIN 4150 Part 3 Structural Vibration in Buildings (Effects on Structures).* *Assessing Vibration: A Technical Guideline* NSW DECC (2006). RTA *Community Involvement and Communications Manual (RTA 2008)*.
	N6	Where complaints relating to noise or vibration impacts as a result of extended workings cannot be satisfactorily resolved with the affected residents then works hours will revert back to standard working hours at that particular location for that particular activity. Resident(s) will be consulted before recommencing any works outside standard working hours. Any complaints received in relation to working hours will be made available to DoP and DECCW.	Construction	RTA *Environmental Noise Management Manual (2001)*. *Interim Construction Noise Guideline* (DECCW) Chapter 14 of the EA. AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites.*
Management of operational noise and vibration.	N7~~5~~	Confirmation of all feasible and reasonable mitigation and management measures to minimise operational noise at sensitive receivers will occur as part of detailed design. Implementation of the measures would occur as construction proceeds.	Pre-construction and construction	Section 14.6 of the EA. NSW Government's *Environmental Criteria for Road Traffic Noise*. RTA's *Environmental Noise Management Manual*.
	N8~~6~~	Monitoring of operational noise will be undertaken within one year after completion of construction. If monitoring indicates a clear trend that traffic noise levels exceed those predicted, investigation of all further feasible and reasonable management measures will occur. Consultation with a suitably qualified and experienced acoustic specialist and the affected property owner will be necessary during the	Operation	NSW Government's *Environmental Criteria for Road Traffic Noise.* RTA's *Environmental Noise Management Manual*.

Outcome	Ref No.	Key action	Timing	Reference document
		development of any additional mitigation measures.		
Flora and fauna				
Minimise impacts on flora and fauna.	F1	Clearing of native vegetation (including endangered ecological communities (EECs)) will be restricted to the minimum area necessary for construction.	Pre-construction and construction	Chapter 10 of the EA. DWE 2008 *Guidelines for Controlled Activities 2008*
	F2	A qualified ecologist will identify any vegetation (including *Marsdenia longiloba*) to be retained and to be clearly delineated on work plans within the construction corridor. Erection of flagging/fencing on-site prior to any construction works, which is to remain in place for the full construction period, will clearly delineate this vegetation.	Pre-construction and construction	Chapter 10 of the EA. *DECC (2004) Threatened species survey and assessment: Guidelines for developments and activities (working draft).* *Australian Network for Plant Conservation 2004 guidelines.*
Threatened species mitigation measures through Newry State Forest (chainage 32500 to 33500).	*F3*	*A threatened flora survey will be undertaken prior to clearing to identify individuals to be translocated and to confirm the extent of clearing.* *Erection of exclusion fencing to prevent any further encroachment into Newry State Forest to the east of the construction footprint.* *Threatened species directly impacted by the Proposal will be translocated to a suitable location outside the impact zone.* *A further visual inspection will be conducted post clearance to identify threatened species which may be indirectly impacted outside the cleared zone.* *Landscape planting to commence along the road boundary as soon as possible during construction.*	*Pre-construction* *Construction* *Construction*	*Section 3.1 of The response to Submissions and Preferred Project Report*
	F45	Plantings of rusty plum (*Amorphospermum whitei*) in areas of suitable habitat adjacent to the Proposal will follow from seed collection and propagation.	Pre-construction	Australian Network for Plant Conservation 2004 guidelines.
	F5	Site induction of construction workers will inform and instruct them of vegetation to be retained and on the identification of threatened species	Pre-construction and construction	*DECC (2004) Threatened species survey and assessment: Guidelines for developments and activities (working draft).*

Outcome	Ref No.	Key action	Timing	Reference document
Maintain fauna habitat and connectivity.	F~~5~~6	A suitably qualified ecologist will undertake pre-clearance surveys for threatened species including frogs. Searches will include nests and hollow bearing trees. Re-location of fauna species at risk of injury found in pre-clearance surveys or during construction will be in suitable habitat as close as possible to the area in which they were found. Immediately prior to clearing an inspection will confirm that the sites subject to pre-clearance surveys remain free of fauna.	Pre construction and construction	*National Parks and Wildlife Act* 1979. *RTA QA Specification G36 Environmental Protection.*
	F~~6~~7	Where feasible and reasonable the identification and distribution of natural and artificial habitat features and resources (such as hollow-bearing trees, hollow logs, nest boxes and bush rocks) will occur along the Proposal. This relocation will limit injury to fauna and damage to existing vegetation. A nest box plan will be developed for the Proposal.	Pre construction and construction	Section 10.5 of the EA. *Australian Network for Plant Conservation 2004 guidelines*.
	F~~7~~8	Retention of mature trees in the median at locations identified in the environmental assessment will provide a stepping stone for gliders. Protection of these trees will occur (F2), and lopping and pruning is not to occur without expert advice.	Pre-construction and construction	Table 10-12 of the EA.
	F~~8~~9	Provision of fauna crossings will be as identified in the environmental assessment. All fauna crossings will be confirmed with the DECCW and I&I (Fisheries) during the detailed design phase.	Pre-construction	Table 3-1 of the Response to Submissions and Preferred Project Report.
Minimise adverse impacts on aquatic habitat and fish species.	F~~9~~10	Design and construction of waterway crossings will be in accordance with the fish habitat classification of each waterway and in consultation with the Department of Industry and Investment. All fauna crossings will be confirmed with the DECCW and I&I (Fisheries) during the detailed design phase.	Pre-construction	*Fish note: Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries). *Policy and Guidelines for Design and Construction of Bridges, Roads, Causeways, Culverts and Similar Structures* (NSW Fisheries 1999).

Outcome	Ref No.	Key action	Timing	Reference document
				Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge 2003).
Minimise fauna road injuries and mortalities during operation.	F~~10~~11	Erection of fauna exclusion fencing (e.g. floppy-top fencing) along the Proposal at appropriate locations will direct fauna movement towards fauna-crossing structures.	Construction and Operation	Figure 10-6 to 10-9 of the environmental assessment.
Offset residual impacts of the Proposal on key habitat.	F~~11~~12	Development of an offset strategy will occur in consultation with the Department of Environment, Climate Change and Water.	Pre-construction and construction	RTA *Compensatory Habitat Policy and Guideline* (draft).
Effective flora and fauna management and mitigation measures.	F~~12~~13	A targeted, adaptive monitoring program will be undertaken for a minimum of 12 months to assess the effectiveness of fauna and flora impact mitigation measures. After 12 months a report will be completed to assess the need for additional measures and/or further targeted monitoring.	Operation	Section 10.5.11 of the EA.
	F~~13~~14	The RTA will set bed levels for culverts and ledges for combined fauna passage in consultation with the Department of Environment, Climate Change and Water.	Pre-construction and construction	Section 10.4.3 of the EA
Aboriginal heritage				
Minimise impacts on Aboriginal heritage.	AH1	The protection of items and areas of archaeological significance not directly affected by construction will occur.	Pre-construction and construction	*RTA Procedure for Aboriginal cultural heritage consultation and investigation.* *Aboriginal cultural heritage: Standards and Guidelines Kit (DECCW).* *Protecting Aboriginal objects and places - Interim guidelines for community consultation.* *National Parks and Wildlife Act* 1974. *Chapter 15 of the EA.*

Outcome	Ref No.	Key action	Timing	Reference document
	AH2	There will be protocols will be established and implemented to manage any previously unidentified Aboriginal objects or skeletal remains encountered during construction. All works in the vicinity of the find will cease to obtain Aboriginal heritage specialist advice and inform the Department of Environment, Climate Change and Water.	Pre-construction and construction	*RTA Procedure for Aboriginal cultural heritage consultation and investigation.* *Protecting Aboriginal objects and places - Interim guidelines for community consultation.* *National Parks and Wildlife Act* 1974. *Chapter 15 of the EA.*
	AH3	The management of any Aboriginal heritage items directly affected will be in consultation with Aboriginal stakeholders and the Department of Environment, Climate Change and Water.	Pre-construction and construction	*RTA Procedure for Aboriginal cultural heritage consultation and investigation.* *Protecting Aboriginal objects and places - Interim guidelines for community consultation.* *National Parks and Wildlife Act* 1974. *Chapter 15 of the EA.*
	AH4	All construction personnel will receive training on their obligations for protection of Aboriginal cultural materials, including information on site locations, conservation management and legal obligations in regard to Aboriginal cultural materials.	Pre-construction	*RTA Procedure for Aboriginal cultural heritage consultation and investigation.* *National Parks and Wildlife Act* 1974.
Aboriginal participation will be on-going.	AH5	The RTA will comply with the NSW Government's *Aboriginal Participation in Construction Guidelines.*	Pre-construction and construction	*RTA Procedure for Aboriginal cultural heritage consultation and investigation.* *NSW Government's Aboriginal Participation in Construction Guidelines (2007).*
Non-Aboriginal heritage				
Minimise impacts on non-Aboriginal heritage.	NH1	The detailed design will minimise impacts to identified non-Aboriginal heritage items where feasible and reasonable.	Pre-construction	*Heritage Act* 1977. *Section 19.3 of the EA.*
	NH2	If any material of potential archaeological significance is	Pre-construction and	*Heritage Act* 1977.

Outcome	Ref No.	Key action	Timing	Reference document
		unearthed, work will cease to obtain specialist heritage advice.	construction	*Section 19.3 of the EA.*
	NH3	Preparation of archival and photographic records for impacted heritage items would be in accordance with relevant guidelines.	Pre-construction	NSW Heritage Branch Guidelines: *How to Prepare Archival Recording of Heritage Items (1998).* *Photographic Recording of Heritage Items Using Film or Digital Capture (2006).* *Heritage Act* 1977. *Section 19.3 of the EA.*
Water quality and hydrology				
Erosion and sediment controls are effective.	W1	Minimisation of the area of soil exposure during construction.	Construction	*RTA QA Specification G40 Clearing and Grubbing.*
	W2	Detailed design will further investigate any additional feasible and reasonable mitigation and management measures to minimise construction erosion and sedimentation.	Pre- construction	*Managing Urban Stormwater – Soils and Construction*", the RTA's "*Guidelines for the Control of Erosion and Sedimentation in Roadwork's*" and the Department of Planning's "*Constructed Wetlands Manual*". Temporary sediment basins to be installed at locations identified in Figures 6-1-6.21 of the EA.
	W3	Monitoring of groundwater impacts and surface water quality upstream and downstream of the site during construction will determine the effectiveness of mitigation strategies. Implementation of additional feasible and reasonable management measures will occur if necessary.	Pre-construction and construction	Draft DECC "*Managing Urban Stormwater: Soils and Construction, Volume 2, Book 4, Main Road Construction* (2006)". *Managing Urban Stormwater: soils and construction* (Landcom 2004). The RTA's *Code of Practice for Water Management – Road Development and Management*. RTA *QA Specification G38 Soil and Water Management*.

Outcome	Ref No.	Key action	Timing	Reference document
				RTA *QA Specification G39 Soil and Water Management (Erosion and Sediment Control Plan).*
	W4	Development and implementation of specific construction measures for in-stream works to limit water quality impacts will occur in consultation with relevant government agencies.	Pre-construction and construction	*Managing urban stormwater: soils and construction* (Landcom 2004). The RTA's *Code of Practice for Water Management – Road Development and Management*. RTA *QA Specification G38 Soil and Water Management*. Chapter 16 of the EA.
	W5	Managing operational water quality will occur by applying *RTA's Code of Practice for Water Management – Road Development and Management (1999)*.	Operation	*RTA's Code of Practice for Water Management – Road Development and Management (1999).*
Minimise groundwater related impacts.	W6	Investigation of the potential for changes in the groundwater table will take place before starting any major earthworks. Where a potential for change is identified, the significance of the change and any resultant impacts will be determined and measures to manage the changes will be designed and implemented as necessary.	Pre-construction and construction	Section 16.4 and table 16-4 of the EA. *RTA's Code of Practice for Water Management – Road Development and Management (1999).* RTA *QA Specification G38 Soil and Water Management*. *Water Act 1912.*
	W7	*Baseline monitoring of groundwater levels and chemical levels at cutting sites near springs, creeks or endangered ecological communities prior to construction commencing.*	*Pre-construction and construction*	Section 16.4.1.3 and table 16-4 of the EA. *RTA's Code of Practice for Water Management – Road Development and Management (1999).* RTA *QA Specification G38 Soil and Water Management*. *Water Act 1912.*
Soils and fill				

Outcome	Ref No.	Key action	Timing	Reference document
Minimise impact of exposing acid sulphate soil.	S1	Identification and management of Acid Sulphate Soils will be in accordance with the *Guidelines for the Management of Acid Sulphate materials: Acid Sulphate Soils, Acid Sulphate Rock and Monosulphidic Black Ooze* (RTA 2005).	Pre-construction and construction	*Guidelines for the Management of Acid Sulphate materials: Acid Sulphate Soils, Acid Sulphate Rock and Monosulphidic Black Ooze* (RTA 2005). *Acid Sulphate Soils Manual"* (Acid Sulphate Soil Management Advisory Committee 1998).
Protection of the environment, workers and the public.	S2	There will be identification, investigation and appropriate management of areas of potential soil contamination (including works in the vicinity of the old municipal tip site in Nambucca State Forest).	Pre-construction and construction	DECC (1999) *Environmental Guidelines – Assessment, Classification and Management of Liquid and non-liquid Waste*. *Contaminated Land Management Guideline* (RTA 2005). DECC Guidelines for NSW Site Auditor Scheme. *Contaminated Land Management Act,* 1997. SEPP 55 – Remediation of *Land*.
Air quality				
Minimise dust generation and impact to sensitive receivers.	AQ1	To minimise windblown, traffic generated or equipment generated dust emissions, there will be feasible and reasonable mitigation and management measures.	Construction	DECC guideline "*Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales*".
	AQ2	Dust generating activities will stop where visible dust is being emitted outside the construction corridor and dust suppression measures are ineffective.	Construction	Section 19.2 of the EA.
Greenhouse gases and energy				
Minimise greenhouse gas and energy consumption.	G1	Wherever feasible and reasonable detailed design will consider whole of life reductions in greenhouse gas emissions and energy consumption.	Pre-construction and construction	AS/NZS 1158:1.1.2005.
	G2	Energy efficient work practices will be adopted to limit energy use.	Preconstruction and construction	

Outcome	Ref No.	Key action	Timing	Reference document
		Where reasonable and feasible, equipment and management measures will be adopted to minimise energy use and greenhouse gas production.		
Visual amenity and design				
Urban and landscape character of the study area will be maintained and enhanced.	UD1	The preparation of detailed urban and landscape design will be in consultation with Nambucca and Bellingen Shire councils and the community. The detailed design and implementation of built elements and landscapes and the mitigation of residual impacts will be in accordance with the visual and urban design objectives and principles of the Proposal.	Pre-construction	*Beyond the Pavement – RTA Urban and Regional Design Practice Notes* (RTA 2004). *Pacific Highway Urban Design Framework* (RTA 2005). Chapter 13 of the environmental assessment. Working Paper 2 – *Visual Amenity and Design.* Landscape Guidelines (RTA 2008).
Minimise visual impacts.	UD2	The species to be used in the landscaping treatments will include native and locally indigenous plants.	Pre-construction and construction	Working Paper 2 - *Visual Amenity and Design* and Working Paper 1 – *Flora and Fauna.*
Monitoring and management of landscaping to ensure its effectiveness.	UD3	Landscape and rehabilitation works will be subject to monitoring and maintenance where necessary for a minimum of two years after construction.	Construction and operation	Chapter 10 and 13 of the EA.
Hazards and risk				
Minimise the risk of hazard on the environment and community.	HR1	Hazardous materials used during construction will be stored in bunded areas within construction sites. Hazardous materials will not be stored on the floodplain below the 20 year ARI flood level. Use of hazardous materials in floodplain areas will be limited to a daily or weekly threshold. Containers, workshops, plant, material stores and storage tanks will not be sited on the floodplain of watercourses where avoidable.	Construction	*AS 1940 The Storage and Handling of Flammable and Combustible Liquids.* *RTA QA Specification G38 Soil and Water Management.* *DEC Bunding and Spill Management Guidelines (in DEC Environmental Protection manual for Authorised Officers).* *RTA Code of Practice for Water management (RTA 1999).* *RTA QA Specification G36 Environmental Protection.*
	HR2	Potentially hazardous and contaminating activities (such as	Construction	*AS 1940 The Storage and Handling of*

Outcome	Ref No.	Key action	Timing	Reference document
		washing construction plant and handling hazardous chemicals) and activities with the potential for spillage such as refuelling, maintenance of equipment, mixing of cutting oil and bitumen will be in bunded areas or in other areas where suitable containment measures are in place to prevent discharge into watercourses.		*Flammable and Combustible Liquids.*
Waste and resource management				
Minimise waste production.	WR1	The waste minimisation hierarchy principles of avoid / reduce / re-use / recycle / dispose will apply to all aspects of the Proposal, including work programs, purchase strategies and site inductions. Quarterly assessments will identify opportunities for improvement.	Pre-construction and construction	*Waste Avoidance and Resource Recovery Act* 2001. NSW Government's *Waste Reduction and Purchasing Policy*. *Waste Avoidance and Resource Recovery Strategy (DECC 2006).* DECC (1999) *Environmental Guidelines – Assessment, Classification and Management of Liquid and non-liquid Waste.* RTA Stockpile management procedures 2001.
Minimise waste produced and dispose appropriately.	WR2	Where reuse or recycling of water is not possible, it will be sent to an appropriately licensed facility.	Construction	*Protection of the Environment Operations Act* 1997. *Waste Classification Guidelines (DECC 2008).* *RTA Guidelines for Management of Acid Sulphate Materials (RTA 2005).* *RTA QA SpecificationsG36 Environmental Protection.*
Landuse and property				
Appropriate compensation will be paid in relation to property acquisitions.	P1	Negotiation of all property acquisitions will be in accordance with the RTA *Land Acquisition Policy Statement.* Compensation assessment will be in accordance with the *Land Acquisition (Just Terms Compensation) Act* 1991.	Pre-construction	RTA *Land Acquisition Policy Statement.* *Land Acquisition (Just Terms Compensation) Act* 1991.

Outcome	*Ref No.*	*Key action*	*Timing*	*Reference document*
Minimise impacts on forestry operations.	P2	The Department of Industry and Investment will have access to state forest land identified for acquisition by RTA to remove any harvestable timber within the footprint of the Proposal prior to commencement of construction. Access to state forest land adjacent to the Proposal will provide for forestry operations, fire management activities and recreation purposes.	Pre-construction, construction and operation	*Community involvement a Communications. Draft: A resource manual for staff* (RTA June 2008).
Maintenance of water supply to properties.	P3	Where the Proposal adversely affects a licensed bore, dam or other property water supply, RTA will investigate an alternate source or negotiate compensation for the loss with the landowner.	Construction and operation	
Socio economic impacts				
Minimise impacts on businesses, agriculture and aquaculture.	S1	There will be ongoing consultation with affected businesses, agricultural and aquaculture landowners.	Pre-construction and construction	*Community Involvement and Communications. Draft: A resource manual for staff* (RTA June 2008).
Minimise disruption to utilities and services.	S2	The identification of utilities and services potentially affected by construction, including requirements for diversion, protection and / or support will occur prior to the start of construction. Consultation with the service providers will determine alterations to services, the limitation of disruptions and requirements for advice to customers.	Pre-construction and construction	
Minimise environmental and social impacts from the construction of temporary ancillary facilities.	S3	Sites chosen for ancillary facilities will satisfy criteria outlined in Chapter 7 of the EA. Occupation and use of compound and work sites will seek to minimise disturbance to adjacent residents.	Pre-construction and construction	Section 7.3.7 of the environmental assessment.
Minimise agricultural impacts during construction and operation	*S4*	*Fencing will be erected around construction activities to prevent livestock from adjacent properties entering construction areas.* *Inclusion of water quality protection measures during the installation of in-stream structures to protect aquaculture.*	*Pre-construction and construction*	*Section 12.4.1 of the environmental assessment.*

5 References

ASSMAC 1998. Acid Sulphate Soils Manual.

Commonwealth Department of Health and Ageing 2004. Guidance on Use of Rainwater Tanks. ISBN 0 642 82443 6.

Department of Environment and Climate Change (2008) Managing Urban Stormwater: Soils and Construction. Volume 2D – Main Road Construction.

National Parks and Wildlife Service 1999, The Comprehensive Regional Assessment of North Eastern NSW.

Landcom 2004, The Blue Book – Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition 2004 (reprinted July 2006).

National Parks and Wildlife Service 1999, The Comprehensive Regional Assessment of North Eastern NSW.

Roads and Traffic Authority (RTA) 2008a, *Community Involvement and Communications Draft: A Resource Manual for Staff*, June 2008.

Roads and Traffic Authority (RTA) 2010, Warrell Creek to Urunga Environmental Assessment. Prepared by SKM January 2010.

Commonwealth Department of Health and Ageing 2004. Guidance on Use of Rainwater Tanks. ISBN 0 642 82443 6.

Roads and Traffic Authority (RTA) 2007, Macksville to Urunga Preferred Route Submissions Report. Prepared for the RTA by SKM September 2007.

Roads and Traffic Authority (RTA) 2008, Warrell Creek Review Report. Prepared for the RTA by SKM June 2008

Appendix A
Detailed DECCW response in relation to noise

Appendix A - Detailed Department of Environment, Climate Change and Water response in relation to noise

Sub no.	Item no.	Issue verbatim	Response
36	13	DECCW note that reference is made to the Interim Construction Noise Guideline (ICNG) for standard hours of work. Despite this, the EA suggests construction work hours to be between 6am and 6pm Monday to Friday, which is outside the hours prescribed by the ICNG. Standard hours of work should comply with the ICNG, and should be reflected accordingly in the EA and draft Statement of Commitments.	Table 14-4 in the Environmental Assessment (EA) presents the recommended standard hours for construction work as stated within the Interim Construction Noise Guideline (Department of Environment, Climate Change and Water). Section 14.3.4.1 indicates that these hours may be varied where necessary to undertake work for safety or accessibility reasons. Section 14.3.4.2 indicates the hours that construction would normally be limited to standard work hours for this Proposal, and the circumstances under which work outside of these hours would be undertaken. It is further noted here that construction hours would be dictated by the conditions of approval and would be managed by the construction contractor through the construction environmental management plan. The RTA acknowledges that these works are outside of the standard hours prescribed by the ICNG and has provided additional mitigation measures to address any complaints received by the community/individuals including reverting back to standard construction hours in any construction area where complaints cannot be resolved to the satisfaction of all parties. The environmental assessment process is seen as an open and transparent process in which community can be informed of the intended construction hours and that a progression of works can occur without causing serious impact to the community.
36	14	The number of noise monitoring locations (8) is quite low considering the length of the Proposal (i.e. a 42km upgrade). A review of recent road upgrades projects [sic] demonstrates this point… The noise monitoring serves several purposes. The first is to enable calibration of the road traffic noise model used for the assessment, the second is to assist in identifying the existing levels of road traffic noise criteria, and the third is to establish construction noise assessment criteria. Additional monitoring for construction noise criteria can be undertaken as part of the normally required construction noise management plan. The model calibration has relied on only four (4) sites, with a significant variation being recorded for one location (location 6). the proponent should be put on notice that additional noise monitoring , for the purpose of noise model calibration, will be required as part of the 'review of operational noise mitigation measures' that is generally required as part of the project approval. The object of the 'review' is to demonstrated, on the basis of detailed design, the noise performance of the Proposal, and the exact manner in which noise impacts are to be mitigated.	The noise monitoring programme for the Warrell Creek to Urunga Proposal is considered to be adequate for the EA stage of the Proposal. The monitoring undertaken for the Proposal was also based on the following considerations. ■ The distance of the monitoring location from the existing alignment. ■ The siting of monitoring locations in an appropriate speed zone (100km/h similar to design alignment). ■ The position of the monitoring location with respect to localised topographic anomalies. ■ The willingness of residents to participate in the noise monitoring exercise. In addition, there are several noise monitoring and modelling exercises that remain for this Proposal to potentially refine the noise predictions in the EA. These include: 1) Construction noise monitoring; 2) The detailed design and noise mitigation assessment; 3) A review of operational mitigation measures; and 4) Post construction, operational noise monitoring and prediction. Through these additional noise assessment processes, there is the ability to monitor additional sites and capture any noise impacts caused by changes to the design and mitigation measures.
36	15	Section 4.8 of the document includes the following statement; "for the modelling scenario, contributions from the existing highway were not included in the prediction of noise emissions". It needs to be confirmed in the revised EA, that the traffic noise predictions for the design year (2022) have included cumulative road traffic noise, as opposed to only Proposal related traffic noise.	Following discussions with the DECCW, SKM has undertaken a sensitivity analysis to identify the potential for traffic on the existing alignment to provide a cumulative noise impact when assessed in conjunction with the proposed upgrade. The study is limited to areas where the two alignments are in close proximity to each other through Warrell Creek/Bald Hill area in Section 1 and Section 3 of the upgrade alignment. In addition, some of these properties would experience noise impacts on different facades and therefore would be the subject of a separate monitoring campaign and would be further assessed during the detailed design phase. The outcome of the study indicated three types of cumulative noise impacts at receiver locations. Broadly speaking these are: ■ Receivers that exhibit an increase where the existing highway is the main contribution. ■ Receivers where the existing highway has a contribution but mitigation is already proposed. ■ Receivers where the existing highway has a contribution but mitigation is not currently proposed. The results of the sensitivity analysis can be seen in the attached figures below that present the noise level increase in dB(A) in red font, which are shown next to the property ID. Only those receivers which have experienced a noise level increase are shown. The figure numbers remain numbered 1-21 to correspond with the figures shown in Appendix B of the Noise and Vibration Working Paper (No 3). The properties that may experience an increase in noise due to the combined effects of the existing and upgraded alignment that are not currently recommended for noise mitigation are listed below.

Sub no.	Item no.	Issue verbatim	Response
			<table><tr><th>Property ID</th><th>Potential Increase</th><th></th><th>Property ID</th><th>Potential Increase</th></tr><tr><td>152</td><td>2</td><td></td><td>1635</td><td>1</td></tr><tr><td>199</td><td>3</td><td></td><td>1686</td><td>2</td></tr><tr><td>203</td><td>3</td><td></td><td>1734</td><td>1</td></tr><tr><td>204</td><td>2</td><td></td><td>1766</td><td>1</td></tr><tr><td>207</td><td>3</td><td></td><td>1799</td><td>1</td></tr></table>
36	16	There appears to be numerous errors in Tables 5-4 and 5-5, with values and text being place in the wrong columns. This makes interpretation of the results difficult a, and indicates that the tables were not review before publication. The table requires amendment and review for accuracy prior to further assessment.	The amended tables are provided in Section 3.5 of the Submissions Report.
36	17	The Nambucca Heads Rest Area assessment has adopted criteria based on the night time RBL acquired from Location 3 of 49dB(A). However, Location 6 is much closer to the rest area. The two locations have similar road traffic noise exposure during the night time period with location 3 being LAeq, 9hr 56dB(A) and location 6 being LAeq, 9hr 57dB(A). However, the RBL at location 6 is 32dB(A), some 17dB(A) lower than location 3. DECCW does not support the assessment criteria for the Nambucca Heads Rest Area and recommend this be reassessed in the revised EA.	The representative receiver location selected for the assessment is correct. The nearest affected receiver for the proposed rest area is located approximately 60 metres from the existing highway. The receiver at Location 3 is approximately 75metres from the highway and approximates the terrain adjacent to the rest area receiver. In contrast, the receiver at Location 6 is located approximately 220 metres from the existing highway with local topography that is not representative of the area adjacent to the rest area receiver. The RTA has committed to undertake a detailed background noise assessment at the nearest affected receiver location to the rest area to provide additional information on the noise levels at this receiver location and revise the assessment on the rest area as necessary.
36	18	The reason for the discrepancies in reported LAeq, 9hr descriptors between Tables 2-1 and 2-2 needs to be explained in the revised EA.	The anomalies occur at 4 locations and are the result of the use of data that has not been adjusted for meteorological effects.
36	19	The number of receivers requiring mitigation after the application of low noise pavement (see Table 5-3, column 4 headed "difference after mitigation") does not appear to be correct when you consider the numbers in columns 2 and 3 of the same table. This needs to be verified in the revised EA.	The amended tables are provided in Section 3.5 of the Submissions Report.
36	20	The maps in Appendix B show numerous examples of closely grouped receivers exceeding the criteria, where architectural acoustic treatment (AAT) is proposed in lieu of roadside barriers, for example sheets 5 of 21, 6 of 21, 14 of 21 and 21 of 21. DECCW acknowledges that in Section 5.5 of the noise working paper that barriers were discounted from several areas 'due to topographic effects or large distances between receivers', and graphic representations have been generated to support the basis for not considering barriers at Rosewood Road, Wedgewood Drive, River Road/Gumma Road, Letitia Close, South Arm Road and Ridgewood Drive. DECCW requires a quantitative assessment based on feasible and reasonable considerations, for cases where clumped residences of more than three are proposed to be mitigated using architectural acoustic treatments in lieu of roadside barriers. This request may require inclusion in conditions of approval if not included in the revised EA.	A quantitative assessment of noise barriers was undertaken for all areas addressed in the Director General's requirements. The omission of noise barriers in various areas of the alignment was not based on simple qualitative assessment. The noise impact assessment initially adopted the use of low noise pavements as a noise attenuation measure for sections of the highway where the noise reductions would benefit the greatest number of receivers. After this form of mitigation was assessed, additional measures were considered. The noise report states the commitment of the Project to providing noise mitigation using the following hierarchy: "The preferred method of mitigation for noise impacts for this Proposal is by implementing noise barriers, firstly using noise mounds and then noise walls so that the ambient level at a residential receiver is at or below the noise criterion for both day and night time periods. Other forms of noise mitigation such as treatments to buildings are considered where noise barriers are not effective or not feasible due to cost or engineering/topographic constraints" This commitment was quantified as per the ENMM guidelines. Section 5.5 of the report states "Testing of barrier options included the minimum performance requirements for noise barriers outlined in Section 5.1". The testing was undertaken by modelling noise barriers and comparing the results to the minimum performance requirements. The results of these assessments indicated that the implementation of noise barriers was not reasonable and therefore alternative mitigation was identified for these receivers. The graphics in the report were intended to provide additional information to the reader as to the reason why noise barriers were not effective in certain instances but were not the basis of the noise barrier assessment.
36	21	DECCW does not accept the application of a 4.5m upper barrier height for the Proposal. Guidance of barrier height selection is provided by the RTA, Environmental Noise Management Manual (ENMM). Where this process recommends barrier heights in excess of 4.5m, strong justification would be needed to lower the assessed barrier height for Albert Drive was determined as 5.5m. The revised EA needs to clearly justify the selection of barrier heights other than referring to the status quo of other projects.	The reasonable feasible assessment has been followed in establishing barrier heights as per Practice IV of the RTA ENMM (refer flow chart pg 104 and 105 which refer to considering visual impacts of the assessed/target barrier). The upper barrier height of 4.5m is consistent with noise walls that have been previously built on the Pacific Highway Upgrades, particularly in rural landscapes. It is important to note that there have been no barriers higher than 4.5m high anywhere along the Pacific Highway Upgrade due to visual impacts, wind and solar shielding implications.

Sub no.	Item no.	Issue verbatim	Response
36	22	The table presenting project specific construction noise objectives (Working Paper 4, Table 4-4, page 87) contains transcription errors similar to Tables 5-4 and 5-5. The table requires review and correction as relevant.	The amended tables are provided in Section 3.5 of the Submissions Report.
36	23	Whist the construction noise assessment is reasonable for an EA, it is based on concept design (i.e. not the detailed design). Notably, the location of construction compounds , concrete batch facilities, pre-cast yards, bitumen facilities are not identified. Work methods are also at the concept stage. Any project approval will ultimately require a requirement for the preparation of a Construction Noise Management Plan, as is normal practice for a road project of this size.	A Construction Noise Management Plan would be prepared as part of the Contractor's Construction Environmental Management Plan prior to construction commencing.

Appendix B

Hydrology and Flooding
Working Paper peer review

Chris Clark
Roads and Traffic Authority
Pacific Highway Office
Po Box 546
GRAFTON NSW 2460

L100803_RTANambuccaReview_Final

1 October 2010

Attention: Mr C Clark

Dear Chris,

Re: Hydrology Review Nambucca River Crossing

INTRODUCTION

WMAwater have been engaged by the RTA to:

- Independently review the hydrology, flooding and river crossing aspects of the proposed Pacific Highway upgrade, Nambucca River Crossing, and
- Consult with Council and residents who have raised issues regarding the impact of the bypass on flooding.

The purpose of this review is to assess the technical suitability of the work carried out by SKM, for quantifying the impacts of the proposed Macksville Bypass on Nambucca River flood levels.

WMAwater have extensive experience in the catchments surrounding the Nambucca River including the Macleay River, Kalang and Bellinger Rivers and the Coffs Harbour area. WMAwater is also leading an Australian Rainfall and Runoff (ARR) revision project that is assessing options for replacing the Average Variability Method (AVM) temporal patterns in the current version of ARR.

BACKGROUND

The Environmental Assessment and Hydrology technical studies for the project have been carried out by SKM. The work carried out by SKM has caused some concern amongst Council and the residents due to increases in 100 year Average Recurrance Interval (ARI) flood levels compared to those documented in the *Lower Nambucca River Flood Study* (DPW, 1994) which are currently used by Council for planning purposes.

The current version of Australian Rainfall and Runoff (ARR 87) details the accepted methods for determining flood estimates in Australia. ARR is not a prescriptive guideline and allows the use of engineering judgement.

As the SKM study has deviated significantly from these accepted methods a review of the flooding aspects is therefore warranted.

The NSW Floodplain Development Manual (NSW Government, 2005) details the process used in NSW for setting flood levels and is used to guide where development can occur.

APPROACH

This review was carried out by discussing the project methodology with the RTA and SKM project staff about the project methodology. Local residents whose submission focused on flooding have also been approached to discuss their concerns.
This review has considered the following information:

- Warrell Creek to Urunga Upgrading the Pacific Highway Environmental Assessment,
- Extracts from the SKM project working files and documents,
- PINNEENA data, and
- Public Submissions relating to flooding.

PREVIOUS STUDIES

The most relevant study is the 1994 Lower Nambucca River Flood Study conducted by Willing and Partners for the Department of Public Works. This study established a hydrologic (RAFTS) and one dimensional hydraulic model (MIKE 11) model of the Nambucca River to set design flood levels. Current practice would be to adopt a two dimensional hydraulic model. The study used the 1977 event for calibration.

RAINFALL AND STREAMFLOW DATA

The work by SKM has used more modern assessment techniques than those applied in the 1994 Lower Nambucca River Flood Study (DPW, 1994) however not all of the available data has been accessed. The SKM study relied heavily on the rainfall data collected by the Bureau of Meteorology and stream gauge data accessed from PINNEENA. PINNEENA does not typically include data in the tidal zone. In the coastal area (where Macksville is located) both streamflow and rainfall data is collected by Manly Hydraulics Laboratory (MHL). MHL is a branch of the NSW Department of Commerce and is contracted to collect this data by the NSW Department of Environment, Climate Change and Water. In a flood study carried out under the NSW flood program the MHL data should have been considered. The quality of the streamflow data used is discussed in the following sections.

FLOOD FREQUENCY ANALYSIS

The SKM study conducted a flood frequency analysis of peak flow at Bowraville (Gauge Number 205006), as well as 1, 2 and 3 day volume analysis. Flood frequency analysis of peak flow is one of the most reliable methods of estimating the probability of a flood. Many alternative methods presented in ARR were calibrated by comparing to flood frequency analysis. Flood

frequency analysis is however very dependent on the quality of the flow data used and the length of record.

The background documents provided by SKM do not include any assessment of the rating curve suitability. Nor does it appear that any discussions have been had with the NSW Office of Water or the Bureau of Meteorology flood forecasting staff who can often provide information regarding the reliability of the rating curve at different levels. The quality of the volume analysis conducted would also depend on the reliability of the rating curve.

The Bowraville gauge record (Gauge Number 205006) was used by both the SKM and DPW studies. An investigation of the gauging record by WMAwater found that the highest gauging at Bowraville recorded in PINNEENA is approximately half the 2 year flow and above this level the rating curve has been extended using an extrapolation technique by the NSW Office of Water. The further the flow estimates are above this level the more unreliable they become. This is particularly a problem when the rating curve is extended from inbank to overbank flow as the hydraulic behaviour and resistance to flow tends to change dramatically. Current best practice for extending rating curves is to use a hydraulic model.

The SKM study appears to have only tested the Generalised Extreme Value distribution during the flood frequency analysis. While this is generally one of the best performing distributions and extreme value theory provides some justification for its use, recommended practice in ARR 87 is to test the Log Pearson III distribution. The draft chapter of the upcoming edition of ARR suggests testing a number of distributions rather than just one.

In addition to the flood frequency assessment, for a Flood Study under the NSW Flood program the following additional steps would be undertaken:

- Detailed assessment of the data quality,
- Assessment of the reliability of the rating curve and discussions with the agencies responsible for collecting data,
- Investigate a number of distributions and
- Consider inclusion of additional historical data in the flood frequency analysis.

HYDROLOGIC MODELLING

For consistency SKM chose to use the RAFTS model based on the model layout in the 1994 Flood Study. While updating the model they found several inconsistencies in the original model. Of particular concern was the lack of consistency in the lag values applied to individual subareas. This appears to have been carried out to achieve a better calibration. SKM used a more consistent approach that is based on the slope and in accordance with the RAFTS manual. The use of the 1994 RAFTS model is sufficient for the purposes of this study, however any future Flood Study of the Nambucca River would be best to develop a new model.

The Bx value adopted in the RAFTS model for the SKM study is extremely large (5.1). Standard values used are typically in the range of 1-1.5. Under normal circumstances a very large Bx value produces a very attenuated hydrograph which would generally under estimate peak flood flows.

In hindsight given the issues a better approach would have been to establish an alternative lumped model such as a WBNM or RORB model to allow cross checking. However we recognise that the RAFTS model was used to be consistent with the previous study.

The initial loss value used is considered reasonable, while the adopted continuing loss of 5mm/hr is considered high it is within the range of reasonable parameter values.

TEMPORAL PATTERNS

It is accepted practice in this region to adopt the Zone 1 temporal patterns from ARR 87. Zone 1 extends from the Clarence River in NSW to south of Melbourne. Zone 3 is typically used from the Richmond River in NSW all the way along the Queensland coast. Due to difficulties in calibrating the hydrologic model using Zone 1 ARR temporal patterns, the Zone 3 temporal pattern was adopted as part of the SKM work.

The authors of the SKM report do not appear experienced in the use of Zone 1 temporal patterns. Typically, in Zone 1 the 1, 2, 9 and 36hr temporal patterns tend to be critical for most catchments. This behaviour with the temporal patterns in Zone 1 is well documented and this is being addressed in the current revision of ARR. While there are issues with the Zone 1 patterns they still tend to fit flood frequency analysis reasonably well. We have not had access to the results used by SKM to make the conclusion that Zone 3 patterns produced a better fit. This conclusion by SKM appears to be partially based on the observation that critical duration does not increase with catchment size yet this is rarely observed in Zone 1 in NSW.

REGIONAL ISSUES

This area of the NSW coast has presented a range of challenges for other studies with problems in matching rainfall runoff modelling with flood frequency results. The Bellingen/Kalang System to the immediate north needed to adopt a larger than standard areal reduction factor to fit the results of the flood frequency analysis. A very high Bx value would have a similar effect as it would lead to significant hydrograph attenuation. Both would result in the lowering of the peak flow.

The most likely cause of both problems is inaccuracy in the design rainfall in ARR 87. This is probably caused by several rain gauges that are subject to high orographic rainfall being considered representative of the whole catchment.

HYDRAULIC MODELLING

A two dimensional hydraulic model (MIKE21) was established of the study area. MIKE21 is one of the three commonly used hydraulic modelling packages in current practice. Ground elevations were characterised using photogrammetry, which was the best data available at the time of the study. The model was established to represent existing and developed conditions.

Airborne Laser Scanning (ALS) is currently being collected in the area by the Department of Lands. The use of ALS has several advantages over photogrammetry (which is suitable for defining roads and road impacts) when determining flood planning levels and should be used in any updated 2D modelling. ALS would be better able to define connections between the river and swamp, which has been a concern of the community.

DESIGN FLOOD LEVELS

The peak flows for the 100 year flood event used in the SKM study were larger than those used in the *Lower Nambucca Flood Study* (refer Table 1). The SKM flows are considered conservative.

Table 1. Peak Flows 100 year (m^3/s)

	Macksville	**Bowraville**
DPW(1994)	3500	1930
SKM	4900	2260

The *Lower Nambucca Flood Study* 100 year flood level at the site of the proposed new bridge is 3.4mAHD whereas the SKM study determined the level to be 3.77mAHD (under existing conditions). A number of differences were noted between the two modelling approaches, which are not pertinent to the suitability of the study to determining the impact of the road, these included:

- Different 1% ocean levels used in the ocean dominated case, and
- Inclusion of entrance scour in the *Lower Nambucca Flood Study*.

A detailed process is outlined in the Floodplain Development Manual for setting flood levels in NSW which was not the purpose of this study. Any future study by Council needs to:

- Consider all the gauge data including the MHL data,
- Given the rating curve is only gauged to a low level, to discuss the rating reliability and extrapolation with the NSW Office of Water and Bureau of Meteorology,
- Consider using a hydraulic model to extend the rating curve, and
- Compare flood levels at Macksville against a stage frequency curve.

CLIMATE CHANGE

The Bureau of Meteorology along with Engineers Australia and CSIRO are currently investigating revising design rainfalls to take account of potential climate change. However, the possible mechanisms are far from clear, and there is no certainty that the changes would in fact increase design rainfalls for major flood producing storms. Even if an increase in total annual rainfall does occur, the impact on design rainfalls may not be adverse. There is some recent literature by CSIRO that suggests rainfalls may increase by up to 30% in parts of NSW (in other places the increases are much less), however this information is not of sufficient accuracy for use as yet.

Any change in design flood rainfall intensities will increase the frequency, depth and extent of inundation across the catchment. It has also been suggested that the cyclone belt may move further southwards. The possible impacts of this on design rainfalls cannot be ascertained at this time as little is known about the mechanisms that determine the movement of cyclones under existing conditions. Current NSW Government policy is to look at the effects of a rainfall increase of 10%, 20% and 30%. Actual rainfall increases are more likely to be between 0 and 10%.

Climate change will lead to a long term increase in mean sea level. The NSW Government has adopted a sea level rise of 40 cm by 2050 and 90 cm by 2100 for planning purposes (DECCW, 2009).

The climate change scenarios investigated by SKM (0.55m sea level rise and a 10% rainfall increase) were at the time of the study generally consistent with State Government policy (DECC, 2007) and are considered reasonable.

COMMUNITY CONCERNS

A number of concerns have been expressed by the community about the impact of the bypass on flooding. Many of the issues were related to not understanding the process in NSW for flood estimation and concerns relating to increased flood levels.

Concerns raised by the community include:

- The road will increase flood levels flooding homes,
- The project has not considered climate change appropriately,
- The hydraulic model doesn't include the connection between Warrell Creek and Gumma Swamp, and
- The Probable Maximum Flood hasn't been considered but rather a 2000 year flood,
- Approved developments in the Nambucca Catchment were not modelled in the developed case, and
- Differences in the 100 year flood level between the *Lower Nambucca Flood Study* and the SKM study

WMAwater met with several concerned residents to discuss the issues raised in their submissions. Table 2 below outlines the community concerns and responses based on our review.

Table 2. Issues and responses

Issue	Comment
The road will increase flood levels	The increase in flood levels as a result of the road is minor (20mm) and considered reasonable. An impact of 20mm is a relatively low impact for a major river/floodplain crossing.
Climate change is not considered or considered properly	Climate change has been considered by the SKM study. The approach adopted by the SKM study is considered reasonable.
Connection to Warrell Creek	We have not conducted a detailed investigation of this issue but it is considered unlikely to make a large difference to flood levels.
PMF not considered	The PMF is used for assessing risk in a flood study under the NSW Flood program. It is National practice to use the 2000 year for bridge design. It is therefore not unreasonable that the PMF was not considered as part of the study.
Approved developments in the Nambucca Catchment were not modelled in the developed case.	Given the size of the catchment it is unlikely that the development will affect flood levels but it will affect local flow paths and the aim was to assess the impact of the bridge not all future development.
Differences in the existing 100 year flood level between *Lower Nambucca Flood Study* and the SKM study	This review was unable to conclude whether the SKM 100 year ARI flood level is a 100 year ARI flood level however it is of the right magnitude and suitable for the purpose of assessing the road impacts.

	A detailed 2D hydraulic modelling study is recommended to update Council's flood level.

CONCLUSIONS

Despite the technical issues discussed above the study that has been carried out by SKM as part of the Environmental Assessment is suitable for assessing the impact of the bypass on the flooding for events up to and including the 100 year event and for determining conceptual bridge sizes as part of an Environmental Assessment. It is recommended that a more detailed design assessment be undertaken in the design phase to confirm culvert and opening sizes.

The main conclusions of this review are:

- The impact of the road seems reasonable (approximately 20mm),
- An impact of 20mm is a relatively low impact for a major river/floodplain crossing
- We are unable to conclusively say whether the SKM 100 year ARI flood level is a 100 year ARI flood level but it is of the right magnitude and suitable for the purpose of assessing the impact of the road
- The impacts are probably slightly conservative. If the 100 year flow defined in the DPW (1994) report were used the impact would be less.

While the study is suitable for assessing the impacts of the bypass, it is not suitable for setting new 100 year flood levels. A more detailed study in accordance with the NSW floodplain Development Manual and under the NSW flood program, would be required in order to set new flood levels for the Nambucca River. Given the issues with the hydrology of the 1994 Flood Study it is recommended that Council consider revising its Flood Study using a new hydrologic model and a 2D hydraulic model.

Yours faithfully,
WMAwater

Mark Babister
Director