



Woodburn to Ballina

Upgrading the Pacific Highway

PREFERRED ROUTE REPORT

NOVEMBER 2005



NSW Roads and Traffic Authority

SH10 Pacific Highway Upgrade Woodburn to Ballina

Preferred Route Report

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Glossary of terms and abbreviations

Term	Description
1 in 100 year flood level	Refers to the flood which occurs, on average, once every 100 years. Also known as the 100 year Average Recurrence Interval of a flood. These events are of a random nature. It is possible for there to be two 100 year floods in successive years; similarly the 100 year flood may not occur for 200 years and the 100 year flood may not be the largest flood in the last 100 years.
Afflux	The rise in water level upstream of a hydraulic structure such as a bridge or culvert, caused by the losses incurred from the hydraulic structure.
AHD	Australian height datum.
AHIMS	Aboriginal Heritage Information Management System
Annual average daily traffic (AADT)	Annual Average Daily Traffic is the yearly two way traffic volume divided by 365, expressed as vehicles per day.
ASS	Acid Sulphate Soils - naturally acid clays, mud and other sediments usually found in swamps and estuaries. They may become extremely acidic when drained and exposed to oxygen, and may produce acidic leachate and run-off which can pollute receiving waters and liberate toxins. ASS are classified as materials which are above the groundwater, are undergoing oxidation and have a pH of less than 4.0.
AusLink	The Australian Government's policy for improved planning and accelerated development of Australia's land transport infrastructure. It is supported by a \$12.7 billion programme of Australian Government investment over the five year period 2004-05 to 2008-09 together with partnering funding from State and Territory Governments and the private sector.
Average daily traffic	Average daily traffic based on survey counts and not adjusted as for AADT.
Average recurrence interval (ARI)	Average or expected period between exceedance of a flood.
Background noise level	The ambient sound pressure level in the absence of the sound under investigation exceeded for 90 percent of the measurement period. Normally equated to the average minimum A-weighted sound pressure level. Symbol LA90 (unit: dBA).
CAMBA	China-Australia Migratory Bird Agreement
CLG	Community Liaison Group
CMW	Corridor Mapping Workshop
Coffee rock	Sandy soil lightly cemented by organic material to form layers of dark brown cemented sand.
DA	Development Application
dBA	Decibels using the 'A' weighted scale, measured according to the frequency of the human ear.

Term	Description
DEH	Department of Environment and Heritage (Commonwealth)
Department of Environment and Conservation (DEC)	In September 2003, a number of separate agencies were consolidated to create a new Department of Environment and Conservation NSW. The new department incorporates the staff of the Environment Protection Authority (EPA), National Parks and Wildlife Service (NPWS), Botanic Gardens Trust and Resource NSW.
DIPNR	Former Department of Infrastructure Planning and Natural Resources (NSW) now DoP (see abbreviation below).
DNR	Department of Natural Resources
DoP	Department of Planning (formerly DIPNR)
DOTARS	Department of Transport and Regional Services
DPI	Department of Primary Industries (NSW)
DPWS	Department of Public Works and Services
DUAP	Department of Urban Affairs and Planning (now known as DoP – see abbreviations above).
Ecologically sustainable development (ESD)	Undertaking development in such a way that it uses, conserves and enhances the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.
ECRTN	Environmental Criteria for Road Traffic Noise
EEC	Endangered Ecological Communities
Environmental assessment (EA)	An environmental assessment of a major infrastructure development prepared in accordance with Part 3A of the EP&A Act 1979.
Environmental impact statement (EIS)	An environmental assessment document prepared in accordance with Part 5 of the EP&A Act 1979.
EP&A Act	<i>Environmental Planning & Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning & Assessment Regulation 2000</i>
EPA	Environmental Protection Authority (now part of the Department of Environment and Conservation).
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
GAF	Government Agency Forum
JAMBA	Japan-Australia Migratory Bird Agreement
km	Kilometre/s
L _{A1}	The noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the LA1 level for 99% of the time.

Term	Description
L _{A10}	The noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the LA10 level for 90% of the time. The LA10 is a common noise descriptor for environmental noise and road traffic noise.
L _{A50}	The noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the LA50 level for 50% of the time.
L _{A90}	The noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the LA90 level for 10% of the time. This measure is commonly referred to as the background noise level.
L _{Aeq}	The equivalent continuous sound level. This is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
LEP	Local Environmental Plan (prepared under the <i>Environmental Planning & Assessment Act 1979</i>).
LGA	Local Government Area
LOS	Level of Service
m	Metre/s
MVKT	Million vehicle kilometres travelled
NCREP	North Coast Regional Environmental Plan
NP&W Act	<i>NSW National Parks and Wildlife Act 1974</i>
NPWS	NSW National Parks and Wildlife Service (now part of the Department of Environment and Conservation).
PASS	Potential Acid Sulphate Soils (see ASS above)
PATN analysis	Process to undertake manipulation, analysis and display of patterns in multivariate biological data
pc/h	Passenger cars per hour
pH	pH is a measure of the hydrogen ion concentration in soil and relates to the levels of acidity and alkalinity
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
REP	Regional Environmental Plan (prepared under the <i>Environmental Planning & Assessment Act 1979</i>)
RODR	Route Options Development Report – Stage 1
RTA	Roads and Traffic Authority NSW
State Environmental Planning Policy Number 14 (SEPP 14)	Policy prepared under the Environmental Planning & Assessment Act 1979 for the protection of identified coastal wetlands in NSW.
State Environmental Planning Policy Number 26 (SEPP 26)	Policy prepared under the Environmental Planning & Assessment Act 1979 for the protection of identified littoral rainforest in NSW.

Term	Description
TSC Act	NSW Threatened Species Conservation Act 1995
VMW	Value Management Workshop

Executive summary

In January 1996, the NSW and Commonwealth Governments announced their joint commitment to the Pacific Highway Upgrading Program, a \$2.2 billion, ten year program to improve the condition of the highway, reduce road accidents and injuries and improve transport efficiency. The NSW government committed \$1.6 billion to the program and the Commonwealth \$600 million. The NSW Roads and Traffic Authority (RTA) is implementing the program.

In June 2004, the Federal Government released AusLink as its new national transport plan. The Pacific Highway between Newcastle and Brisbane forms part of the Australian Government's AusLink National Network. The AusLink National Network is based on national, regional and urban transport corridors, links to ports and airports, and intermodal connections between road and rail.

The RTA has engaged Hyder Consulting Pty Ltd to undertake route option investigations, concept development and an environmental assessment for the upgrading of the Pacific Highway between Woodburn and Ballina on the North Coast of NSW.

Route options

Since the planning and design process for this section of the Pacific Highway commenced, a series of options have been investigated and analysed with extensive input from community representatives. A short list of route options was publicly displayed from May to July 2005 with submissions invited from the community.

The development of the short listed options and the community response to these, were documented in two reports; *Woodburn to Ballina: Route Options Development Report – Stage 1* (RTA, 2005a) and *Woodburn to Ballina: Route Options Submissions Report* (RTA, 2005b).

In conjunction with the public display of the short listed options, a Value Management Workshop (VMW) was held in July 2005 attended by key project stakeholders from various government agencies, councils and community representatives. The workshop participants assessed the short listed route options tabled for the project and obtained an understanding of their relative merits and weaknesses. A significant outcome of the VMW was to recommend the elimination of some routes and to recommend particular routes for further study with suggested refinements to address concerns of the workshop participants.

The study team has investigated a series of refinements suggested by both the VMW participants as well as from submissions received during the public display period. Further targeted engineering and environmental investigations have been undertaken on each of the suggested refinements to allow the refined options to be reassessed against the project objectives.

A final assessment of all routes, including the refined routes, using fundamental guiding principles was undertaken by the study team.

Preferred route

The preferred route (as illustrated in **Figure 0-1**) commences at the existing Pacific Highway alignment approximately 3.0 km south of Woodburn and extends generally in a north-east direction away from the current highway. An approximately 350 m long bridge crossing would be required at the Tuckombil Canal (Evans River).

Between Woodburn and Broadwater the route continues in a north-easterly direction through agricultural land, skirting the edge of an endangered ecological community and Broadwater National Park. This section of the route consists of embankments and bridges to provide immunity from floodwaters. North of Lang Hill the route follows the western edge of Broadwater National Park before joining the existing highway alignment which bisects the Park. Through the Park, the route would follow the existing highway road reserve, avoiding any direct impact on the National Park.

In the vicinity of Broadwater, the route would be located to the east of Cooks Hill and west of the National Park boundary.

North of Cooks Hill the route would swing north-west and approximately 2.0 km north of Broadwater crosses the Richmond River on a bridge approximately 850 m long with a navigational clearance of 15 m. The route would proceed to the west of Laws Hill on the northern side of the river. North of the river, the highway would head north-west towards the Blackwall Range.

The route would skirt around Jali Local Aboriginal Land Council (LALC) land and areas of Wardell Heath containing endangered ecological communities before returning east to join the existing highway approximately 4.0 km north of Wardell. For the remaining 6.5 km the route would follow the existing highway corridor, and would be raised up on embankments to be above the floodwaters. The route would connect with the approved Ballina Bypass.

The total length of the preferred route is 36 km.

Location and configuration of interchanges would be determined as part of the detailed investigations to be undertaken during the preparation of the concept design and environmental assessment stages.

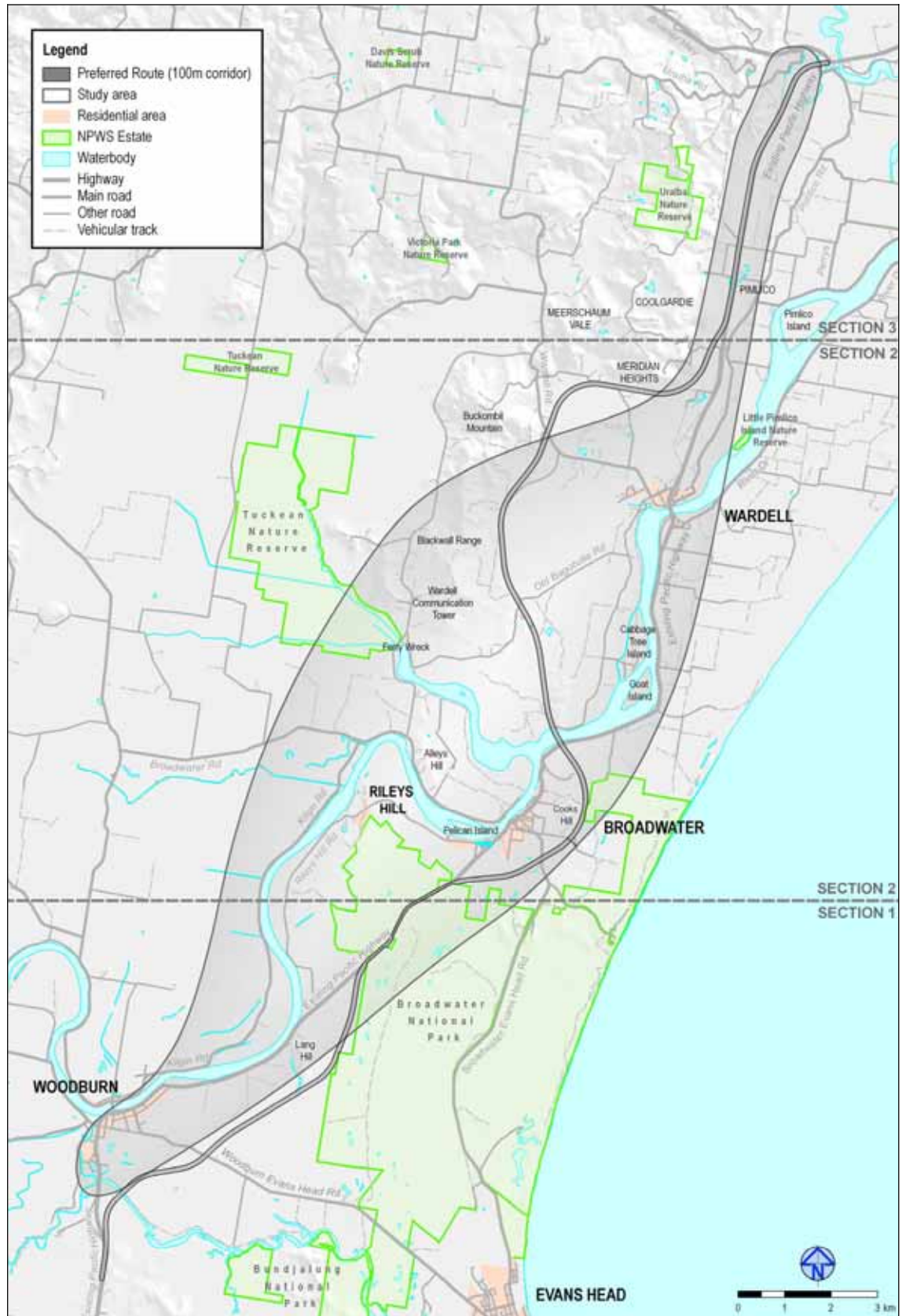


Figure 0-1 Preferred route

The selection of the preferred route is based on technical investigations undertaken, the outcomes of the VMW, assessment of issues raised in submissions during community consultation activities and the refinements of the options undertaken by the study team. In summary, the preferred alignment is the preferred route for the upgrade of the Pacific Highway between Woodburn and Ballina on the basis that it:

- Best meets the objectives of both the Pacific Highway Upgrade Program and the Woodburn to Ballina project.
- Provides for grade separation of the Pacific Highway and local road intersections including consolidation of accesses by the use of service roads.
- Provides efficient connections from the upgraded highway towards Ballina, Lismore and Evans Head through the construction of interchanges.
- Provides reasonable physical separation from existing and proposed residential areas so that, with sensitive urban design, acceptable visual and traffic noise outcomes could be achieved.
- Is the route recommended at the VMW as the preferred option in section 1 and section 3 of the project and is the route agreed to be feasible in section 2 subject to the further investigation of environmental, heritage and quarry issues.

Ballina Bypass (Bruxner Highway interchange section) and connection with the Woodburn to Ballina project

The concept design for the approved Ballina Bypass includes a part grade separated interchange at the Bruxner Highway.

A review will be undertaken of the interchange design at the Bruxner Highway to ensure a good level of connection between the Woodburn to Ballina and Ballina Bypass projects.

The next steps

The proposed next steps for the development of the Woodburn to Ballina Project are to:

- Refine the concept design for the preferred route.
- Submit the proposal to the Department of Planning for approval under the recently introduced Part 3A of the *Environmental Planning and Assessment (EP&A) Act 1979*. The proposal would be the subject of an environmental assessment (EA) which would examine the potential impacts of the preferred route. The EA may include a statement of commitments in respect of environmental management and mitigation measures proposed to be undertaken if the project is approved.
- When completed, the EA would be publicly exhibited and submissions sought. The RTA may be asked to prepare a report on the submissions,

consider modifications to the project to minimise environmental impacts and revise its statement of commitments.

- The Department of Planning would consider the EA, the public submissions and any report requested from the RTA in recommending to the Minister for Planning whether the project should be approved.

The proposed next step for the Ballina Bypass (Bruxner Highway interchange section) is to:

- Undertake a review of the interchange design at the Bruxner Highway to ensure a good level of connection between the Woodburn to Ballina and Ballina Bypass projects.

1 Introduction

1.1 Preamble

In January 1996, the NSW and Commonwealth Governments announced their joint commitment to the Pacific Highway Upgrading Program, a \$2.2 billion, ten year program to improve the condition of the highway, reduce road accidents and injuries and improve transport efficiency. The NSW government committed \$1.6 billion to the program and the Commonwealth \$600 million. The NSW Roads and Traffic Authority (RTA) is implementing the program.

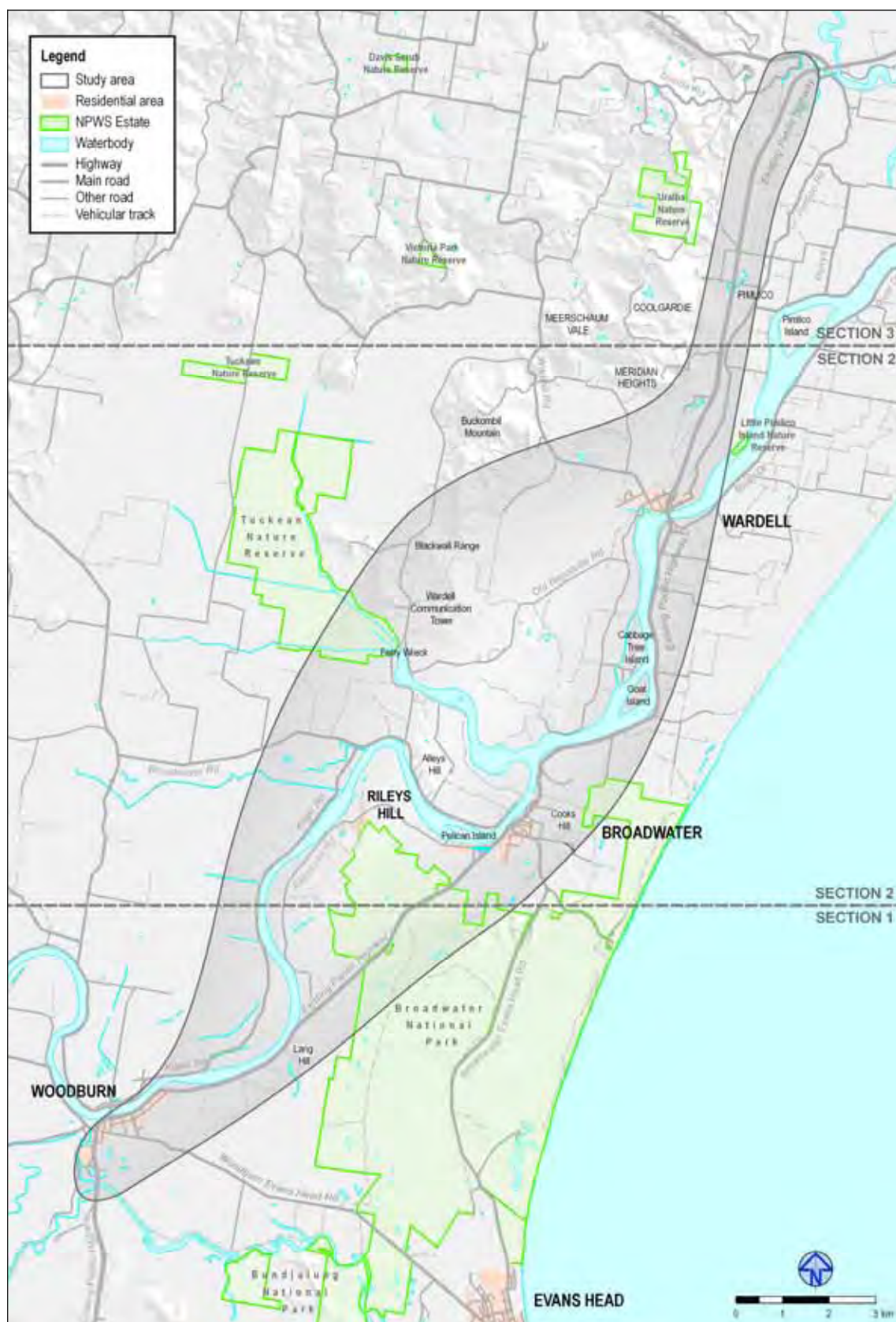
In June 2004, the Federal Government released AusLink as its new national transport plan. The Pacific Highway between Newcastle and Brisbane forms part of the Australian Government's AusLink National Network. The AusLink National Network is based on national, regional and urban transport corridors, links to ports and airports, and intermodal connections between road and rail.

The RTA has engaged Hyder Consulting Pty Ltd to undertake route option investigations, concept development and an environmental assessment for the upgrading of the Pacific Highway between Woodburn and Ballina on the North Coast of NSW (refer **Figure 1-1** and **Figure 1-2**).

This report describes the selection and assessment of the short listed options and the subsequent development and refinement of the preferred route.



Figure 1-1 Location - Woodburn to Ballina upgrade section of the Pacific Highway



1.2 The need for the project

The need for the project has been derived from an investigation of overall strategic planning, transport, economic and environmental issues of the region and this section of the Highway, including:

- Increasing usage of the Highway due to growth of population, urban areas, commercial development, tourism and employment opportunities within the North Coast Region of NSW and in adjoining areas in southern Queensland.
- Increased use of the Highway affecting existing transport infrastructure, freight service patterns, transport networks and network performance, travel times and safety.
- The impact upon environmental quality and amenity for residents, due to the increased usage of the existing Highway; traffic noise and constraints on social interaction between residents living on either side of the Pacific Highway in Woodburn, Broadwater and Wardell.
- Meeting Commonwealth Government requirements for the Pacific Highway Upgrading Program and strategies including the *AusLink White Paper*, DOTARS, 2004.
- Meeting NSW Government requirements for the Pacific Highway – policies, strategies (including *Upgrading the Pacific Highway*, RTA, 1997, and *North Coast Urban Planning Strategy*, DIPNR, 1995), freight transport initiatives and sustainability. The project is required to meet the NSW Government's overall objective of fully upgrading the Pacific Highway to dual carriageways between Hexham and the NSW/Queensland border. It would provide additional capacity in an area with continued traffic growth, and would join other completed and planned projects to form a long, continuous length of dual carriageway.
- The role of the Pacific Highway between Woodburn and Ballina in serving national, regional and local transport and accessibility roles.
- The condition of the Pacific Highway between Woodburn and Ballina and the existing level of service. The existing Pacific Highway through the study area is primarily a two-lane road with occasional overtaking lanes. Accident histories show unacceptably high accident levels in many areas. There is a need to provide a higher standard road to better serve existing and future road users.
- The consequences of not improving the Pacific Highway – effect on the overall efficiency and safety of the Pacific Highway, local environmental amenity and road safety.

Establishing the need for the project enabled the identification and selection of appropriate project goals and objectives for the options assessment process and the selection of a preferred route.

1.3 Study area

The original study area identified by the RTA for the proposed Woodburn to Ballina upgrade extends from the southern side of the point where the existing Pacific Highway crosses the Tuckombil Canal, 1.6 km south of Woodburn, northwards to the intersection of the existing Pacific Highway with the Bruxner Highway. The study area is shown in **Figure 1-2**.

The concept design at the southern end will be coordinated with the RTA's adjacent Pacific Highway study known as the 'Iluka Road to Woodburn Upgrade' project, while the concept design at the northern end will be coordinated with the approved Ballina Bypass project.

From Woodburn, north towards Wardell, the eastern extent of the study area comprises the existing Pacific Highway corridor and adjacent lands between it and the nearby coast. To the west, the study area extends into the Tuckean Nature Reserve, some 1.5 km north-west of The Barrage on Bagotville Road.

From Wardell, north to the Bruxner Highway intersection, the study area is constrained by the Blackwall Range to the west and linking in with the southern section of the approved Ballina Bypass.

During the development of potential route options (refer Section 4), some of the options investigated were slightly outside the original study area. Consideration of these routes occurred where the impacts of the potential routes could be avoided, or minimised, by slightly deviating from the original study area boundary. The preferred route (refer Section 7) also passes slightly outside the original study area in some locations.

1.4 Planning process

The planning process to select the preferred route involved a series of stages that relied on the collection and interpretation of environmental, socio-economic and engineering inputs. The extent and detail of information varied at each stage, ranging from study area overviews of opportunities and constraints, to detailed route investigations where specific potential impacts could be identified.

In parallel with these investigations, the community and other stakeholders were consulted to provide input into the process and provide feedback regarding the studies and investigations.

Route options were developed through an iterative process involving a range of environmental, community, safety, engineering and cost considerations. Initially a series of corridors was established from which a long list of 14 initial route options were developed. The initial options were then assessed against the assessment criteria (refer Section 4.1.5). The outcome of the assessment process was a short list of route options that were to be further investigated.

Information about the short listed route options was placed on public display from May to July 2005 to obtain feedback from the community and other stakeholders through submissions and telephone contact. Following the public display, a Value Management Workshop (VMW) was undertaken (refer Section 5.3).

These stakeholder activities and further investigations led to the development and assessment of some modifications to options (refer Section 5.4).

1.5 Community and stakeholder involvement

1.5.1 Stakeholder program objectives

The community and other stakeholders have been involved in a comprehensive consultation program. The consultation program itself was discussed with Ballina, Richmond Valley and Lismore Councils and some key stakeholders. The objectives of the community and stakeholder involvement were to:

- Enhance community and stakeholder awareness and understanding of the project.
- Ensure that affected stakeholders are informed and have the opportunity to provide input into decisions taken during the course of the project
- Ensure that stakeholder concerns and issues were considered and the project is informed by stakeholder involvement at all its stages.
- Ensure that the study team was aware of stakeholder perceptions and preferences.
- Seek community knowledge and data that might assist the investigation of potential impacts.
- Improve the options and identify means of avoiding and mitigating impacts.

The key community activities undertaken, which were designed to keep stakeholders well informed and involved in the project, consisted of:

- Preparing and distributing initial and updated information about the investigation and assessment process and the results of the assessment studies.
- Providing a range of opportunities for the two-way exchange of information.
- Providing stakeholders with a range of means to make submissions.

1.5.2 Stakeholders

Information was sought for the project from government agency representatives, regional and local organisations including local councils and other stakeholders at project commencement and at various stages during the investigation (refer **Figure 1-3**).

Relevant government agencies/organisations were invited to attend various meetings, including the Planning Focus Meeting (PFM) in November 2004; the Government Agency Forum (GAF) in January 2005; the Corridor Mapping Workshop (CMW) in February 2005 and the Value Management Workshop (VMW) in July 2005. Representatives of the Community Liaison Group (CLG) established for the project were also invited to attend the CMW and VMW.

A summary of key stakeholder milestones is presented in **Table 1-1**.

1.5.3 Consultation initiatives

A Community Involvement Plan was prepared to coordinate the information flow between the study team and the community. The main aspects of this plan are:

- A free call information line (1800 887 112).
- Community information sessions.
- Community updates.
- Website information.
- CLG and four focus groups (ecology, sugar cane, flooding and Aboriginal).
- Public access to a staffed community information centre in Woodburn.
- Landowner, resident and business discussions.
- Public display of route options (including staffed information displays).
- Public display of the preferred route (including staffed information displays).

The input provided by the communities in the study area has been invaluable in providing local information on key issues. The community input was also significant in refining the options assessment and route selection processes and has played a key role in the development of the preferred route.

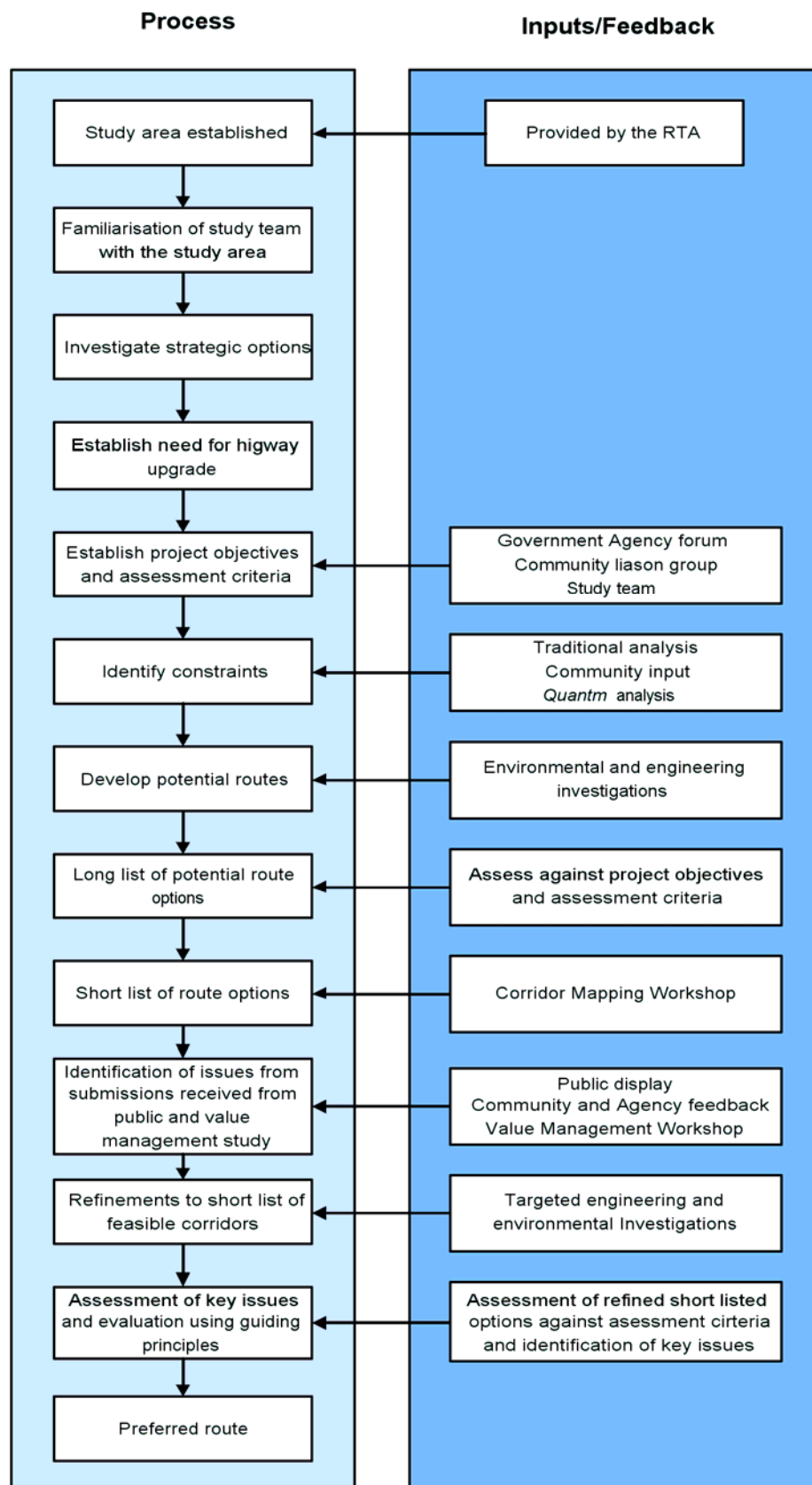


Figure 1-3 Stakeholder input

Table 1-1 Key stakeholder milestones

Date	Milestone
October 2004	Minister for Roads announces investigations have commenced into a proposed upgrade of the Pacific Highway between Woodburn and Ballina.
November 2004	Community Update No. 1 distributed: • Pacific Highway Upgrading Program outlined. • Study area identified. • Invites nominations to participate in a Community Liaison Group (CLG). • Community comment invited.
November 2004	Advertisement in local papers inviting the community to attend Community Information Sessions (CIS), and invite nominations to participate in a CLG. Three CIS held in Wardell, Broadwater and Woodburn during November 2004.
November 2004	Planning Focus Meeting held, including representatives of: • State Government agencies. • Lismore City Council. • Ballina Shire Council. • Richmond Valley Council. • Richmond River County Council.
November 2004	Meetings held with Lismore City, Ballina Shire and Richmond Valley Councils.
December 2004	CLG formed, and first meeting held. The meeting outlined: • Background to the project. • Role of the CLG in the overall consultation process. • Project objectives. • Outline of study process and program • Issues for discussion at subsequent meetings.
January 2005	CLG meeting No. 2a and 2b held. The meetings outlined: • Review of project objectives. • Identification of constraints and opportunities. • Identification of potential route options. • Establishment of Focus Groups.
January 2005	Government Agency Forum held. The meeting outlined: • Review of project objectives. • Identification of constraints and opportunities. • Review of issues and risks presented by the identified constraints and opportunities.
January 2005	Flooding Focus Group formed to discuss flooding issues, and meeting No. 1 held.
January 2005	Sugar Focus Group formed to discuss sugar cane industry issues, and meeting No. 1 held.
February 2005	CLG meeting No. 3a and 3b held. The meetings outlined: • Update on constraints and opportunities. • Update on the development of possible route options. • Review of strengths and weaknesses of possible route options. • Corridor Mapping Workshop (CMW) and CLG representation.

Date	Milestone
February 2005	Corridor Mapping Workshop held. Participants included nominated CLG representatives, State Government agencies, local Councils, representatives of community groups and the study team.
March 2005	Ecology Focus Group formed to discuss ecological issues, and meeting No. 1 held.
March 2005	Sugar Focus Group and Flooding Focus Group meetings No. 2 held.
March 2005	Meetings held with Lismore City, Ballina Shire and Richmond Valley Councils.
March 2005	CLG meeting No. 4 held. The meeting outlined: • Review of Corridor Mapping Workshop. • Methodology for assessing the long list of route options. • Assessment criteria and performance measures. • Noise assessment methodology and results of monitoring.
April 2005	CLG meeting No. 5 held. The meeting outlined: • Discussion of a submission relating to a community alternative route. • Presentation on the Iluka Road to Woodburn upgrade, for the information of the CLG. • Overview of traffic and transport studies. • Overview of noise studies. • Value management process. • Opportunity for CLG members to provide feedback on the CLG process.
April 2005	Ecology Focus Group meeting No. 2 held.
May 2005	Sugar Focus Group, Flooding Focus Group and Ecology Focus Group meetings No. 3 held.
May 2005	CLG meeting No. 6 held. The meeting outlined: • Review of CLG comments on the long list of options. • Review of comments on the CLG process. • CLG representation at the Value Management Workshop (VMW)
May 2005	Community Update No. 2 distributed: • Short list of route options identified. • Notification of locations and times of staffed and un-staffed displays. • Community submissions invited.
May to July 2005	Route options displayed at various locations within the study area between 23 May and 4 July 2005.
June 2005	Staffed displays held at Wardell, Broadwater and Woodburn to answer specific questions regarding the route options being considered for the upgrade.
June 2005	Owners of properties potentially directly affected by the route options invited to meet with the study team.
June 2005	Meetings held with Lismore City, Ballina Shire and Richmond Valley Councils.
June 2005	CLG meeting No. 7 held. The meeting reviewed the CLG member opinions on the displayed route options.
June 2005	Sugar Focus Group and Flooding Focus Group meetings No. 4 held.

Date	Milestone
June 2005	Meeting held with representatives of the Jali LALC and Elder groups to discuss the short list of route options.
July 2005	Ecology Focus Group meeting No. 4 held.
July 2005	CLG meeting No. 8 held. The meeting outlined: • Review of initial assessment on the community alternate route. • Review of CLG issues to be raised by the CLG representatives at the VMW. • Initial feedback on issues raised in community submissions.
July 2005	Value Management Workshop held. Participants included nominated CLG representatives, State Government agencies, local Councils, representatives of the indigenous community, representatives of community groups and the study team.
August 2005	Meeting held with representatives of the Local Aboriginal Land Councils, and the Elder groups to discuss the short list of route options. Formation of an Aboriginal Focus Group.
September 2005	Sugar Focus Group and Flooding Focus Group meetings No. 5 held.
September 2005	Aboriginal Focus Group meeting No. 1 held.
September 2005	CLG meeting No. 9 held. The meeting outlined: • Update on the assessment on the community alternate route. • Overview of the VMW and presentations from each of the CLG representatives. • Overview of the process for selecting a preferred route.
October 2005	Aboriginal Focus Group meeting No. 2 held.
November 2005	Ecology Focus Group meeting No. 5 held.
November 2005	Preferred route announced.

1.6 Report Purpose

This report summarises the selection of the preferred route and concludes the route planning and selection phase of the project. It provides an overview of the:

- Characteristics of the study area.
- Issues surrounding the development of feasible route options.
- Evaluation and refinement of the short listed route options.
- Preferred route for the project.

This report concludes by providing a description of the preferred route and its potential impacts.

This report is structured as follows:

- **Section 1 - Introduction** provides an overview of the project and the purpose and structure of this report

- **Section 2 - Characteristics of the study area and issues for route option development** describes the traffic and transportation, environmental, socio-economic, land use and planning and geology and soils characteristics of the study area and the main issues that needed to be considered in the development of a long list of route options.
- **Section 3 - Project objectives and assessment approach** documents the objectives of the Pacific Highway upgrading program and the Woodburn to Ballina project as well as the identification of the assessment criteria framework and the options assessment process used.
- **Section 4 - Route options** summarises how the long list of route options were assessed and describes and compares the characteristics of the short listed route options in the southern, central and northern sections of the study area.
- **Section 5 - Outcomes of the public display and the Value Management Workshop** presents a summary of public submissions made in response to the display of the route options, the outcomes of the VMW, and how they influenced the development of modifications to some options.
- **Section 6 - Preferred route selection** describes the options selection process, additional investigations of the displayed options undertaken, assessment of the displayed and modified options and the selection of the preferred route.
- **Section 7 - The preferred route** describes the preferred route, the refinements undertaken to the alignment as a result of suggestions made at the Value Management Workshop and community submissions, and its potential environmental impacts.
- **Section 8 - The next steps** outlines the process required to formally assess the preferred route under relevant NSW environmental legislation and the review of the Bruxner Highway interchange section of the Ballina Bypass.

2 Characteristics of the study area and issues for route option development

2.1 Overview of the study area

The dominant feature of the study area is the Richmond River which meanders through a large floodplain close to the Pacific Ocean. The Blackwall Mountain Range forms a backdrop to the north-west of the study area and smaller hills punctuate the floodplain. Sugar cane farms extend across much of the floodplain land along the Richmond River with holdings of pastureland.

Residential rural settlements are scattered along roadways, with larger concentrated townships at Woodburn, Broadwater and Wardell. Smaller communities are located at Cabbage Tree Island, Rileys Hill and Meridian Heights. The aerial view of the study area for the Woodburn to Ballina Upgrade is shown in **Figure 2-1**.

The existing Pacific Highway within the study area, skirts close to the Richmond River and passes directly through the townships of Woodburn, Broadwater and Wardell. Local access roads link properties and residences to the highway and to adjoining settlements to the west, including Meridian Heights and Meerschaum Vale. To the east, local roads join Pimlico and the coastal village settlement of Evans Head to the highway.

Communities in the riverside townships of Woodburn, Broadwater and Wardell and the settlements at Cabbage Tree Island, Rileys Hill and Meridian Heights represent agricultural, commercial, tourism and residential interests. The highway passes through or near to these communities, bringing goods and services, visitors, and business opportunities. Visitors to the townships – both passing through on the Pacific Highway and using the townships as a place to rest and revive, and those that choose to stay in the area and holiday – are also recognised as part of the community.

The NSW North Coast community as a whole has been aware of the Pacific Highway upgrading or bypass proposals for many years, and local communities expect to be closely involved in these studies at appropriate stages. Local and regional media are highly interested in the issues raised by each proposal to upgrade the Pacific Highway.

Issues of concern for community members vary depending on their proximity to the project and level of dependence on the trade provided by people using the Pacific Highway. The community recognises the economic linkages between some businesses dependent on highway traffic for commercial sustainability, and other service or supporting sectors such as schools, medical services, and commercial facilities. They also recognise that the highway traffic detracts from town amenity, and that, should the current trend of increasing traffic continue, the supply of services and facilities in the area may decline.

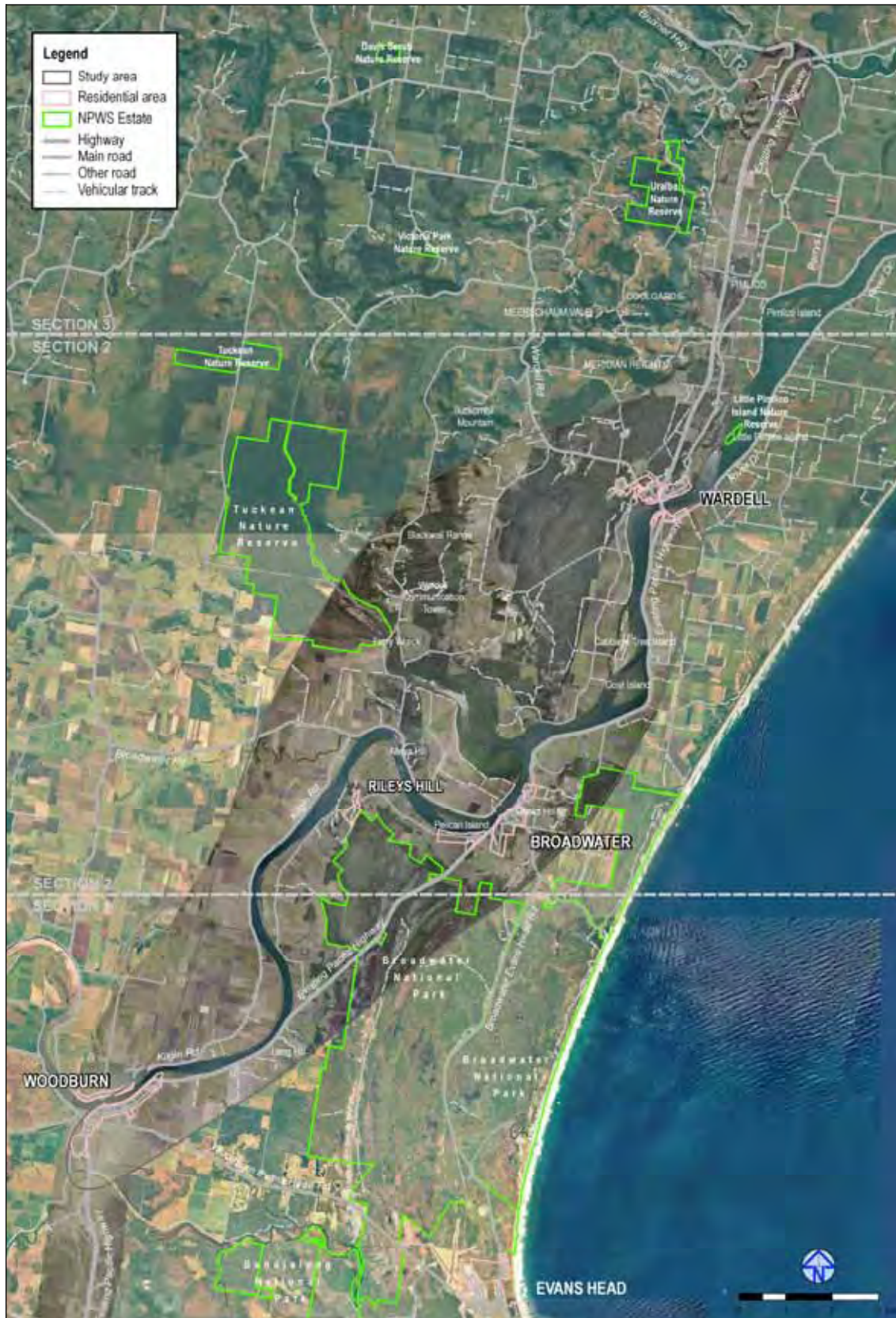


Figure 2-1 Aerial view of study area

2.2 Issues for identification of options

A wide range of issues influenced the identification and selection of route options. These issues have been grouped into the following broad categories:

- Traffic and road safety.
- Social.
- Economic.
- Statutory and strategic planning.
- Land use and zoning.
- Urban design, landscape and visual.
- Biodiversity.
- Heritage.
- Water quality.
- Climate and air quality.
- Noise.
- Flooding and drainage.
- Topography, geology and soils.
- Engineering.
- Value for money.

Each of these broad categories were discussed in detail in the *Route Options Development Report – Stage 1 (RTA, 2005a)*. They are outlined below in the context of the main issues that needed to be considered in the development of the Woodburn to Ballina upgrade.

2.3 Traffic and transportation

The Pacific Highway is a primary arterial road and the main transport corridor along the east coast of New South Wales.

On a regional level, this section of the Pacific Highway connects to Ballina while local roads provide connections between the Highway and coastal areas including Evans Head, as well as to several inland destinations including Coraki, Lismore and Alstonville. At a local level, the Pacific Highway provides direct access to the townships of Woodburn and Broadwater, and indirect access to Wardell.

Traffic volumes are around 10,000 vehicles per day with an almost equal distribution of north bound and south bound vehicles. **Figure 2-2** shows the traffic volumes and profile along the Pacific Highway.

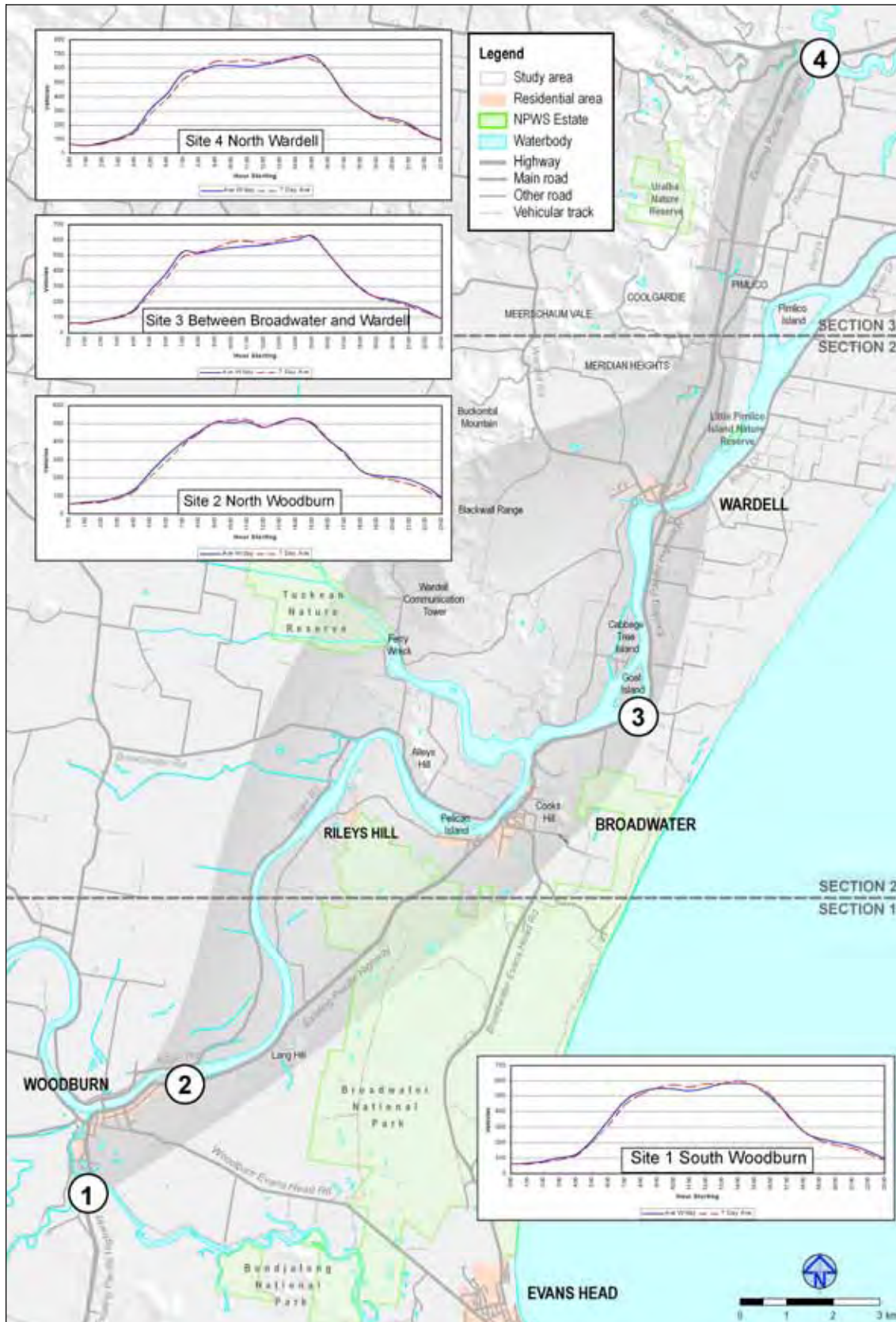


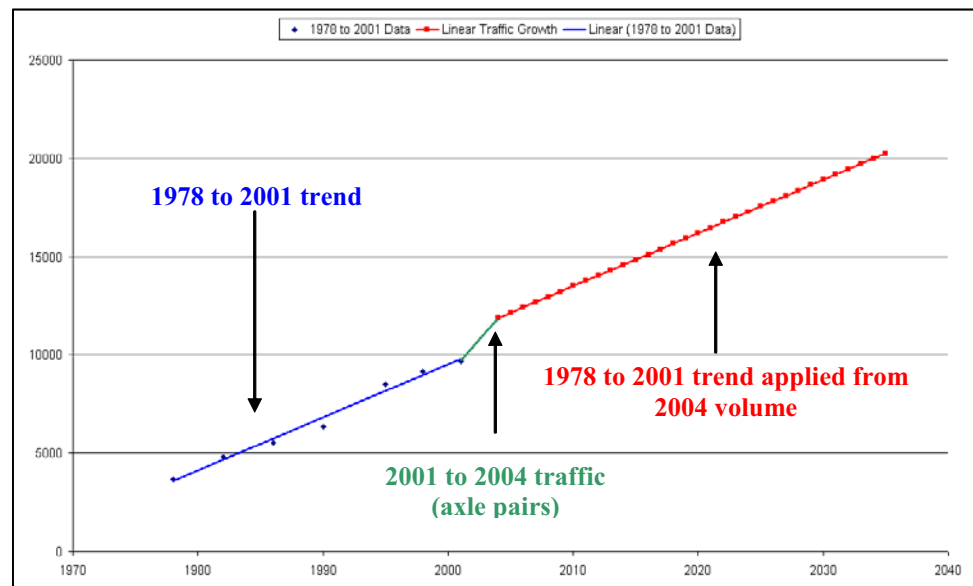
Figure 2-2 Hourly traffic profile along Pacific Highway

Figure 2-3 shows the historic trend in traffic growth in terms of axle pairs (as distinct from numbers of vehicles) from 1978 to 2001, and the assumed linear growth from 2004. There was substantial growth between 2001 and 2004, presumably as a result of the opening of the Yelgun to Chinderah upgrade and the declaration of the Pacific Highway as a B-Double route.

A B-Double is defined as a combination consisting of a prime mover towing two semi-trailers. B-Doubles are currently limited in length to 25 metres and 9 axle combinations. The gross mass limit is 62.5 tonnes. The 19 metre B-Doubles have general access to all roads as long as the combination's gross mass is no more than 50 tonnes or a specific load limit has not been placed on a road, bridge etc.

Some 19 metre B-Doubles have been using the highway since 1998, while the 25 metre B-Double was only granted access to the full length of the highway in August 2002. This was following reviews undertaken after the opening of the Yelgun to Chinderah Freeway, which bypassed a length of low standard alignment through the Burringbar Range. The RTA is continuing to monitor the use of B-Doubles and the commercial fleet mix now in operation along the Pacific Highway.

Between late 2002 and late 2004, vehicle monitoring at port Macquarie has indicated that there has been a shift in the mix of heavy vehicle fleet from semi-trailers to B-Doubles (ie. The number of semi-trailers on the highway has fallen since late 2002 from around 1,050 per day to around 900 per day and now appears to have stabilised at the lower number, while the number of B-Doubles has shown a gradual increase from around 180 to 300 in the same period) and there has been no growth in overall heavy vehicle numbers since late 2002.



Data: Permanent site 04.264, the Pacific Highway, south of the Bruxner Highway.

Figure 2-3 Linear traffic growth (axle pairs) from 2004

The data suggests that initially overall traffic grew significantly between 2001 and 2004; however recent data suggests similar growth rates prior to 2001. Therefore, the linear growth rate prior to 2001 has been adopted as the applied trend from 2004.

Based upon the historical traffic data from 1978 to 2001, traffic forecasts predict that by 2035 (20 years after opening), daily traffic volumes would range from 13,900 to 17,500 vehicles per day.

The Pacific Highway is a significant link in the national freight network with volumes of around 90 trucks per hour during the day, and just over 40 trucks per hour overnight. In contrast, light vehicle volumes fluctuate from around 500 cars per hour during the day, to 20 cars per hour around midnight.

During the day on a typical weekday, heavy vehicles comprise around 15 per cent of all vehicles. During the night on a typical weekday, this is significantly greater at around 45 per cent.

The accident rate is approximately 48 crashes per 100 million vehicle kilometres travelled, which is significantly higher than the target of 15 crashes per 100 million vehicle kilometres travelled for the upgraded Pacific Highway. 53 per cent of crashes were single vehicle loss of control, on a straight or bend. This is a considerably higher proportion than the average for the 700 km of Pacific Highway (18 per cent in 2003, and 24 per cent between 2000 and 2002).

The study area is served by bus / coach, train and air services. Buses and coaches provide the connectivity with train and air services at nearby regional centres.

2.4 Social issues

The upgrade of the Pacific Highway between Woodburn and Ballina would have a marked effect on the amenity of the towns through which the Pacific Highway currently passes.

A number of potential social benefits and disbenefits have been identified. Potential benefits include improved amenity and sense of place whilst potential disbenefits include short-term disruption from construction activities and possible disruption to long term business profitability.

The position of the Pacific Highway through Woodburn, Broadwater and Wardell is a constraint on social interaction between residents who live on either side of the highway. Although pedestrians, cyclists and drivers are able to cross the highway in each township the volume, speed and type of traffic on the highway can be intimidating. A change in the alignment of the Pacific Highway would encourage greater social interaction and sense of community within the townships.

In the case of Wardell, a change in the alignment of the highway might be particularly important as Wardell has been earmarked by Ballina Shire Council for further growth. In September 2003 Ballina Shire Council

endorsed the Wardell Strategic and Land Use Plan which aims to encourage new residential development in Wardell and to enhance the provision of services and promote economic development, consistent with environmental objectives and protecting the village lifestyle.

It is likely that in the future Broadwater will continue to be supported by the sugar mill and that traffic and other activity related to the sugar mill will continue. Being subject to flooding Broadwater is not likely to experience further residential development, but the amenity of residents is likely to be improved as a result of a reduction in Pacific Highway through traffic.

Woodburn is currently known to travellers as a pleasant and convenient place to stop and rest, particularly as it is situated alongside the Richmond River. This role for Woodburn may continue into the future, even if the new alignment of the Pacific Highway does not go through Woodburn. A reduction in through traffic in Woodburn may provide the opportunity for urban design improvements in Woodburn that could make it an even more attractive rest stop for travellers.

The current alignment of the Pacific Highway intersects Broadwater National Park. In the vicinity there are a number of recreational and leisure opportunities including swimming, walking, picnicking, cycling and fishing. The Richmond Valley Shire Council provides visitor facilities on the nearby Richmond River including a boat ramp, wharf, toilets and fireplaces. All have the potential to be affected by the project, in either a positive or negative way.

2.5 Economic issues

2.5.1 Business impacts

A route that avoids the townships could have a direct negative impact on any businesses dependent on highway through traffic. These businesses are typically motels, service stations, and fast food outlets. Any business that is not currently dependent on highway through traffic is not likely to be negatively affected by a route which avoids the towns and may benefit from substantial positive effects. There are a number of share farms in the study area which could be affected by routes which deviate from the existing highway.

2.5.2 Recreational and commercial fisheries

Beach access for 4WD vehicles is provided near Broadwater and also at Evans Head, making the area a major drawcard for fishing and 4WDs alike. There are boating and/or visitor facilities provided by the respective Councils at, or near, each of the townships alongside the Richmond River. These form a focal point for local boating and fishing activities.

The two key fish species that make up the commercial fishing on the Richmond River are mullet and prawns. Estimates provided by the local

fishing cooperative value the annual catch at approximately \$1 million per year caught under the regulation of eight fishing licences. The NSW Department of Primary Industries (Fisheries) reported that the Richmond River is an important fish nursery habitat and fishing ground. As a result, the river would be particularly sensitive to any construction activity related to the upgraded Pacific Highway.

2.6 Land use and planning

The NSW North Coast is experiencing a rapid growth of population, urbanisation and tourism and has done so for some years. This is due to an attractive climate, the desire to experience a change in life-style and improvements in access to transport (air, rail and road), with links to major cities and regional centres. This growth has promoted increased economic activity and consequently affected the traditional agricultural base of the regional economy.

A similar population expansion is being experienced in south-eastern Queensland in the area between Brisbane and the NSW border. As a consequence of this growth the region is experiencing pressure on transport infrastructure in particular the movement of freight by road transport, pressure on environmental amenity and quality, pressure on the communities in the region and economic pressures related to employment opportunities and commercial expansion opportunities.

2.6.1 Statutory and strategic planning

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal item of legislation controlling the assessment of development and infrastructure proposals in NSW.

During the development of the route options in 2005, the NSW Parliament passed the *Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Act 2005 No 43* on 16 June 2005. This amendment came into force on 1 August 2005.

The amendment introduces a new Part 3A to the *Environmental Planning and Assessment Act 1979* (EP&A Act) to cover the assessment of major infrastructure development. This type of development was previously assessed under Part 4 and/or Part 5 of the EP&A Act.

By an order gazetted on 29 July 2005, the Minister for Planning declared that Part 3A of the EP&A Act applies to all projects for which the proponent is also the determining authority and which otherwise would have required an environmental impact statement (EIS) to be obtained under Part 5.

Within the meaning of Part 5 of the EP&A Act, the RTA is both the proponent and the determining authority for the Woodburn to Ballina project. In the opinion of the RTA, the project would (but for Part 3A of the Act) require an EIS to be obtained under Part 5 of the Act. Consequently,

the RTA proposes to submit the Woodburn to Ballina project to the Department of Planning for approval under Part 3A of the Act.

Environmental planning instruments under the EP&A Act include Local and Regional Environmental Plans (LEPs and REPs) and State Environmental Planning Policies (SEPPs), which specify how land may be used and developed.

The study area for the Woodburn to Ballina section of the proposed Pacific Highway upgrade is located within three local government areas – Ballina, Lismore and Richmond Valley Councils. Further details of statutory planning matters within the study area are provided in the *Route Options Development Report – Stage 1* (RTA, 2005a).

Local Environmental Plans (LEPs) for each Council are:

- Ballina LEP 1987.
- Richmond River LEP 1992.
- Lismore LEP 2000.

Each LEP is a performance based planning instrument which requires any development proposal to demonstrate that it is consistent with overall aims and objectives as well as any zone objectives, in order to be regarded as permissible.

The term permissibility relates to whether an “activity”, as described in the *Environmental Planning and Assessment Act 1979*, is in accordance with the land use zoning provisions contained in Councils’ environmental planning instruments and whether Council consent is required or not.

Ballina, Lismore and Richmond Valley Councils’ environmental planning provisions that would apply to a proposed upgrade of the Pacific Highway between Woodburn and Ballina generally require Council consent for roads on most land use zones. Although these Councils adopt the *Environmental Planning and Assessment Model Provisions 1980*, some exceptions noted in Councils’ LEPs do not enable the RTA to proceed with an activity without Council consent.

Under Part 3A of the EP&A Act, any impact on heritage items listed on Councils’ LEPs and SEPP14 wetlands, which previously required Council consent, would be matters for consultation by the Department of Planning with the relevant Council and DEC.

- Approvals in relation to National Parks

Any road development with lands zoned as National Park would require an Act of Parliament to revoke the National Park dedication. Refinement of the preferred route adjacent to Broadwater National Park has kept the alignment out of the Park.

- Approvals in relation to Aboriginal lands

Under Section 42, *Aboriginal Land Rights Act 1983*, land owned by a LALC may not be compulsorily acquired by the RTA except by an Act of Parliament. Refinement of the preferred route has avoided property owned by a LALC.

If the upgrade were to require any Crown land subject to a Native Title claim, the NSW government would be liable for Native Title compensation for that piece of land. The land would also be left unavailable for the resolution of the Native Title claim.

- Approvals under Commonwealth legislation

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) imposes an obligation to consider potential impacts on matters of National Environmental Significance (NES matters), such as nationally threatened species and communities, and migratory species protected under international agreements. Route option development seeks to avoid where possible, or minimise impacts on these areas.

2.6.2 Existing land use

The *North Coast Regional Environmental Plan* (NCREP) establishes a regional framework for the development of the North Coast Region. The *North Coast Urban Planning Strategy* (Department of Planning, 1995) provides a more detailed implementation framework based on the provisions of the North Coast REP. The Strategy forecasts substantial residential population growth in the North Coast Region, with the population predicted to almost double in the period from 1991 to 2016. Population growth directly relates to demand for improved transport infrastructure. This includes demand for travel within the local area and North Coast region, and connections to other areas such as Sydney/Newcastle, south-eastern Queensland and areas west of the Great Dividing Range.

Woodburn

Woodburn is located on the Richmond River south of Ballina and Broadwater, 723 km north of Sydney on the Pacific Highway. Woodburn was known to local Aborigines as 'maniworkan'. The town has developed around, and benefited from, commerce associated with the Pacific Highway. Riverside Park is a favourite place for motorists to rest on their journey north or south.

Broadwater

Broadwater is a small township located on the Richmond River south of Ballina and Wardell, 734 km north of Sydney on the Pacific Highway. It is a town characterised by its main industrial employment generator, the Broadwater Sugar Mill, from which it derives its local name of "Sugartown". The Mill and in particular its stack form a significant landmark. The town

directly addresses the Pacific Highway and its streetscape of churches, shops and small cottages is of heritage quality.

Wardell

Wardell is the largest of the three townships in the study area. It is located on the Richmond River south of Ballina, 743 km north of Sydney on the Pacific Highway. The town straddles the Richmond River and also the existing Pacific Highway. The commercial centre of the town is located just off the Pacific Highway.

Field investigations and analysis of aerial photography indicates that the study area incorporates urban land, agricultural land, forested land (timber) and conservation reserves (refer **Table 2-1**). Rural land uses within the study area consists of beef production, sugar cane, tea tree plantations, and soybean in addition to commercial fishing and timber production. Broadwater National Park and Tuckean Nature Reserve are located within the study area. The distribution of these land uses is shown on **Figure 2-4**.

Table 2-1 Current land use within the study area

Land Use	% of area	Land Use	% of area
Sugar Cane	36.6	Urban	2.3
Timber	22.8	Rural residential	0.5
Grazing	21.0	Intensive agricultural	0.5
Water courses	8.8	Quarry	0.3
National Park	7.2		

Source: Based on aerial photography interpretation and ground truthing.

2.6.3 Property impacts and land acquisition

The development of a road corridor through the study area would have a number of direct and indirect impacts on properties. In the design and selection of route options the RTA has attempted to minimise the impact on private properties. The comparative impact on properties and dwellings of the various route options is one of the criteria upon which routes are assessed during the selection of a preferred route. Those routes which have fewer property impacts affect fewer people and perform better in this assessment.

Further refinements to reduce the number and nature of property impacts would continue at the concept design stage of the preferred route. Design would include minimising the amount of private property affected, solutions to mitigate noise, visual and environmental impacts, and solutions to access and severance problems arising from the route alignment

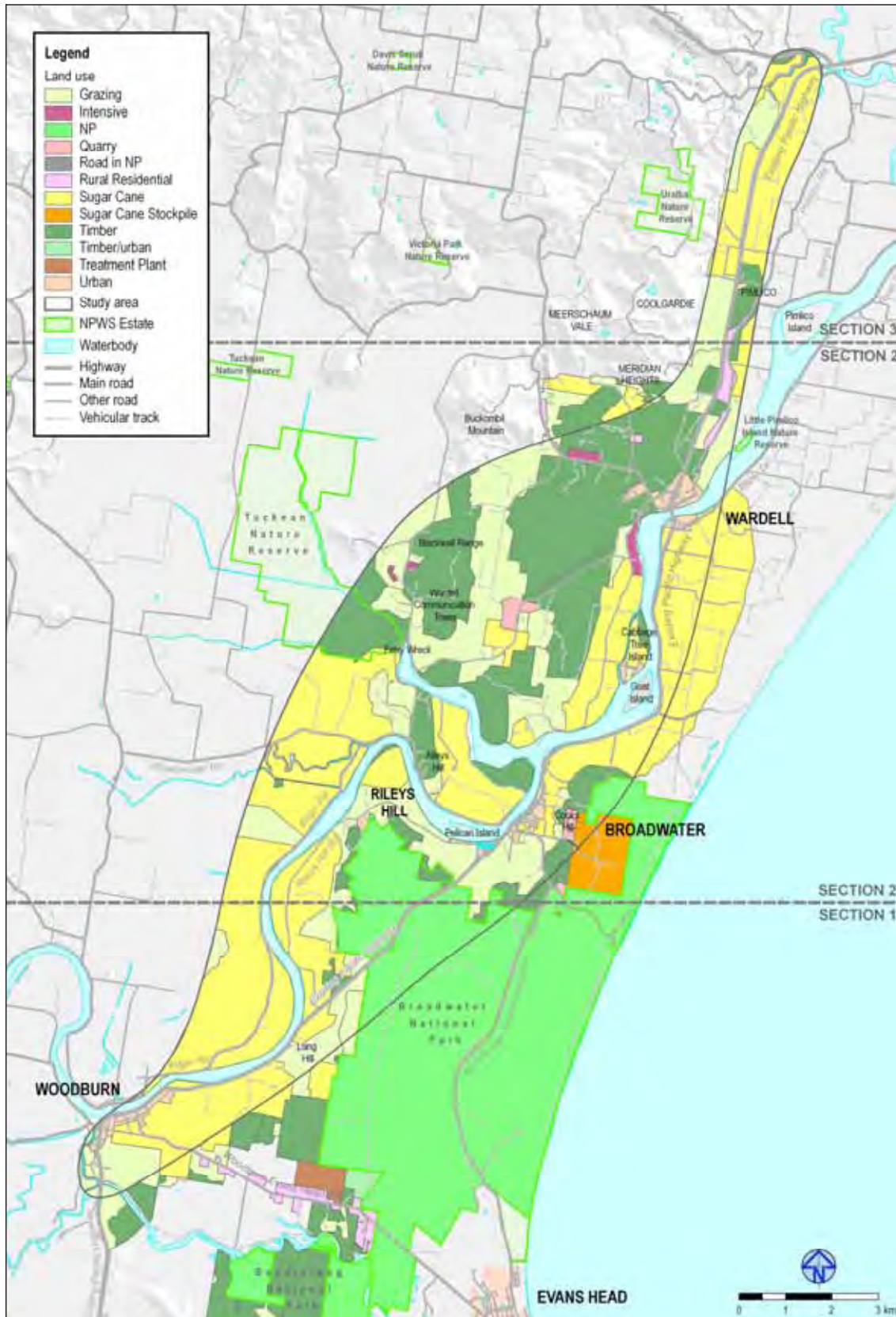


Figure 2-4 Land use

To construct the upgrade the RTA would be required to acquire the land in accordance with the provisions of the *Land Acquisitions (Just Terms Compensation) Act 1991*. The RTA's *Land Acquisition Policy* reflects the provisions of this legislation. Both partial and total property acquisitions would be undertaken as appropriate.

2.6.4 Agricultural Impacts

Sugar cane production is the most important industry on the poorly drained floodplain of the Richmond River. Soybeans are often grown in rotation with the cane. There are a few small plantations of *Melaleuca alternifolia* (Tea Tree) and one plot of Lemon Myrtle.

The uncleared timbered areas provide a prime location for beekeeping, especially in the Woodburn area. Beef production is undertaken on cleared pastured areas that are not suitable for cultivation and within the timbered areas. There are no dairy farms within the study area.

The proposed realignment of the Pacific Highway would impact on local agricultural production. One of the determining factors in assessing the value of the impacts is the capability of the land to support particular agricultural enterprises. Based on income generated, the impacts would be greater where land is capable of supporting a high value enterprise such as crop production through regular cultivation in comparison with land supporting an extensive grazing enterprise.

Although direct land loss is the most visible impact from development, stakeholders are also impacted by losses in production infrastructure, sharefarmer employment, altered drainage and access, and forced changes to management.

Sugar cane production

Sugar cane farming within the study area relies on crop rotation and a longer production cycle than sugar cropped areas in the north, due to the relatively short summer period. As a consequence, more than two thirds of total production from a crop is recovered from the second year of a planting. Thus, on sugar farms there are fallow fields, first year cane and second year cane at any one time. Interruptions to this cycle by excision of land can cause serious disruption and economic consequences.

In the past, transport for the sugar cane to the mill was via the Richmond River. This influenced the layout of the farms on the floodplain in the study area such that the land title alignment tends to be in blocks that are perpendicular to the river. A north-south highway alignment parallel to the river that crosses the cane production area would impact on a great number of farms. Severance of a farm can lead to harvesting problems, duplication of equipment and lost access to loading pads and road networks.

Beef cattle production

While farms which run beef cattle in the area vary in size, commercial beef properties are less intensive in terms of management inputs than the cane farms. Interrupted access to infrastructure to carry out management procedures is an issue as will be loss of pivotal improved pasture/cropped areas, which are significant contributors to the feed cycle.

2.6.5 Urban design and visual amenity

Constraints associated with an upgraded Pacific Highway through the study area include Broadwater National Park and Tuckean Nature Reserve, townships and settlements, topography, built and natural landmarks and visually sensitive landscapes. The assessment of visual impacts conducted for the project has determined the visual impacts of the proposed route on the spatial precincts identified in the study area.

A key aspect of the urban design and landscape design effort is to address and mitigate the visual impacts of the new highway, in particular from publicly accessible locations.

The new highway would need to cross the Richmond River at least once, and may also need to pass over The Tuckean Broadwater. The visual impact of river crossing alternatives is a critical consideration, involving the length of sightlines to bridges along reaches of the waterways and the scale and extent of construction on the riverbanks.

The urban and landscape design aims to integrate and balance all factors which bear on route selection to achieve a preferred route which is logical, reasonable, and best supports the vision. The following objectives define the urban and landscape design vision for the upgrade:

- Provide a flowing road alignment responsive to and integrated with the landscape, and which sustains environmentally sound planting strategies.
- Provide a road corridor which is well vegetated where appropriate, responds to the adjoining landscape context, and optimises view opportunities.
- Provide an enjoyable and interesting highway with varied views and vistas of the Richmond River Valley, and pleasant restful places to stop.
- Understand and take account of the needs of communities and towns along the route.
- Provide an appropriate balance between consistency and variety in the design of road elements.
- Provide a simple, elegant and unobtrusive road design.

2.7 Environmental issues

2.7.1 Biodiversity

The broad study area is generally situated within the alluvial floodplains of the Richmond River and areas in the north west contain Pleistocene sand deposits grading into the volcanics of the Blackwall Range and Coolgardie escarpment areas. The area contains an exceptionally high biodiversity. Vegetation communities are very diverse and habitats support an extremely high diversity of fauna species and represent a rich area for birds, bats, amphibians and snakes.

Vegetation communities were broadly mapped within the study area using a level of constraint to represent the various levels of conservation value.

Figure 2-5 outlines the level of constraint allocated to vegetation within the study area.

Terrestrial flora

Flora surveys conducted in the study area identified over 400 plant species, including 50 threatened flora species known or likely to occur within the vegetation communities identified. PATN analysis of the flora species recorded in the study area yielded nine distinct vegetation communities:

- Community 1: Banksia – Callitris Dry Heathy Woodlands.
- Community 2: Paperbark – Mahogany Wet Heathy Woodlands.
- Community 3: Paperbark – Blackbutt emergent Closed Forest.
- Community 4: Mahogany – Blackbutt Forests.
- Community 5: Paperbark – Swamp Oak Swampy Forests.
- Community 6: Red Gum – Tuckeroo Riparian emergent Closed Forests.
- Community 7: Knotweed Riparian Herbfields.
- Community 8: Closed Forests.
- Community 9: Mangrove Closed Forests.

All vegetation communities were assessed for their conservation significance. Of the nine communities identified, six are analogous or partly analogous with endangered ecological communities listed under Schedule 1 Part 3 of the *Threatened Species Conservation Act 1995* (TSC Act) as listed below:

- Community 2: Paperbark – Mahogany Wet Heathy Woodlands and Heaths. Substantially analogous with the EEC “Swamp Sclerophyll Forest on Coastal Floodplains of NSW North Coast, Sydney Basin and South-East Corner bioregions”.

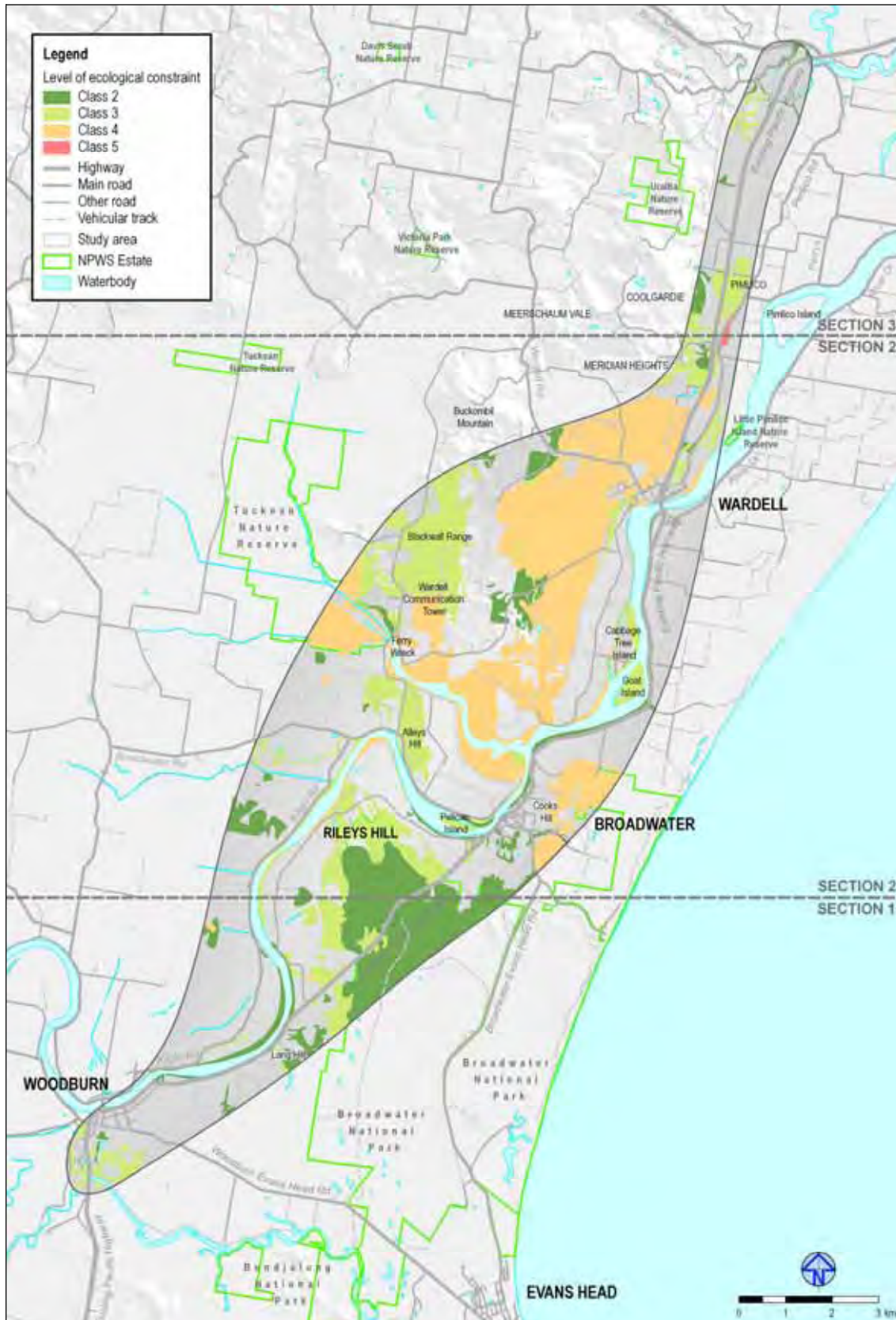


Figure 2-5 Broad vegetation communities

- Community 3: Paperbark – Blackbutt emergent Closed Forest. Substantially analogous with the EEC “Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion”, or in situations where *Melaleuca quinquenervia* is dominant with the EEC “Swamp Sclerophyll Forest on Coastal Floodplains of NSW North Coast, Sydney Basin and South-East Corner bioregions”.
- Community 5: Paperbark – Swamp Oak Swampy Forests. Substantially analogous with the EEC “Swamp Sclerophyll Forest on Coastal Floodplains of NSW North Coast, Sydney Basin and South-East Corner bioregions”.
- Community 6: Red Gum – Tuckeroo Riparian emergent Closed Forests. Partly analogous with the EEC “River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner bioregions”.
- Community 7: Knotweed Riparian Herbfields. Substantially analogous with the EEC “Freshwater Wetlands of the NSW North Coast, Sydney Basin and South-East Corner bioregions”.
- Community 8: Closed Forests. Substantially Analogous with the EEC “Lowland Rainforest on Floodplain in the NSW North Coast Bioregion”

Terrestrial fauna

Early assessment results indicated that there are at least 61 threatened fauna species occurring or considered as likely to occur in the study area. These include 33 threatened bird species, 2 threatened frog species, 2 reptiles, 24 mammals (including 13 bats) and an endangered population of Emu. The search of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) online search identified 52 threatened species (including flora species) listed under this Act as likely or potentially occurring within the study area and adjoining habitats.

Eighteen fauna species listed as Threatened under the TSC Act were identified during the surveys. Three of these species, the Grey-headed Flying-fox (*Pteropus poliocephalus*), the Long-nosed Potoroo (*Potorous tridactylus tridactylus*) and the Olongburra Frog (*Litoria olongburensis*) are also listed as Threatened under the EPBC Act.

A total of 39 mammal species were positively identified during the surveys undertaken as part of this project. Nine of the mammal species are listed as threatened under the TSC Act. In addition, one mammal species, the Long-nosed Potoroo (*Potorous tridactylus tridactylus*) was tentatively identified by tracks observed and hair samples collected during the surveys. This identification was made with reference to the type of the tracks, the results of hair sample analysis, and the habitat in which the tracks and hair samples were observed or collected. The Long-nosed Potoroo is listed as a threatened species under both the TSC Act and the EPBC Act.

A total of 21 reptiles and amphibians were positively identified during the surveys. Two reptile species unable to be captured were tentatively identified from observations (*Lampropholis amicula*, *delicata* or *guichenoti*

and *Ctenotus robustus*) and one reptile species, the Lace Monitor (*Varanus varius*), was tentatively identified by tracks found during the survey. In addition, one frog species was tentatively identified from a call heard during the surveys (*Pseudophryne* species). Two of the amphibian species (Olongburra Frog *Litoria olongburensis*) and the Wallum Froglet (*Crinia tinnula*) identified are listed as Threatened under the TSC Act.

A total of 142 bird species were positively identified during the surveys. Six bird species are listed as Threatened under the TSC Act. These are:

- Osprey (*Pandion haliaetus*),
- Black-necked Stork (*Ephippiorhynchus asiaticus*),
- Rose-crowned Fruit-dove (*Ptilinopus regina*),
- Pied Oystercatcher (*Haematopus longirostris*),
- Mangrove Honeyeater (*Lichenostomus fasciocularis*), and
- Grey-crowned Babbler (*Pomatostomus temporalis*).

Aquatic ecology

The study area encompasses a number of watercourses, wetlands and floodplains of the Richmond River system and its tributaries.

Thirty eight aquatic species were identified during the surveys. While early assessments and database searches indicated that there could be 10 Threatened aquatic species, there were no aquatic species listed as Threatened under the *Fisheries Management Act 1994* detected during the aquatic surveys. Although no Threatened aquatic species were identified during the surveys, they are known to be located within and adjoining the study area.

Only one threatened aquatic species, listed on both the TSC Act and the EPBC Act, the Oxleyan Pygmy Perch, is known to occur in the study area. This species is known to be located in Broadwater National Park and in the vicinity of Rileys Hill.

Over 30 Migratory and Marine species listed under the *Commonwealth EPBC Act 1999* are considered as likely to occur within the habitats of the study area. Similarly, a number of these species are listed under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA).

Development of the route options and preferred route has endeavoured to be sensitive to the complex biodiversity of the area.

2.7.2 Heritage

Aboriginal heritage

The study area lies within land administered by the Jali LALC, although sections at the southern end (approximately 1.0 km, south of Tuckombil

Canal) and through Broadwater National Park between Woodburn and Broadwater (approximately 500 m) are also shared by the Bogal and Ngulingah LALCs. This sharing arrangement has arisen due to the high spiritual and archaeological significance of the Evans Head/Goanna Headland locality to Bundjalung people from a wide geographical area.

The location of 'Jali land' to the west of Wardell, including Cabbage Tree Island, was a primary constraint in the development of route options. Aboriginal cultural attachment to the land, which includes parts of Wardell heath, was pointed out to the study team, as well as the community's desire to save as much Aboriginal heritage for future generations as possible.

A search of the Register of Native Title Claims, the Register of Indigenous Land Use Agreements, the National Native Title register and the Applications Summary was performed for the Ballina, Richmond Valley and Lismore Local Government Areas on 2 September 2004.

Advice provided by the National Native Title Tribunal indicates that there are three Registered Native Title Claims relevant to the study area. The claims do not relate to freehold lands or to lands lawfully owned and occupied.

While all freehold land by definition is not Crown Land, the tenure of any Crown Land can be the subject of a Native Title Claim. There is no legislation in force which excludes Crown Land from a Native Title Claim. The RTA can acquire Crown Land, however the NSW government would be liable for Native Title compensation for that piece of land.

Twelve Aboriginal sites have been registered to date on the Department of Environment and Conservation's (DEC) Aboriginal Heritage Information Management System (AHIMS) on the coastal barriers, Richmond alluvial floodplain and coastal ramp between Woodburn and Teven Junction on the southern outskirts of Ballina. These include four open campsites, four Bora/ceremonial grounds, two natural mythological/sacred sites and two burial sites, one with an associated midden and open camp. Aboriginal heritage and non-Aboriginal heritage sites are shown on **Figure 2-6**.

Development of the route options and preferred route has taken into consideration Aboriginal cultural heritage, land ownership and current Native Title Claims.

Non-Aboriginal heritage

Heritage items in Australia are protected by a hierarchy of legislation based on whether their level of assessed significance is considered to be of National (or Commonwealth), State or Local importance.

A number of identified heritage items are known to be located within the study area as shown in **Figure 2-6**. These have been assessed as either having Commonwealth, State or Local heritage significance, and are summarised in **Table 2-2**.

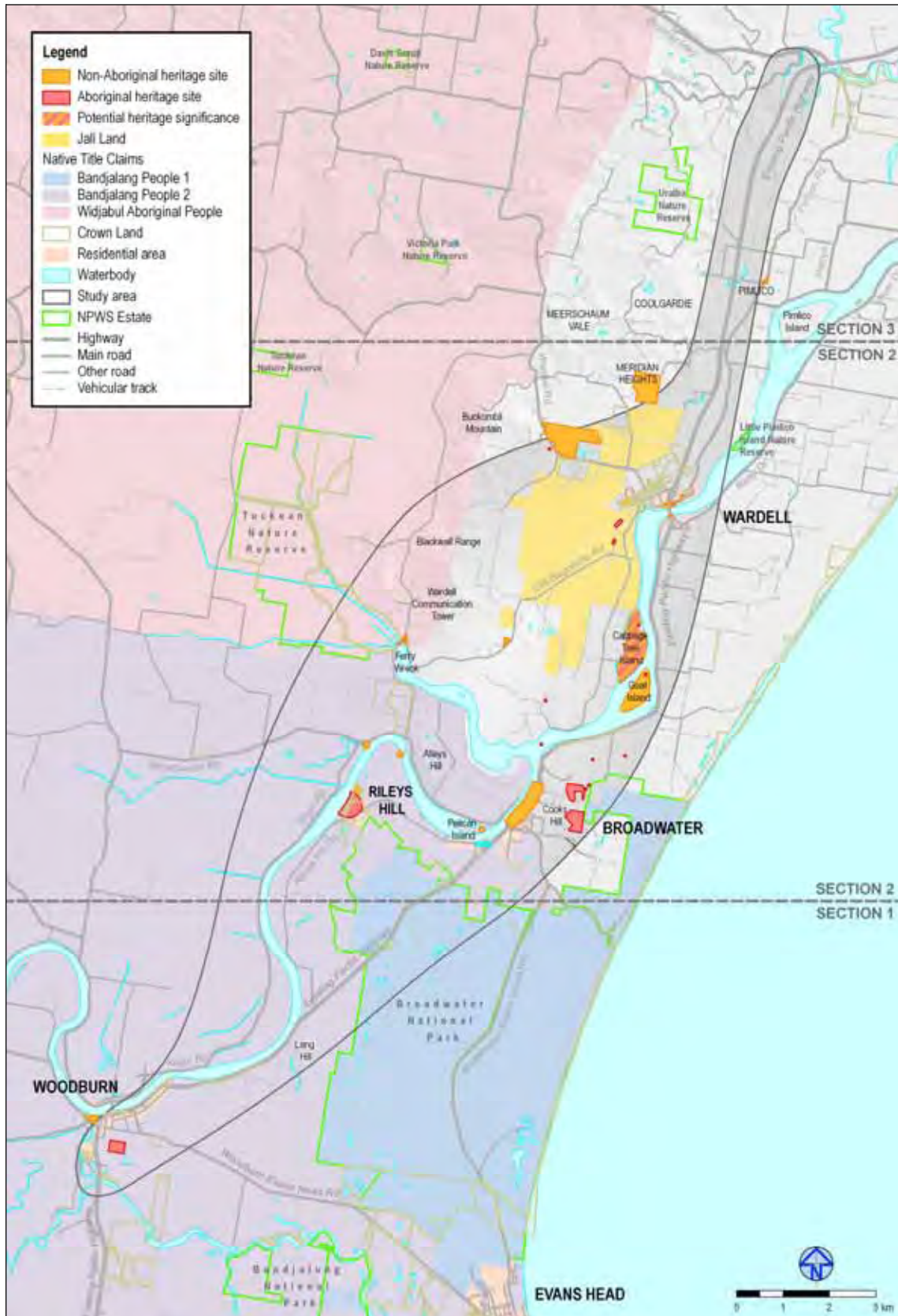


Figure 2-6 Aboriginal and non-Aboriginal heritage

In addition, the background historical research identified the potential for currently unregistered historic places and/ or archaeological sites to be present within the study area. These include the potential for:

- Historic built heritage items.
- Historic archaeological items.

Development of the route options and preferred route has taken into account the constraints placed by the location of heritage items within the study area.

Table 2-2 Summary of identified non-Aboriginal heritage items within the Study Area

Constraint	Level of Significance	Statutory Registers
Catholic Church, Broadwater	Commonwealth /Local	Register of National Estate State Heritage Inventory Richmond River LEP (1992)
Government Officials Residence, Wardell	Commonwealth /Local	Register of National Estate
House (including fence), 54 Richmond St, Wardell	Commonwealth /Local	Register of National Estate
St Patrick's Catholic Church Group, Wardell	Commonwealth /Local	Register of National Estate
St Barnabas' Anglican Church, Wardell	Commonwealth /Local	Register of National Estate
National Bank, Wardell	Commonwealth /Local	Register of National Estate Ballina LEP 1987
Royal Hotel, Wardell	Commonwealth /Local	Register of National Estate Ballina LEP 1987
Police Station, Wardell	Commonwealth /Local	Register of National Estate Ballina LEP 1987
Courthouse/Police Station, Woodburn	Local	State Heritage Inventory Richmond River LEP 1992
Post Office, Woodburn	Local	State Heritage Inventory Richmond River LEP 1992
General Cemetery, Woodburn	Local	State Heritage Inventory Richmond River LEP 1992
Rileys Hill Boat Dock, Rileys Hill	Local	State Heritage Inventory Richmond River LEP 1992
St Joseph's Roman Catholic Church, Woodburn	Local	Richmond River LEP 1992

2.7.3 Water quality

Preliminary surface water investigations have involved desktop investigations of available data. A program of water quality sampling and analysis for waterways in the area would be undertaken to establish baseline water quality data for monitoring purposes during construction and operation of the upgraded Pacific Highway.

In coastal areas in northern NSW the flow regime of watercourses is a major determining factor of water quality. Frequent rainfall keeps river flows and the small dams high compared with inland rivers, and extractions from the river for irrigation are taken mainly from unregulated flows (RACAC, 1996).

The hydrology of the study area has been substantially modified by a network of channels which have been constructed to support sugar cane cultivation areas. Tidal gates have been erected where these channels enter the Richmond River to restrict tidal backflow. This drainage system has lowered the water table, exposing acid sulphate soils that have developed through the oxidation of iron pyrite. As a consequence, significant quantities of sulphuric acid are released from the drains into the Richmond River each year.

Water quality sampling has been undertaken by a variety of organisations within and in close proximity to the study area. The majority of water quality sampling that has been undertaken in the area has occurred as part of the Lower Richmond Water Quality Monitoring Program, the Manly Hydraulics Laboratory monitoring program, or long term monitoring by the Richmond River County Council

An analysis of the available water quality data shows that the issues of concern within the study area are very low pH and low dissolved oxygen levels. Turbidity levels are also elevated at a number of sites. The results can be described as follows:

Richmond River

The available data for the river, from the sampling programs mentioned above, show slightly basic pH levels upstream of the study area, low pH levels downstream of Rocky Mouth Creek, and neutral pH levels at Wardell in the downstream portion of the study area. Dissolved oxygen levels are low in the main river.

Tuckean Broadwater

Records from the Broadwater and Bagotville Barrage, from the sampling programs mentioned above, show very low pH levels, extremely low dissolved oxygen levels, and high turbidity levels. This site fails to meet aquatic ecosystem requirements for these parameters on most occasions.

Tuckombil Canal

The data available for this area, from the sampling programs mentioned above, show high salinity levels and extremely low dissolved oxygen.

Rocky Mouth Creek

Records from Rocky Mouth Creek, from the sampling programs mentioned above, indicate that this area suffers from very low pH and low dissolved oxygen levels. The area fails to satisfy aquatic ecosystem requirements for the majority of samples.

During preliminary clearing works and construction there would be the potential for acidic runoff as a result of disturbance of acid sulphate soils with adverse impacts on water quality and aquatic flora and fauna. Additional issues arising from road construction and operation would involve erosion and sedimentation of exposed soils and cleared river banks particularly during heavy rainfall events and riverbed disturbance during bridge construction.

2.7.4 Climate and air quality

The study area lies on the coast and the local climate is heavily influenced by offshore meteorological activity. The study area has a warm to sub-tropical climate and high rainfall, which provides an ideal situation for a great variety of agricultural and horticultural pursuits. There is a pronounced summer to autumn wet season and a marked dry season between July and December. The mean annual rainfall ranges from approximately 1650 mm along the coast to about 1025 mm at Casino, with average rainfall at Broadwater of about 1480 mm. High summer rainfalls, sometimes greater than 500 mm result from southward extensions of tropical cyclones, whilst the periods of high rainfall in winter derive from intense offshore low-pressure systems. During construction rainfall events would have the potential to cause localised flooding and erosion in areas with high erosion potential and/or a high watertable as well as construction delays.

When the new road is open to traffic, the most significant climatic impacts are likely to be rainfall and fog. Morning fogs in winter are common in the Richmond Valley. These factors can contribute to road accidents as a result of reduced visibility and slippery road conditions. It is proposed to undertake a review of local climate and meteorology with particular emphasis on the frequency of inversions and fogs.

There is limited information regarding existing air quality within the study area. Areas located away from larger regional centres generally do not have air quality monitoring stations. The main reason for this is that in predominantly rural areas, pollutants do not exist in high enough concentrations to cause adverse environmental or health impacts or concerns. As such, monitoring for such pollutants on a long term basis is not usually undertaken outside metropolitan and or industrial areas.

No air monitoring is proposed, however, a desktop study which assesses the current and predicted levels of roadway pollutants would be undertaken following a site visit. Further investigations would be undertaken to identify other significant sources of air pollutants in the region; quantify relevant vehicle emissions; model predicted concentrations at receptor locations downwind of "at grade", "fill", "bridges" and "cut section" highways; assess the impacts of the

proposal in accordance with relevant air quality goals; and, estimate dust impacts during construction.

During construction there would be potential for reduced air quality adjacent to worksites primarily due to dust along the preferred route alignment. When the road is open to traffic adjacent residents would potentially experience new or increased air pollution impacts. By removing the highway from Woodburn, Broadwater and Wardell there would be potential for reduced impacts from particulate and gaseous emissions in residential areas.

2.7.5 Noise environment

The study area has a large number of residential dwellings, some of which are clustered together in the townships, while others are dispersed. Any option to upgrade the Pacific Highway within the study area would result in potential for either new or increased noise impacts to nearby residences, and to other noise sensitive receptors such as schools and churches. At the same time there would be potential for traffic noise levels to decrease in the townships.

Road traffic noise goals are identified from the EPA's (now incorporated in DEC) *Environmental Criteria for Road Traffic Noise* (ECRTN) guideline. The appropriate noise goals for the proposed upgrade of the Pacific Highway are listed in **Table 2-3** below. The assessment methodology and application of the noise criteria are taken from the RTA's *Environmental Noise Management Manual* (ENMM).

Table 2-3 Road traffic noise base criteria

Type of Development	Criteria		Where criteria are already exceeded
	Day	Night	
New Freeway or arterial road	L _{Aeq} (15hour)55dB	L _{Aeq} (9hour)50 dB	New road designed to not increase existing noise by more than 0.5dB.
Redevelopment of an existing freeway/arterial road	L _{Aeq} (15hour)60 dB	L _{Aeq} (9hour) 55 dB	Redevelopment to be designed in order not to increase existing noise by more than 2dB where reasonable and feasible.

Preliminary background noise level monitoring and manual noise measurements were undertaken throughout the study area between November and December 2004. The eight (8) noise monitoring station locations are identified in **Figure 2-7**, together with locations of manual measurements which were taken as spot checks. The findings of the traffic noise monitoring are summarised in **Table 2-4**.

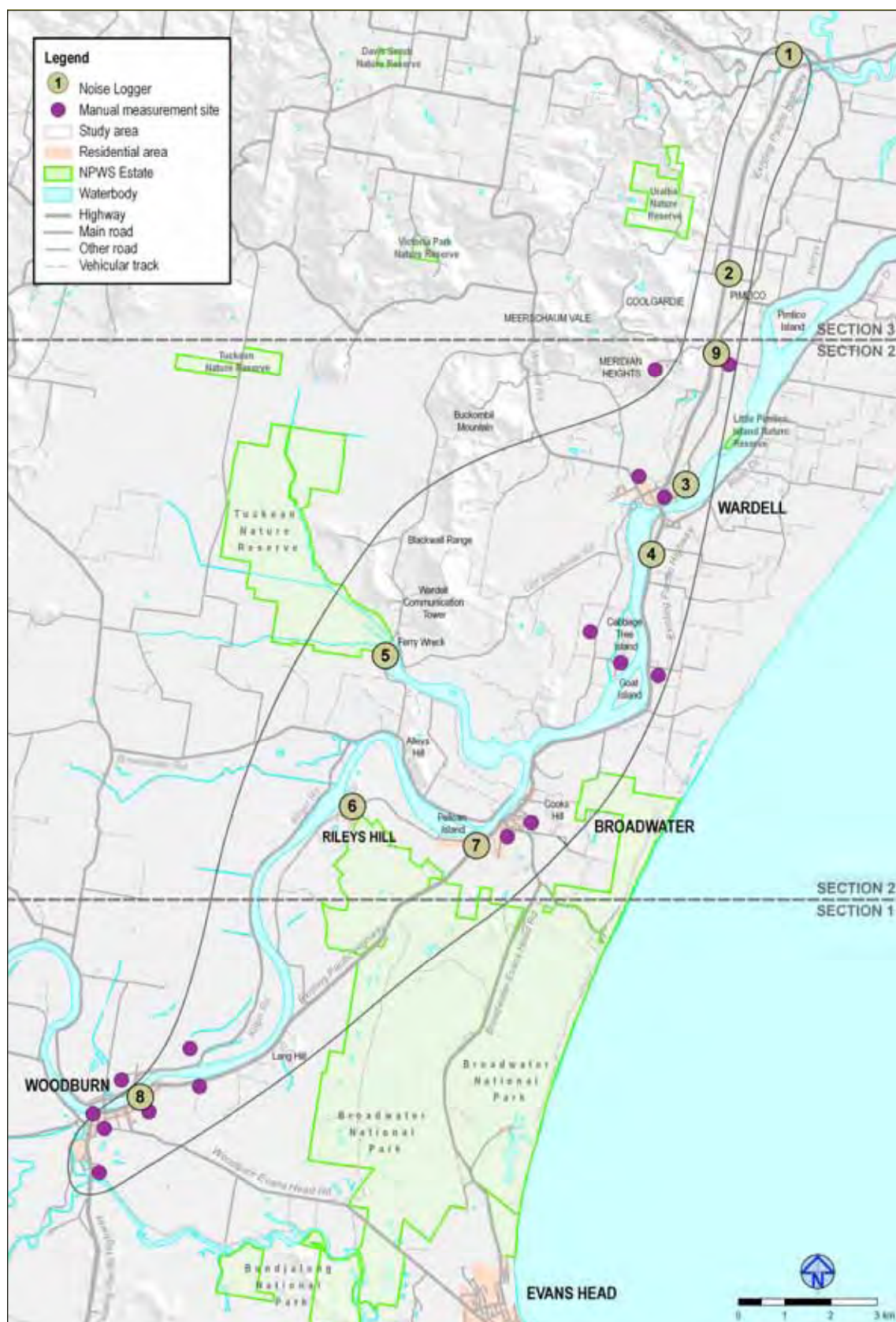


Figure 2-7 Noise monitoring station locations

Table 2-4 Traffic noise monitoring findings

Location (logger ref.)	Average Noise Level, L_{Aeq} dB		L_{A0} Noise Level, dB	
	Daytime (07:00h – 22:00h)	Nighttime (22:00h – 07:00h)	Daytime (07:00h – 22:00h))	Nighttime (22:00h – 07:00h)
14-16 Uralba Road (1)	52	51	54	53
52 Laws Road, Pimlico (2)	63	62	66	65
760 Pimlico Road, Pimlico (weekend period only) (9)	56	53	57	55
Millfield, south of Wardell (4)	69	69	72	70
No 13 Pacific Highway, Broadwater (7)	68	66	70	64
No 97 River Street, Woodburn (8)	64	64	67	65

Concurrently, environmental noise surveys were undertaken at several locations unaffected or little affected by noise from the existing Pacific Highway and the findings are summarised in **Table 2-5**.

Table 2-5 Existing (2004) environmental noise levels

Location (logger ref.)	Average Noise Level, L_{Aeq} dB		Background Noise Level, 10 th percentile L_{A90} dB	
	Daytime (07:00h – 22:00h)	Nighttime (22:00h – 07:00h)	Daytime (07:00h – 22:00h))	Nighttime (22:00h – 07:00h)
Off Richmond Road, Wardell (3)	54	46	32	34
Bagotville Barrage (5)	52	47	33	32
Rileys Hill (6)	56	59	33	35

Findings from specific measuring sites along the Pacific Highway indicate that existing traffic noise levels already exceed EPA/DEC base criteria for 'new' and 'redeveloped' roads. Noise levels away from the highway and the townships would be expected to be lower, particularly at night.

The development of route options, including retaining the existing highway alignment, has been undertaken in consideration of the existing and potential traffic noise impacts on sensitive receptors such as residences, schools and places of worship. Also, the approach to refining route options has also aimed to achieve the project objectives.

2.8 Flooding and drainage

The study area lies within the coastal flood plain of the Richmond River catchment. The catchment covers an area of 6,864 square kilometres, from Cape Byron in the north to the coastal plain adjacent to Evans Head in the south and the Border Ranges National Park and the Richmond Range in the west. In addition the Richmond River is within the study area for most of its length, and is, therefore, a major consideration for route selection.

The flood depths obtained and shown in **Figure 2-8** and **Figure 2-9** demonstrate that much of the study area lies within the floodplain. Flood depths within the floodplain of the study area vary from zero to 3.5 metres for the 1 in 100 year ARI flood event, and are between 0.5 to 1.0 metres less for the 1 in 20 year ARI flood event. The area of inundation for the 1 in 20 year ARI storm is significant and not much less than that occupied by the 1 in 100 year ARI storm event. This is due to the flat, low-lying nature of much of the floodplain.

Flooding duration varies throughout the study area. For the 1 in 100 year ARI storm event flood duration is up to 7 days, although inundation of the floodplain could occur for longer periods, depending on tidal levels at the time of the flood.

Generally during the less frequent flood events floodwaters spread out over the flood plain, with lower velocities towards the edges of the flood plain and higher toward the river and where flood depth is greatest. The modelling has demonstrated that the floodplain has the following characteristics:

- The floodplain is naturally constrained just downstream of Broadwater by the Blackwall Range to the north and remnant coastal dunes to the south.
- Tuckean Swamp, a large low lying area to the west of the Bagotville Barrage, provides significant flood storage upstream of the constriction in the floodplain at Broadwater.
- Flows within the Richmond River can pass through Tuckombil Canal to areas of flood storage east of Woodburn, and to the ocean at Evans Head through the Evans River.
- A large area of flood storage is present south of Swan Bay (south and west of Woodburn).
- Breakouts from the Richmond River occur east of Coraki.
- Breakouts from the Richmond River occur to the south of the study area where there is significant flood storage. This water drains via the Tuckombil Canal and the Evans River to the sea.
- Floodwater moves in a clockwise direction from the north of Woodburn to the south-east. Some of this water is held as storage in low lying areas east of Woodburn and eventually drains via the Richmond River as flood waters recede. However, the balance drains to the sea via the Evans River.

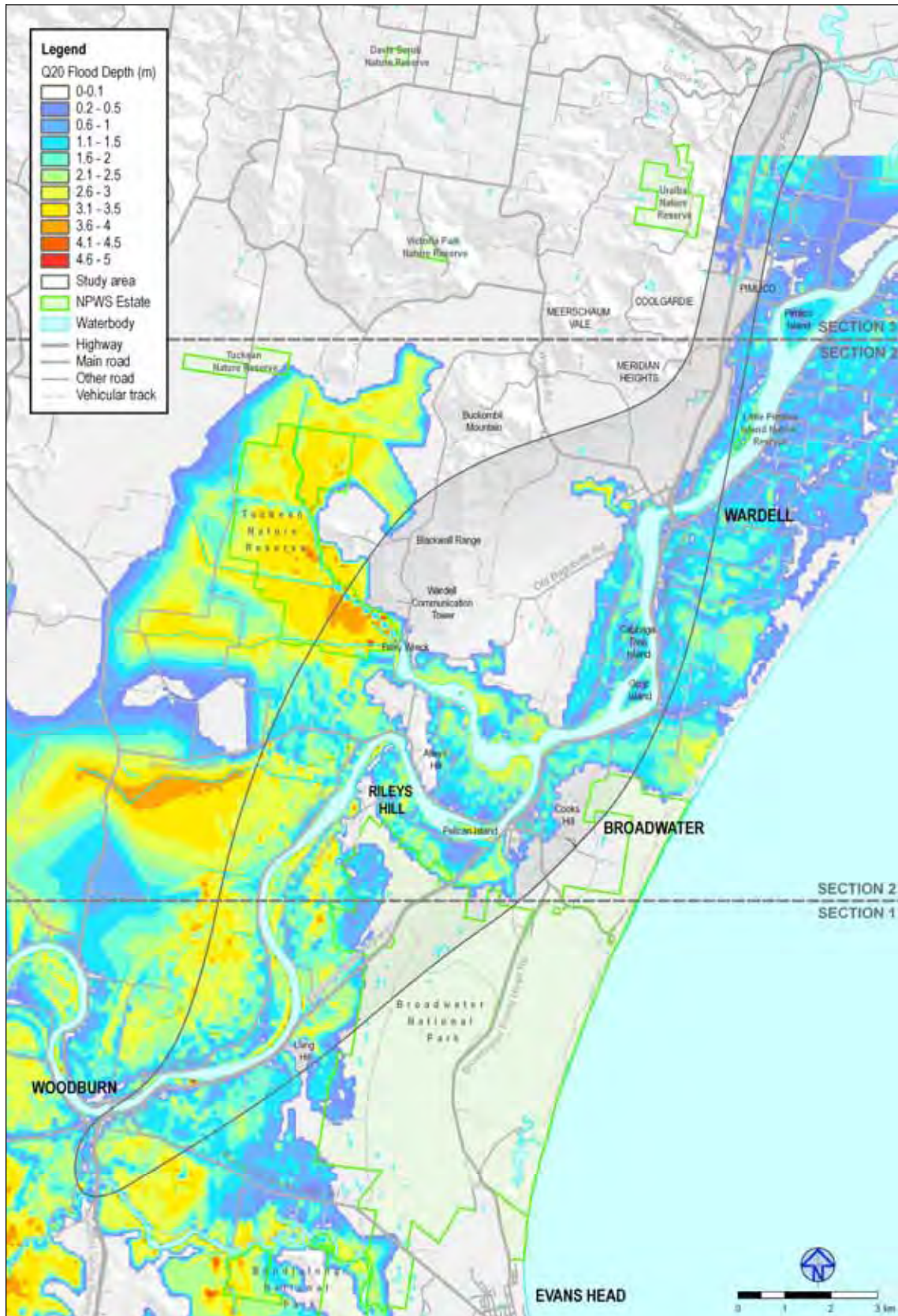


Figure 2-8 1 in 20 year (Q20) Flood depth

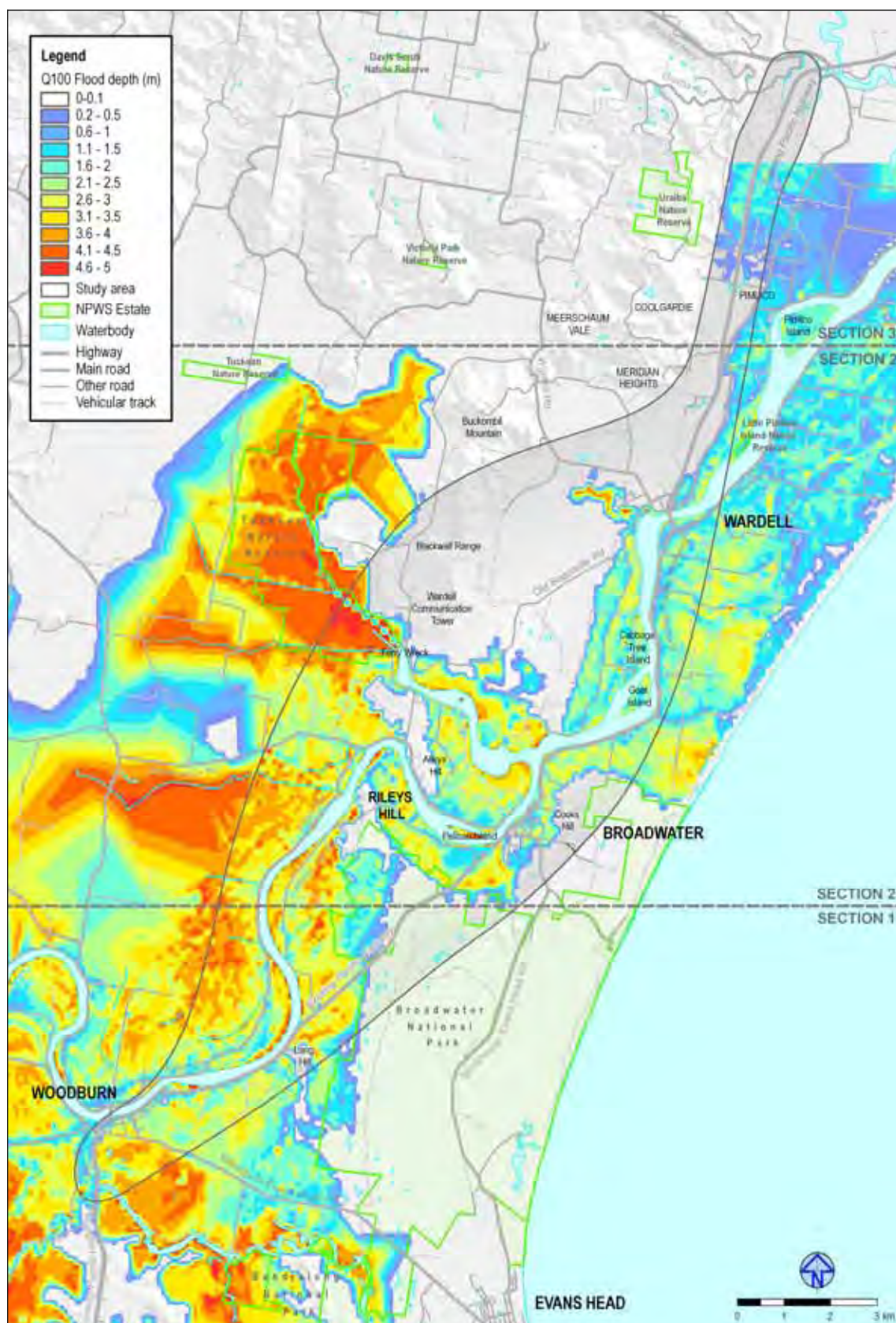


Figure 2-9 1 in 100 year (Q100) Flood depth

- There is a constriction to the flood flows downstream of the town of Broadwater. The constriction is characterised by a steeper hydraulic grade and higher velocities. This constriction controls flooding upstream, and it would be important that any proposal did not significantly constrict flows at this point.

2.9 Topography, geology and soils

The two major geological terrain units within the study area are described in **Table 2-6**:

Table 2-6 Geological terrain units

Terrain Unit	Topography	Geology	Soils
Floodplains	Flat to gently sloping coastal plains and river terraces.	Quaternary unconsolidated alluvial and estuarine soils about 6 to 35 m thick.	Alluvial/estuarine: sands, silts, clays, organic clays, possible gravels, expected to be actual and potential acid sulphate soils.
Hills	Gently to moderately undulating hills with wide Richmond River valleys and creeks.	Neranleigh-Fernvale Beds (metasandstones and slate) and Bundamba Group (sandstone, conglomerate, shales and siltstones) some basalt at higher elevations.	Residual clays of high plasticity. Small Creeks: Alluvial sediments. Hillslope Colluvium: Likely sandy, silty clay or sands.

The geotechnical issues expected to impact the upgrading of the Pacific Highway within the study area in relation to the terrain units are as follows:

Floodplain Terrain

Where the proposed highway traverses the floodplain terrain, it would probably be carried on a fill embankment in order to protect it from flooding. A key geotechnical issue for the proposed upgrade is the presence of low strength and highly compressible soft soils beneath the low-lying floodplains. The location of deep soft soils in the study area is shown in **Figure 2-10**. These soils would impact on the time (variable from six months to many years dependent on soil properties and construction methods) that is required to construct the road, and management of embankment stability and fill materials during construction.

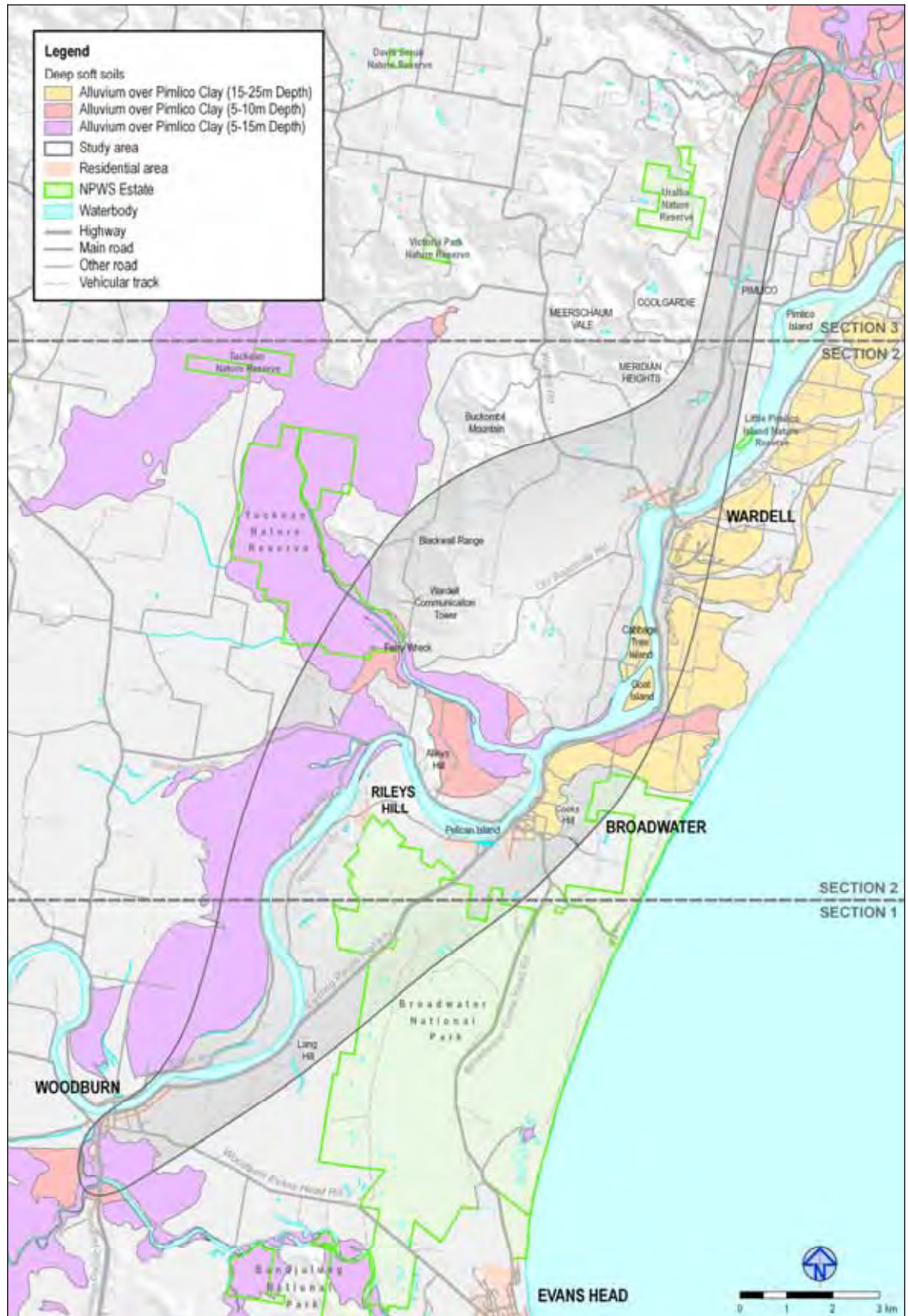


Figure 2-10 Deep soft soils

The weight of the embankment would cause settlement of the highly compressible soils during construction and also later following completion to design height. The bearing capacity (shear strength) of the foundation soils will improve over time as settlement occurs. The rate of embankment construction by successive placement of fill layers would need to be balanced so that the strength of the foundation soils is not exceeded and does not result in any instability of the embankments during construction. Methods are available for increasing the rate of settlement and strength improvement, such as providing soil drainage by inclusion of wick drains and surcharging by temporarily adding a greater height of fill than required.

The construction of non-flexible pavement on the top of the embankment would not commence until there is a low risk of future settlement of the foundation soils causing damage to the pavement. This will require the selection of a suitable pavement type and may mean that additional time is needed after completing construction of the embankment to wait for additional foundation settlement to occur.

Deep compressible alluvium is expected at most of the river crossings. Bridges crossing the Richmond River would most likely be supported on piles founded on rocks which are anticipated to be varying in depth from between 20 m on the western side of the study area and 50 m on the eastern side. As fill embankments on the highly compressible soils on the floodplains will settle, bridge approach treatment would be required to provide a smooth transition between the bridge structures and the embankments on the floodplains. These treatments may be in the form of a piled embankment or deep soil mixing.

The soil underlying floodplains are expected to be potential acid sulphate soils. If required a plan would be prepared to address the management of activities that disturb these soils.

Undulating Terrain

Roads located in the undulating terrain would require cuts through soil and rock. Some of the rock is weathered and can be excavated using conventional rippers and excavators. Some relatively high strength rock at greater depth may need to be excavated by drilling and blasting. Most materials excavated from cuts are expected to be relatively low quality, but suitable for general embankment fill. There are some existing operational quarries in or near the study area that could supply high quality construction materials.

3 Project objectives and assessment approach

3.1 Objectives

The proposed Woodburn to Ballina Upgrade forms part of the Pacific Highway Upgrading Program. The development of options and the selection of a preferred route have been undertaken in the context of both the Pacific Highway Upgrade objectives and the Project specific objectives.

3.1.1 Pacific Highway Upgrading Program objectives

The objectives of the Pacific Highway Upgrading Program are to:

- Significantly reduce road accidents and injuries.
- Reduce travel times.
- Reduce freight transport costs.
- Develop a route that involves the community and considers their interests.
- Provide a route that supports economic development.
- Manage the upgrading of the route in accordance with ecologically sustainable development (ESD) principles.
- Provide the best value for money.

3.1.2 Woodburn to Ballina upgrade project objectives

The agreed project objectives of the Woodburn to Ballina upgrade, developed in conjunction with community and government agency involvement are:

Project Objective 1	Improve the efficiency of state, regional and local travel, safety and accessibility.
Project Objective 2	Provide a flowing road alignment responsive to and integrated with the landscape; optimising views, elegant design and planting opportunities.
Project Objective 3	Engage with the community and be informed by their views and experience.
Project Objective 4	Identify and enhance potential beneficial environmental effects, and mitigate potential adverse environmental effects.
Project Objective 5	Minimise adverse socio-economic effects on the local community and maximise socio-economic benefits arising from the project.
Project Objective 6	Achieve high quality design and constructability.

Project Objective 7	Value for money.
Project Objective 8	Apply a sustainability framework to all stages of the project.

3.2 Assessment approach

Assessment criteria and related performance measures for the Woodburn to Ballina upgrade have been developed from the project objectives, with the exception of project objectives 3 and 8 as they are 'process' objectives.

The assessment criteria evolved through the development phases of the project, to reflect the greater level of detail available as the studies progressed, and provided the framework for the assessment of the options.

3.2.1 Assessment approach for the long list of options

The assessment of the long list of options is summarised in Section 4.1.5 and documented in the *Route Options Development Report – Stage 1* (RTA, 2005a).

3.2.2 Assessment approach for the short list of options

The method used to assess the short list of options involved identifying significant issues, reviewing investigations into those issues, and comparing the performance of each option against the assessment criteria.

With all studies of this nature quantitative analysis is limited to the availability of data, current knowledge and scientific assessment techniques. Despite these limits, the assessment attempts to present quantitative measures for the assessment of the environmental, transport and engineering implications of each option in an objective manner. Qualitative measures are provided for the assessment of other issues, such as urban design and social impacts.

The assessment criteria used for the short list of options are shown in **Table 3-1**. The details of the assessment of the short listed options and the selection of the preferred route are documented in Section 6.

Table 3-1 Assessment criteria for short list of options

Project objective	Assessment criteria
1 Improve the efficiency of state, regional and local travel, safety and accessibility.	• Travel time. • Vehicle operating costs. • Accident costs. • Mitigation measures (crash barriers length). • Local motorway access. • Changes to local traffic movements and access.

Project objective	Assessment criteria
2 Provide a flowing road alignment responsive to and integrated with the landscape; optimising views, elegant design and planting opportunities.	• Road responds to the topography. • Corridor alignment responds to existing landscape patterns. • Maximise potential to have visual access to existing mature native vegetation as part of route landscape experience. • Minimise adverse perceived impacts of road on towns. • Minimise visual impact of road on context. • Maximise the richness of the highway experience.
4 Identify and enhance potential beneficial environmental effects, and mitigate potential adverse environmental effects.	<i>Conserve biological diversity and ecological integrity/function.</i> • Number of threatened species known or likely to occur within the corridor. • Extent of Endangered Ecological Communities impacted. • Extent of National Park estate impacted. <i>Minimise noise impact on the local community.</i> • Community noise burden – noise change. • Community noise burden – steady state change. <i>Conserve items of cultural and archaeological significance.</i> • Number of non-Aboriginal heritage items impacted. • Potential non- Aboriginal heritage areas impacted. • Number of known Aboriginal heritage items impacted. • Potential Aboriginal heritage areas impacted. <i>Minimises impact on water bodies.</i> • Extent of SEPP 14 Coastal Wetlands impacted. • Number of waterway crossings.
5 Minimise adverse socio-economic effects on the local community and maximise socio-economic benefits arising from the project.	• Ecological impacts. • Business impacts. • Social amenity impacts. • Recreation and tourism impacts. • Agricultural displacement. • Agricultural production impacts. • Number of buildings impacted. • Access to opportunities. • Amenity. • Social character to the towns.

Project objective	Assessment criteria
6 Achieve high quality design and constructability.	• Length of highway bridges. • Length of highway in flood affected areas. • Length of highway over deep soft soils. • Volume of external borrow to fill material. • Total volume of fill material. • Area of potential high risk Acid Sulphate Soils. • Potential for change in the flooding regime.
7 Value for money.	• Estimated project cost. • Net present value. • Benefit cost ratio.

4 Route options

4.1 Development of route options

A combination of desktop studies and study area visits were undertaken at the commencement of the project to identify constraints to development of the highway upgrade across the study area.

Constraints identified included topographic and geological features, areas that are sensitive from an ecological and/or heritage perspective, areas that have been identified as potential residential, industrial and commercial development sites, areas of high agricultural potential and areas of flood sensitivity.

The development of route options seeks to avoid these areas where possible, while identifying potential routes that are feasible and meet the project objectives.

Initially, a long list of route options was developed by combining three different approaches, referred to as:

- Traditional approach.
- Community approach.
- *Quantm* approach.

4.1.1 Traditional approach

The traditional decision making approach to route development and optimisation gave priority to technical aspects involving engineering, traffic and transport, environmental, social and economic opportunities and constraints. It recognised the project objectives and design principles.

Potential route options were mapped to avoid areas of high environmental significance and to capture engineering opportunities. The goal was to establish options which were feasible and different.

This approach involved a mix of qualitative and quantitative information and was essentially a manual process.

4.1.2 Community approach

A CLG was formed and the members participated in the identification and review of potential route options. These activities included:

- Identification of potential route options by the CLG, based on the constraint information presented and CLG member's local knowledge.
- Assessment of these route options, in terms of strengths and weaknesses.

- Review of project objectives and assessment criteria.

4.1.3 *Quantm* approach

The *Quantm* system is a strategic route planning software program for corridor and route optimisation.

The *Quantm* program considered a wide range of factors to generate potential routes including existing terrain, geotechnical data, linear features (such as roads, rivers and utilities), zones that require special treatment for social or environmental reasons (such as parks, towns or floodplains), geometric standards, and construction costs.

From these inputs, multiple potential route options were generated throughout the study area and optimised based on cost.

4.1.4 Long list of route options

The potential route options generated from the traditional, community and *Quantm* processes were reviewed and consolidated.

These consolidated route options formed the long list of route options and largely fell into two broad groupings; eastern and western. The long list of route options are illustrated in **Figure 4-1** as a series of links between common nodes, with the eastern options shown in green and the western options shown in yellow.

4.1.5 Assessment of the long list of route options

The long list of route options were assessed against assessment criteria using performance measures. The assessments indicated critical issues for many of the route options.

Following the assessment a review of the strengths and weaknesses of the long list of route options was undertaken by the study team and through the stakeholder consultation processes, including assessment by the CLG, and assessment at a Corridor Mapping Workshop (CMW) attended by government agencies, councils and community representatives.

From the assessment and review, critical weaknesses emerged for several links of the long list of route options. These links were not pursued in the identification of a short list of route options.

The best route options, or links thereof, were used as building blocks to develop short list of route options for further detailed assessment.

The assessment of the long list of options (with the outcome of a short list of options) is documented in the *Route Options Development Report – Stage 1* (RTA,2005a), while the assessment of the short list of options (with the outcome of a preferred route) is presented in the rest of this report.

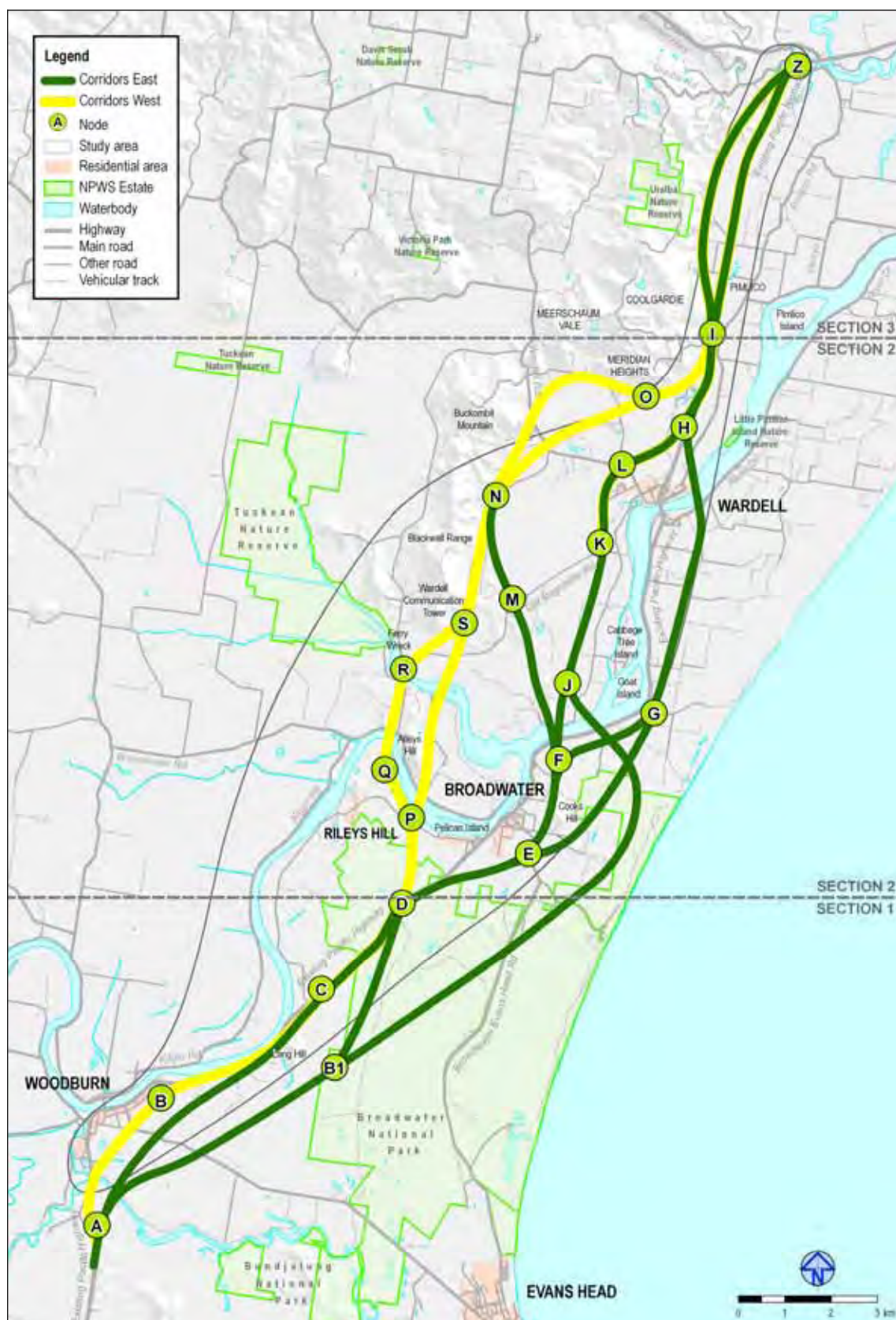


Figure 4-1 Long list of route options

4.2 Description of the short listed route options

To simplify the identification of the feasible routes, the short listed linkages were split into three sections, section 1 - Southern, section 2 - Central and section 3 - Northern. These route options were placed on public display and were the subject of a VMW involving a large range of stakeholders. The short listed route options are shown in **Figure 4-2** and described in the following sections.

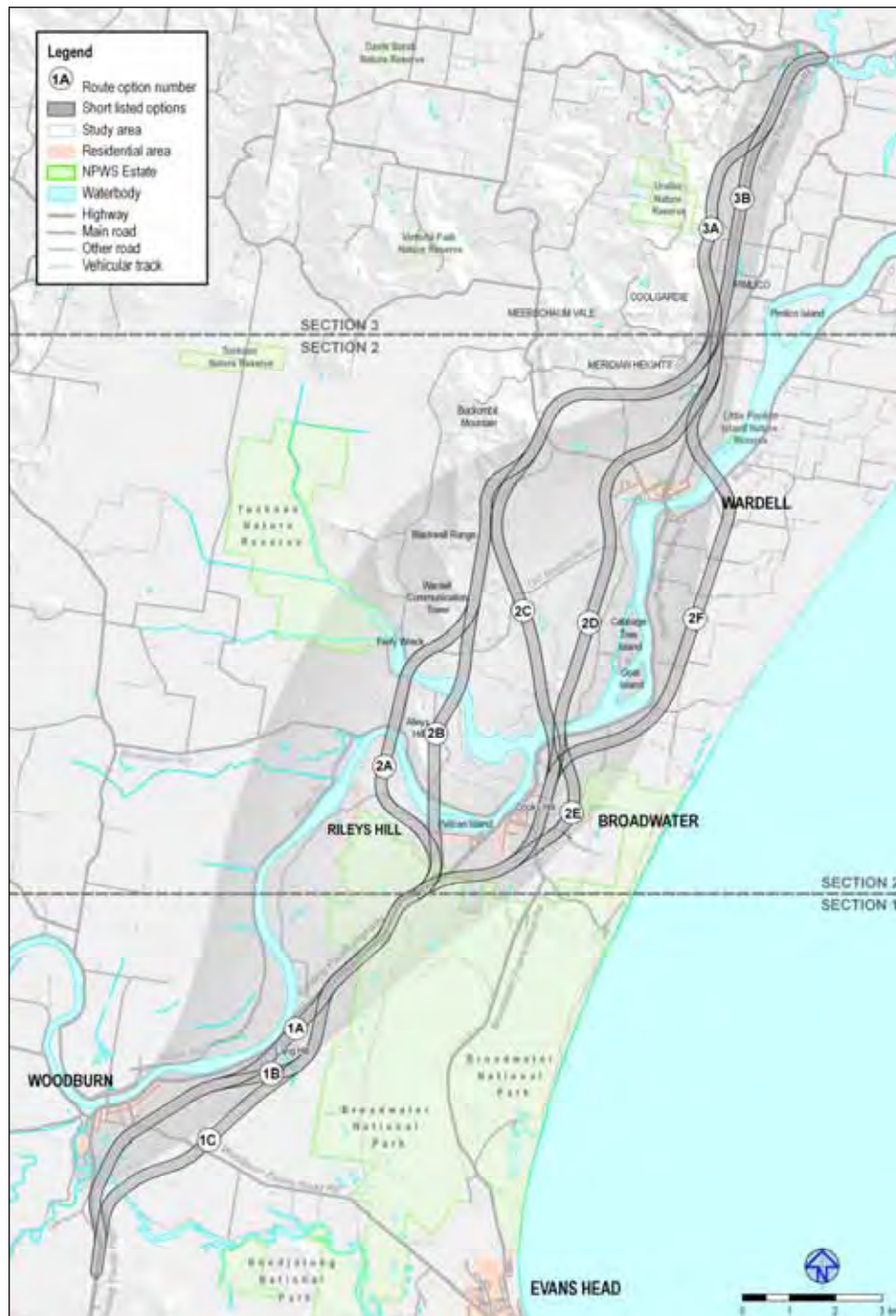


Figure 4-2 Short list of route options

4.2.1 Section 1 – Southern

Three options were considered in section 1 - Option 1A, Option 1B and Option 1C. They have a common starting point at the Pacific Highway, south of Woodburn, and a common terminating point to the south of Broadwater. The section 1 options are shown in **Figure 4-3** and their characteristics are summarised in **Table 4-1**.



Figure 4-3 Section 1 options

Option 1A

Option 1A departs from the existing Pacific Highway approximately 3 km south of Woodburn, generally running parallel to and east of the existing Highway, avoiding an existing Telstra fibre optic conduit. It crosses the Tuckombil Canal and travels north-east generally 400 m east of Woodburn, providing a minimum distance to residential property. It then generally runs parallel to and east of the Richmond River, between the existing Highway and Lang Hill, until McDonalds Creek where it then follows the existing Pacific Highway through Broadwater National Park. Through Broadwater National Park the alignment shares the existing Highway corridor.

Vertically, the alignment follows the natural surface and is above the flood level then grades down to the natural ground which is above the flood level at the northern end of the National Park.

Option 1B

Option 1B is the same as Option 1A except it runs to the east of Lang Hill and then joins the existing Highway just north of McDonalds Creek.

Vertically, the alignment is also the same as Option 1A with the exception that only a short section of this part of the route, just east of Lang Hill, is on land which is already above the flood level.

Option 1C

Option 1C departs from the existing Pacific Highway approximately 3 km south of Woodburn, crosses the Tuckombil Canal and travels north-east generally 1.7 km east of Woodburn. The route travels north-east around the eastern side of Lang Hill and then joins the existing Highway just north of McDonalds Creek where it then follows the existing Pacific Highway through Broadwater National Park.

Vertically, the alignment follows the natural surface and is above the flood level then grades down to the natural ground which is above the flood level at the northern end of the National Park.

Table 4-1 Summary characteristics of section 1 route options

Characteristics ¹	Option 1A	Option 1B	Option 1C
Total length (m)	11,445	11,821	11,263
Length of bridges (m)	350	350	350
Length of flood alleviation structures (m)	1,380	1,380	880

¹ Characteristics related to area are based upon the upgrade 'footprint', which is less than the corridor width. The footprint assessed for all options excludes interchanges, local road crossings and rest areas.

Characteristics ¹	Option 1A	Option 1B	Option 1C
Maximum depth cut/fill (m)	4 - 6	4 - 6	4 - 6
Speed limit (km/h)	110	110	110
Interchanges	Two alternative options for an interchange near Woodburn on all three options		
Preliminary cost estimate (\$2005)	\$277 million	\$246 million	\$238 million
Potential social and landuse impacts			
Approximate number of land parcels within road footprint	49	48	29
Impacts on land use (hectares)	Grazing 13.7 National Park 5.8 Sugar Cane 25.8	Grazing 22.3 National Park 5.8 Sugar Cane 20.5	Grazing 13.5 National Park 5.8 Sugar Cane 25.8
Approximate number of dwellings within road footprint	2	1	1
Approximate number of other buildings within road footprint	1	1	2
Community Noise Burden – Steady State 2035 (predicted % population ‘bothered’ by traffic noise)	0.9	0.8	0.3
Community Noise Burden – Noise Change 2015 (predicted number of dwellings to experience a traffic noise increase)	32	30	16
Visual impacts	High	Medium high	Medium high
Impact on towns	Increased amenity in Woodburn, better access as a stopover than other options		Decreased access to Woodburn as a stopover due to distance from town

Characteristics ¹	Option 1A	Option 1B	Option 1C
Flooding (current design assumption)	Target of less than 50 mm afflux for the 1 in 100 year design flood		
Potential environmental impacts			
Number of known threatened species known or likely to occur in route corridor	66	66	74
Extent of native vegetation impacted (hectares)	7.6	10.3	22.4
Extent of Endangered Ecological Communities impacted (hectares)	5.3	8.2	18.8
Extent of National Park Estate impacted (hectares)	3.7	3.7	3.8
Impacts on Aboriginal heritage	1 known site and potential for additional sites	1 known site and potential for additional sites	No known sites, potential for sites
Impacts on non-Aboriginal heritage	No known sites, potential for sites from farming and early pioneering activities	No known sites, potential for sites from farming and early pioneering activities	No known sites, potential for sites from farming and early pioneering activities
Water quality	2 waterway crossings	2 waterway crossings	2 waterway crossings

4.2.2 Section 2 – Central

Six options were considered in section 2 - Option 2A, Option 2B, Option 2C, Option 2D, Option 2E and Option 2F. They have a common starting point at the Pacific Highway south of Broadwater and terminate at the Pacific Highway, north of Wardell. All options involve a crossing of Richmond River. The section 2 options are shown in **Figure 4-4** and their characteristics are summarised in **Table 4-2**.

Option 2A

Option 2A departs from the existing Pacific Highway at the northern end of Broadwater National Park and heads north-west towards Rileys Hill and parallel with the Richmond River. The route then curves to the north and bridges the Richmond River, following an existing clearing west of Alleys

Hill to the southern bank of the Tuckean Broadwater. It then bridges the Tuckean Broadwater west of the Ferry Wreck (Disused Ferry). It then runs east and parallel to the Bagotville - Wardell Road. The alignment turns to the north near the Wardell communication tower.

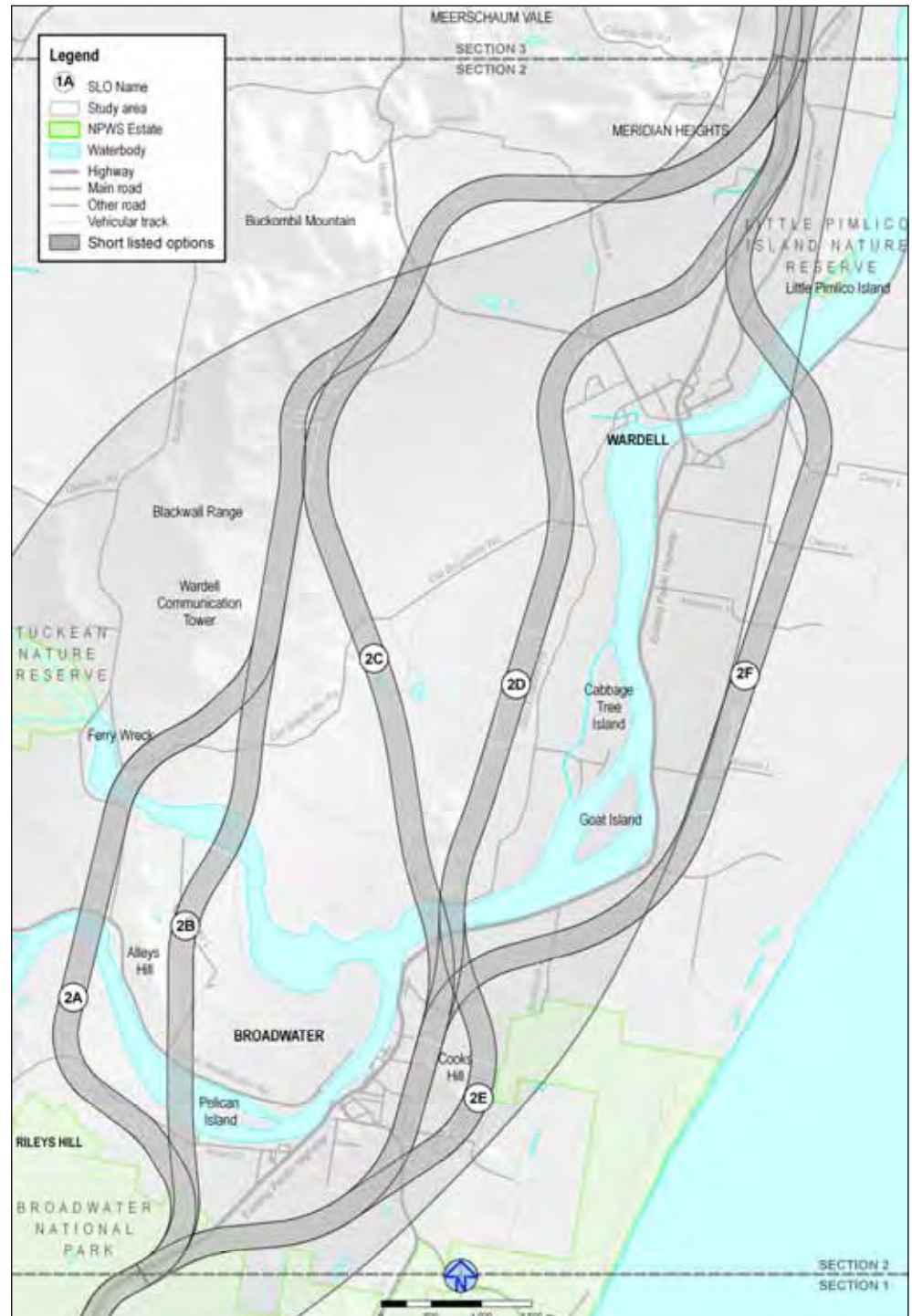


Figure 4-4 Section 2 options

The route generally passes to the east of the toe of the Blackwall Range. Near the base of Buckombil Mountain the alignment then crosses Thurgates Lane and heads north-east along the edge of the timbered land in the vicinity of Bingal Creek. The route heads east through the edge of Wardell Heath towards the existing Pacific Highway. It then turns to the north-west near Coolgardie Road and is located generally within cleared land.

From the Tuckean Broadwater to Coolgardie Road the alignment could be located to minimise cuttings and balance earthworks or lowered to provide material for use on other lower sections of the study area.

Option 2B

Option 2B leaves the northern end of Broadwater National Park and turns northward away from the existing Pacific Highway above the flood level and bridges the Richmond River 200 metres west of Pelican Island.

The route from the Richmond River to the Tuckean Broadwater is designed to sit above the flood level. The route bridges the Tuckean Broadwater and then generally heads northward and follows the same route as Option 2A from just east of the Wardell communication tower.

Option 2C

Option 2C leaves the northern end of Broadwater National Park and turns eastward at the flood level and runs 800 metres from, and parallel with, the Richmond River. At Broadwater, the route is about 200 metres east of the residential area and is located on the western side of Cooks Hill. After passing Cooks Hill the route heads north above the flood level and crosses the Richmond River 1500 metres west of Goat Island.

North of the Richmond River the route heads north-west and is aligned to run along the western edges of Wardell Heath in cleared land. It then follows the same alignment as Option 2A from Thurgates Lane.

Option 2D

Option 2D leaves the northern end of Broadwater National Park and turns eastward above the flood level and runs 800 metres from, and parallel with, the Richmond River. At Broadwater the route is about 200 metres east of the residential area and is located on the western side of Cooks Hill. After passing Cooks Hill the route heads north above the flood level and crosses the Richmond River 1500 metres west of Goat Island.

North of the Richmond River the route heads north above the flood level and is aligned to run along the eastern edge of Wardell Heath approximately 400 metres west of the local access road. It continues north through Wardell Heath and circles to the west around Wardell township approximately 200 metres from residences. North of Wardell it follows the disused airstrip until it joins with the existing Pacific Highway. From the northern edge of the disused airstrip the route follows the existing Highway until the Coolgardie Road intersection.

Option 2E

Option 2E is the same as Option 2D except at the northern end of Broadwater National Park the route turns east and skirts to the east of Cooks Hill providing a greater distance and visual/noise barrier to residential properties in Broadwater. After passing Cooks Hill the route turns north-west and joins Option 2D on the southern banks of the Richmond River.

Option 2F

Option 2F leaves the northern end of Broadwater National Park and turns eastward above the flood level. It runs 800 metres east of and parallel with the Richmond River. At Broadwater the route is about 200 metres east of the residential area and is located on the western side of Cooks Hill. After passing Cooks Hill at Pine Tree Road the route heads north-east parallel to and 500 metres east of the Richmond River above the flood level. In the vicinity of Goat Island the route then heads northward towards Wardell township above the flood level. At Carney Lane the route turns north-west to cross the Richmond River 450 metres south of the southern side of Little Pimlico Island.

Table 4-2 Summary characteristics of section 2 route options

Characteristics ²	Option 2A	Option 2B	Option 2C	Option 2D	Option 2E	Option 2F
Total length (m)	16,537	15,556	16,954	15,107	15,516	15,818
Length of bridges (m)	1,170	1,460	780	1,180	1,180	1,110
Length of flood alleviation structures (m)	No major structures	100	No major structures	No major structures	No major structures	4,000
Maximum depth cut/fill (m)	2-4	2-4	4-6	4-6	4-6	4-6
Speed limit (km/h)	110	110	110	110	110	110
Interchanges	Two interchange alternatives on all options					
Preliminary cost estimate (\$2005)	\$316 million	\$308 million	\$297 million	\$286 million	\$278 million	\$562 million
Potential social and landuse impacts						
Approximate number of land parcels within road footprint	64	51	54	51	50	66

² Characteristics related to area are based upon the upgrade 'footprint', which is less than the corridor width. The footprint assessed for all options excludes interchanges, local road crossings and rest areas.

Characteristics ²	Option 2A	Option 2B	Option 2C	Option 2D	Option 2E	Option 2F
Impacts on land use (hectares)	Grazing 73.5 National Park 4.0 Sugar Cane 5.6 Timber 4.0	Grazing 58.5 National Park 3.9 Sugar Cane 15.5 Timber 2.9	Grazing 62.3 National Park 4.9 Sugar Cane 11.2 Timber 1.2	Grazing 15.3 National Park 4.9 Sugar Cane 33.5 Timber 17.4	Grazing 13.5 National Park 5.0 Sugar Cane 31.8 Timber 22.6	Grazing 16.9 National Park 5.5 Sugar Cane 45.0 Timber 1.2 Urban 0.1
Approximate number of dwellings within road footprint	2	1	2	2	2	4 ³
Approximate number of other buildings within road footprint	8	2	4	4	15	3
Community Noise Burden – Steady State 2035 (predicted % population 'bothered' by traffic noise)	1.6	1.5	2.6	3.1	2.2	3.4
Community Noise Burden – Noise Change 2015 (predicted number of dwellings to experience a traffic noise increase)	108	108	116	172	158	174
Visual impacts	Medium High	Medium	Medium	Medium	Medium Low	High
Impact on towns	Close to Rileys Hill	Between Rileys Hill and Broad-water	Close to Broad-water	Close to Broad-water and Wardell	Close to Broad-water and Wardell	Close to Broad-water and Wardell

³ Option 2F also impacts the Sandalwood Van & Leisure Park at Wardell.

Characteristics ²	Option 2A	Option 2B	Option 2C	Option 2D	Option 2E	Option 2F
Flooding (current design assumption)	Target of less than 50 mm afflux for the 1 in 100 year design flood					
Potential environmental impacts						
Number of known threatened species known or likely to occur in route corridor	85	85	85	78	78	66
Extent of native vegetation impacted (hectares)	29.9	27.2	34.4	28.5	31.9	13.2
Extent of Endangered Ecological Communities impacted (hectares)	23.9	22.7	24.80	9.3	11.2	6.7
Extent of National Park Estate impacted (hectares)	4.5	4.3	3.7	3.7	3.7	3.8
Impacts on Aboriginal heritage	No known sites, potential for sites	No known sites, potential for sites	1 known site and potential for additional sites	1 known site and potential for sites along the eastern edge of Wardell heath	3 known sites and potential for sites in the vicinity of Cooks Hill	No known sites, potential for sites in the vicinity of Cooks Hill
Impacts on non-Aboriginal heritage	2 known sites and potential for additional sites from farming and early pioneer activities	2 known sites and potential for additional sites from farming and early pioneer activities	2 known sites and potential for additional sites from farming and early pioneer activities	No known sites, potential for sites from farming and early pioneer activities	No known sites, potential for sites from farming and early pioneer activities	No known sites, potential for sites from farming and early pioneer activities
Water quality	2 waterway crossings	2 waterway crossings	2 waterway crossings	4 waterway crossings	3 waterway crossings	7 waterway crossings

4.2.3 Section 3 – Northern

Two options were considered in section 3 - Option 3A and Option 3B. They have a common starting point at the Pacific Highway north of Wardell and terminate at the Pacific Highway at the point where the Ballina Bypass would join the Highway. The section 3 options are shown in **Figure 4-5** and their characteristics are summarised in **Table 4-3**.

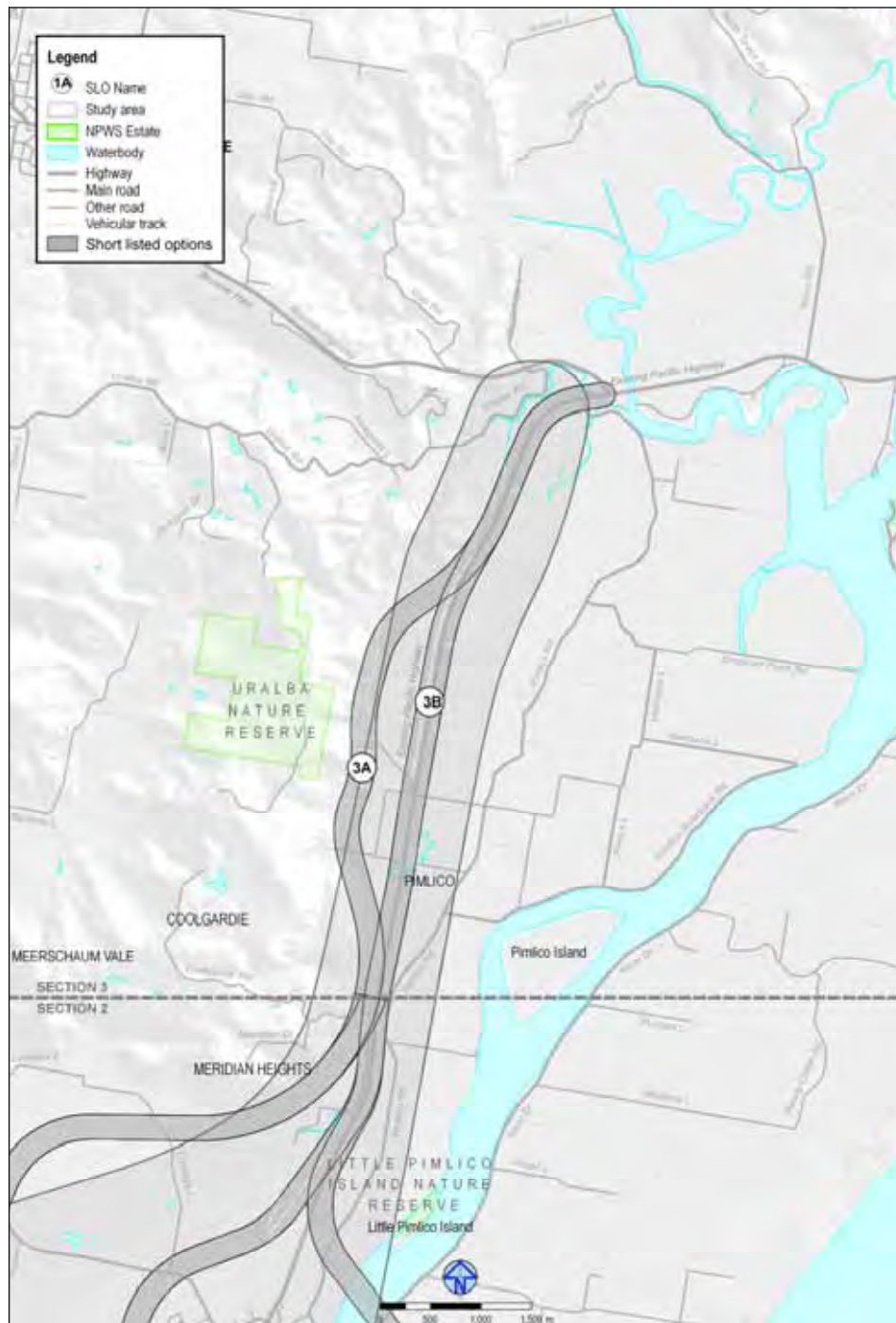


Figure 4-5 Section 3 options

Option 3A

Option 3A north of Coolgardie Road departs from the existing Pacific Highway and hugs the Blackwall Range escarpment adjacent to sugar cane land. The route approaches then abuts the existing highway in the vicinity of Uralba and utilises the existing Pacific Highway corridor until the Bruxner Highway intersection.

Option 3B

North of Coolgardie Road the route traverses the existing Pacific Highway corridor until the Bruxner Highway intersection. It would be raised to sit above the flood level.

Table 4-3 Summary characteristics of section 3 route options

Characteristics ⁴	Option 3A	Option 3B
Total length (km)	7,066	6,724
Length of bridges (m)	No major bridges	No major bridges
Length of flood alleviation structures (m)	No major structures	No major structures
Maximum depth cut/fill (m)	2-4	2-4
Speed limit (km/h)	110	110
Interchanges	No proposed interchanges	
Preliminary cost estimate (\$2005)	\$152 million	\$143 million
Potential social and landuse impacts		
Approximate number of land parcels within road footprint	21	22
Impacts on land use (hectares)	Grazing 12.4 Sugar Cane 17.8	Grazing 0.3 Sugar Cane 3.0 Timber 0.4 Urban 0.1
Approximate number of dwellings within road footprint	5	1

⁴ Characteristics related to area are based upon the upgrade 'footprint', which is less than the corridor width. The footprint assessed for all options excludes interchanges, local road crossings and rest areas.

Characteristics ⁴	Option 3A	Option 3B
Approximate number of other buildings within road footprint	1	0
Community Noise Burden – Steady State 2035 (predicted % population ‘bothered’ by traffic noise)	0.9	0.7
Community Noise Burden – Noise Change 2015 (predicted number of dwellings to experience a traffic noise increase)	35	43
Visual impacts	Low	Low
Impact on towns	No expected impact	
Flooding (current design assumption)	Target of less than 50 mm afflux for the 1 in 100 year design flood	
Potential environmental impacts		
Number of known threatened species known or likely to occur in route corridor	61	61
Extent of native vegetation impacted (hectares)	12.7	13.2
Extent of Endangered Ecological Communities impacted (hectares)	12.6	12.4
Extent of National Park Estate impacted (hectares)	0	0
Impacts on Aboriginal heritage	No known sites	
Impacts on non-Aboriginal heritage	No known sites, potential for sites from farming and early pioneering activities	
Water quality	1 waterway crossing	1 waterway crossing

4.3 Route options consultation

The input provided by residents and community and business organisations in the study area has been invaluable for providing local information on key constraints. Community input was also significant in refining the study process in order to select the preferred route later in the project process. Such input has included:

- Information for the constraints mapping.
- Refinement of the project objectives.
- Review of performance criteria and performance measures.
- CLG meetings to generate potential route options and gain feedback and their analysis of these options.
- Consultation with government and community representatives at the CMW.
- Assessing the long list of potential route options against the performance criteria and performance measures, utilising predominately quantifiable measurements.
- Reviewing the above assessment by considering the strengths and weaknesses of the route options, by link where appropriate.
- Selecting a short list of feasible route options for more detailed investigation and assessment.

All community submissions (through the 1800 telephone information line, email, fax, and other correspondence) were collated on an issues database, sorted by issue and then considered.

The community made suggestions in relation to the process of investigation or the study methodology, for example:

- The location of the community information centre for the display about the route options and study area constraints.
- Community focus groups were requested to discuss issues such as flooding, ecology, the sugar industry, and Aboriginal issues.
- The CLG members were able to contribute to the agendas for the CLG meetings.

5 Outcomes of the public display and the value management workshop

5.1 Introduction

The assessment of the options throughout this study has been based on qualitative and quantitative assessments undertaken by the study team as described in Section 3.2. The assessment criteria and performance measures have provided the framework in assessing the options.

This assessment has been complemented by input from diverse stakeholder groups, predominately through the feedback following the public display of the short listed options and the VMW.

The issues, comments and concerns raised in responses to the display and during the VMW have provided input to the iterative assessment process. Stakeholder input also contributed to identifying the need for further investigations and potential route modifications.

This section focuses on the issues, investigations and considerations that arose from the public display of route options and the VMW.

5.1.1 Route options display activities

The short list of route options were placed on display on 23 May 2005. In response to community feedback and submissions received, the display period was extended and submissions closed on 4 July 2005.

The key components of the community consultation process during the display of the route options were:

- Free call information line (1800 887 112).
- Information displays (both staffed and unstaffed).
- Project community information centre at Woodburn.
- Community Update brochure.
- Meetings with the CLG.
- Consultation with individuals and representatives of the Aboriginal community.
- Briefings with Richmond Valley, Ballina Shire and Lismore City Councils, community groups and individuals.
- Advertisements in local newspapers.
- Web site updates at www.rta.nsw.gov.au/pacific.htm.
- Letters to and meetings with potentially affected property owners.

5.1.2 Overview of issues

The following responses were received during and after the public display period:

- 214 written submissions were received from 174 individuals and organisations
- 383 Feedback Forms
- One Form Letter (19 signatories) objecting to Option 2D

Table 5-1 lists the issues raised in the written submissions received.

Table 5-1 Written submission issues

Issue	No. of Times Raised
Option opinions (expressing a preference or dislike of options)	334
Socio-economic impact	162
Biodiversity	138
Concept design issues	129
Property issues	106
Route options development process	94
Noise	67
Hydrology	66
Consultation process	53
Pollution and global warming	49
Transport	45
Aboriginal and non-Aboriginal heritage	20
Timing	17
Land use, planning and zoning	13
Visual impact	8
Bushfires	3

The submissions received and the study team's responses are documented in detail in the *Route Options Submissions Report* (RTA 2005b).

5.1.3 Route preferences expressed by the community

Feedback forms and written responses provided a means for the community to nominate a preferred route for the highway upgrade.

Route option preferences from feedback forms and written submissions are shown in **Table 5-2** and **Table 5-3**.

Table 5-2 Route option preferences from feedback forms

Section	Option preferred	Number
Section 1	1A	13
	1B	2
	1C	142
	No preference stated	226
Section 2	2A	25
	2B	41
	2C	6
	2D	40
	2E	40
	2F	58
	No preference stated	173
Section 3	3A	31
	3B	229
	No preference stated	123

Table 5-3 Route option preferences from written submissions

Section	Option	Preferred	Not preferred
Section 1	1A	3	7
	1B	0	7
	1C	4	8
Section 2	2A	4	33
	2B	4	32
	2C	0	35
	2D	19	23
	2E	7	15
	2F	32	19
Section 3	3A	1	18
	3B	27	1

5.1.4 Key issues in each study area section

The following issues raised in the feedback forms have been identified for sections 1, 2 and 3 of the proposed upgrade:

- Section 1:** Issues raised included the impact on Woodburn and property, noise and agricultural land impacts. Particular issues were flooding, traffic and cost of the proposed option.
- Section 2:** Issues raised included impacts on the environment (wildlife habitat), flooding, impacts on the towns and property and noise impacts.
- Section 3:** Issues raised included a preference for using the existing Pacific Highway corridor, property and environmental impacts, construction costs and social impacts.

Key issues raised in the written submissions that specifically referred to study area sections were as follows:

Section 1

- Options should be moved further to the east to avoid agricultural impacts.
- The encroachment on Broadwater National Park should be minimised.
- Ecological impact would be minimised with Option 1A.
- Fauna underpasses must be constructed within Broadwater National Park.

Section 2

- Options 2A and 2B require two bridges, are on soft ground and would, therefore, be more expensive. Disturbance of acid sulphate soils would impact on the Tuckean Broadwater.
- Options 2A and 2B would impact on the Tuckean Broadwater, a wetland of regional significance; and core koala habitat.
- Impacts of Options 2A, 2B, and 2C on wildlife.
- Option 2E if further east would avoid high value habitat.
- Option 2D would impact on Jali owned Aboriginal land and the native flora and fauna of Wardell heath.
- Broadwater National Park does not contain high value habitat due to past sand mining operations.
- Operation of the Broadwater Sugar Mill and the co-generation plant would be adversely affected by Option 2F.
- Ecological impact would be minimised with Option 2F.

- Options 2A, 2B and 2C would impact on the wildlife corridor between Wardell wetlands and the Blackwall Range, wetlands and high value habitat with a range of threatened species.

Section 3

- Why build a new road (Option 3A) when the existing highway (Option 3B) is being upgraded, and use of the existing highway is consistent with RTA policy?
- Option 3A is subject to flooding, according to information from local residents.
- Option 3A would impact on a remnant coastal rainforest, which is habitat for vulnerable and endangered species, and would fragment the migratory corridor.
- Part of Option 3A is within an area zoned Environmental Protection (Habitat)(7f).
- Ecological impact would be minimised with Option 3B.

5.2 Community alternative route

Some members of the CLG had suggested an alternative route, shown in **Figure 5-1**, to the east of the identified long list of options because of their concerns of the impact of a new roadway on the existing flooding regimes. This route has been considered in the *Route Options Development Report – Stage 1* (RTA, 2005a), however, during the route options display, a detailed submission concerning this route was received by the study team.

The route was suggested by the community because it was perceived to be a “flood free” route from south of Woodburn and to the east of the study area. The route was described as “flood free” because it was believed to be located outside the floodplain. Additional investigations were undertaken based on the strength of this submission. The result of these investigations is contained in the *Community Alternative Route Report* in **Appendix A**.

An assessment was undertaken to determine the advantages and disadvantages of the route. To do this, a comparison was made with the base case, defined as the upgrading of the existing Pacific Highway from the southern start of the community alternative route (CA route) to the substation south of Tuckombil Canal, Option 1C and part of Option 2E to the south of the Richmond River.

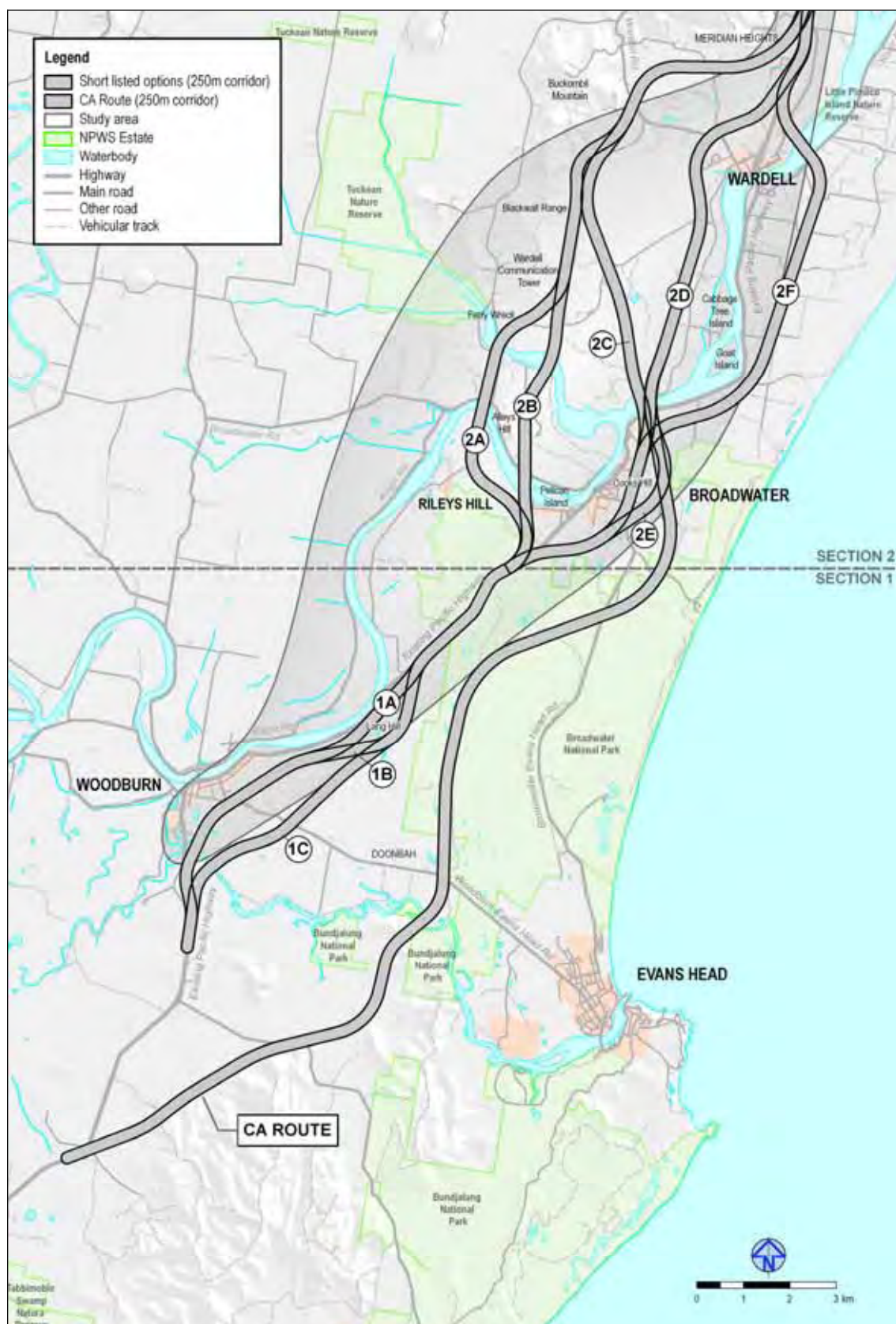


Figure 5-1 Community alternative route

The advantages of the CA route include:

- Engineering advantages over the base case route because this route generally follows higher ground and therefore is less flood affected. This reduces:
 - Need for flood bridges to maintain Richmond River floodplain storage.
 - Need for soft soil improvements.
 - Need for the importation of large quantities of fill material.
- Approximately 10% cheaper than the base case.

The disadvantages of the CA route include:

- Does not satisfy its main objective of being outside of the floodplain (approximately 4.2 kilometres of the CA route remains within the 1 in 100 year floodplain).
- Need to acquire and provide compensatory habitat for NPWS estate (55.1 hectares).
- Need to construct an additional 6km of new highway corridor instead of re-using the existing highway corridor, which is otherwise satisfactory in terms of geometry.
- Impacts on the ecology within both Broadwater and Bundjalung National Parks and other vegetated areas south of the Evans River would be much higher than the base case route, as there is a larger area of undisturbed native vegetation.
- Ecology surveys identified endangered ecological communities and numerous threatened species within the route.
- The Evans River is of a high quality due to the amount of river that is undeveloped, a crossing over the river would have high impacts on the quality of the river and the important ecological habitats it supports.
- Traverses some areas of high Aboriginal cultural significance around the Evans River. The route passes through more undisturbed land and traverses more landforms of potential archaeological sensitivity than the base case and thus has more potential to intercept archaeological sites.
- Impacts directly on areas of NPWS estate, predominantly the Broadwater National Park. The Department of Environment and Conservation (DEC) has indicated that this National Park is of high importance due to the large number of threatened species that occur within the park boundaries. Revocation of National Park status is undertaken through negotiations with DEC and an Act of Parliament. However DEC policy on the revocation of a National Park states that this would only occur if there was no other feasible and reasonable option.

Table 5-4 summarises a comparison between the base case and the community alternative route.

Table 5-4 Comparison of the base case (Option 1C) and the community alternative route

Perspectives	Base case (Option 1C)	Community alternative route
Environmental	Some impact on endangered ecological communities. Crosses Tuckombil Canal	Much larger impact on endangered ecological communities and threatened species. Crosses Evans River. Large impact on Broadwater National Park.
Heritage	Traverses an area of high Aboriginal cultural significance east of Cooks Hill.	Traverses areas of high Aboriginal cultural significance including the Evans River and sand-based ground east of Cooks Hill. Has potential to intercept additional Aboriginal archaeological sites as it passes through undisturbed land and traverses landforms of potential archaeological sensitivity.
Functional	Soft soils. Majority of route in floodplain. Utilises parts of the existing highway.	Generally follows higher ground and therefore is less flood affected and has better soil conditions. Reduced utilisation of existing highway.
Social and Noise	Reduced impact on Woodburn.	Reduced impact on Woodburn. Greater impact on Doonbah and rural residential properties.
Business and Economic	Large impact on sugar cane farms.	Reduced impact on sugar cane farms. Increased impact on grazing land.

The conclusion of the assessment of the CA route was that it should not be included into the short list of route options due to the environmental and Aboriginal cultural impacts and statutory implications with a route passing through Broadwater and Bundjalung National Parks.

5.3 Value Management Workshop

In conjunction with the public display and seeking of submissions from the public, a VMW was held in July 2005 that brought together a wide range of stakeholder interests and expertise. The objective of the VMW was to review the investigations undertaken at that time, assess the options against agreed assessment criteria, and determine a preferred direction for further investigation to progress the project development following the VMW. The VMW report is contained in **Appendix B**.

The assessments undertaken at the VMW were one input into the process for determining the preferred route for the project.

The VMW process builds on the detailed and specialist knowledge and perspectives which resides with the workshop participants. It then provides a structured assessment of the route options and generates value improvement ideas, based upon the views of the participants.

During the VMW, assessment criteria were developed under five key perspectives (Environment, Heritage, Functional, Social and Noise, and Business and Economic) based on what participants considered important for assessment of the route options.

The route options were reviewed by the group (to meet the project objectives and address the problems identified) and a number of key issues and concerns were identified to be addressed as the project proceeded.

The group then assessed the corridor options in each section using the assessment criteria developed in the workshop, with '1' denoting the best performing option in a section, the outcomes of which are shown in **Table 5-5**, **Table 5-6** and **Table 5-7**.

Table 5-5 VMW section 1 assessment

Option	Environ-mental	Heritage	Functional	Social & Noise	Business & Economic	Cost (units)
1A	1	3	3	3	3	100
1B	2	2	2	2	2	88
1C	3	1	1	1	1	86

Table 5-6 VMW section 2 assessment

Option	Environ-mental	Heritage	Functional	Social & Noise	Business & Economic	Cost (units)
2A	4	1	5	3	5	100
2B	4	3	4	3	4	109
2C	3	4	3	1	3	93
2D	2	5	2	2	2	88
2E	2	6	1	2	1	84
2F	1	2	6	1	6	160

Table 5-7 VMW section 3 assessment

Option	Environ- mental	Heritage	Functional	Social & Noise	Business & Economic	Cost (units)
3A	2	2	2	2	2	100
3B	1	1	1	1	1	98

The outcome of the VMW was the unanimous support for Option 1C in section 1 and Option 3B in section 3 as the preferred options to move forward for more detailed investigation and development to progress the project subject to satisfactory resolution of the issues raised during the VMW.

However, in section 2 of the Study Area, it was agreed that:

- All the options examined raise issues and incur potential risks
- Options 2A and 2B should not be further pursued

The participants agreed that Option 2C had possibilities subject to resolving the heritage issues, quarry issues, and environmental issues. However, Options 2D, 2E and 2F were also assessed as possibilities subject to further investigation to resolve issues raised during the VMW.

The participants made these recommendations subject to the following issues being addressed;

- In section 1, of the displayed routes the participants preferred Option 1C subject to further investigations into the feasibility of avoiding or minimising impacts of removing vegetation, endangered ecological communities, and threatened species within the alignment. Participants were of the understanding that the Community Alternative Route would be further investigated following the VMW. The further investigation of this route is described in Section 5.2 where it was concluded that it should not be considered further.
- In section 2, the participants did not reach a consensus, but agreed that Option 2C should be considered further if the alignment in the vicinity of Cooks Hill could be improved, the quarry issues could be managed, environmental issues could be dealt with, and Aboriginal and non-Aboriginal heritage issues could be identified and managed. Participants believed that Option 2E should be considered further subject to satisfactorily resolving the Aboriginal and non-Aboriginal heritage issues and quarry issues. Option 2D is a high risk option given the location of Jali land and heritage issues, while Option 2F is feasible but was ranked as the lowest performing option in section 2 from the functional, business and economic perspectives.
- In section 3, the participants preferred Option 3B subject to confirming the required road footprint and the impact on sugar cane agricultural land (if any).

5.4 Additional investigations of displayed options

Further investigation of the route options continued during and following the public display period and VMW. Some specific investigations were undertaken as a result of issues identified during the VMW and submissions from the community.

The issues identified (described below) resulted in refinements to the displayed options. The routes which had been refined were referred to as 'modified' routes, and are shown in **Figure 5-2** and **Figure 5-3**. The performance of the modified routes against the assessment criteria can be found in **Appendix C**.

5.4.1 Jali LALC owned land and Crown land affected by Native Title claim

In section 2, a large parcel of land forming part of Wardell heath to the south-west of Wardell is owned by the Jali LALC. Under the Aboriginal Land Rights Act 1983, Section 42, land owned by a LALC may not be compulsorily acquired by the RTA except by an Act of Parliament. Options 2C, 2D and 2E impacted on this land. It was not feasible to adjust Options 2D and 2E, however, Option 2C was modified to the west to avoid impacting LALC land (refer **Figure 5-3**).

In section 1, additional investigations revealed that a Crown land parcel described as Lot 368 DP 755624, was subject to a Native Title claim. Option 1C was affected by this land parcel, hence Option 1C was realigned to the west to avoid this Crown land parcel (refer **Figure 5-2**).

5.4.2 Broadwater National Park

Option 2C was identified as impacting on a corner of the Broadwater National Park and a parcel of land described as Lot 7008 DP 92609 which was identified as Crown land subject to Native Title claim.

The Option 2C alignment was moved north to avoid the land impact on the National Park and the Crown land (refer **Figure 5-3**).

5.4.3 Property, agricultural and quarry impacts

In section 1, submissions received from the community raised concerns regarding the degree of agricultural land severance of Option 1C from the Woodburn – Evans Head Road to Lang Hill.

Option 1C was able to be realigned to the east to reduce the severance impacts on agricultural land (refer **Figure 5-2**).

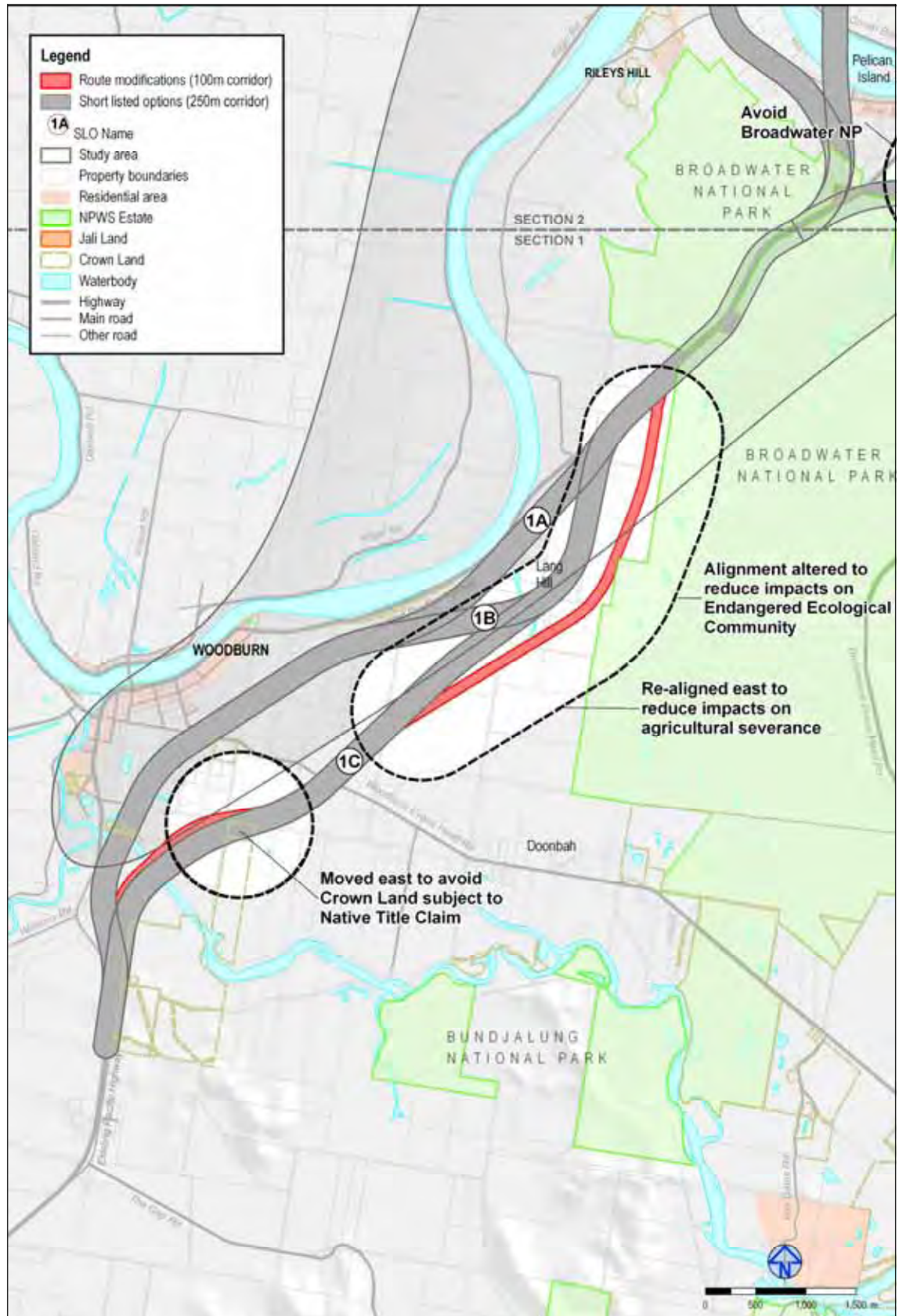


Figure 5-2 Section 1 modifications

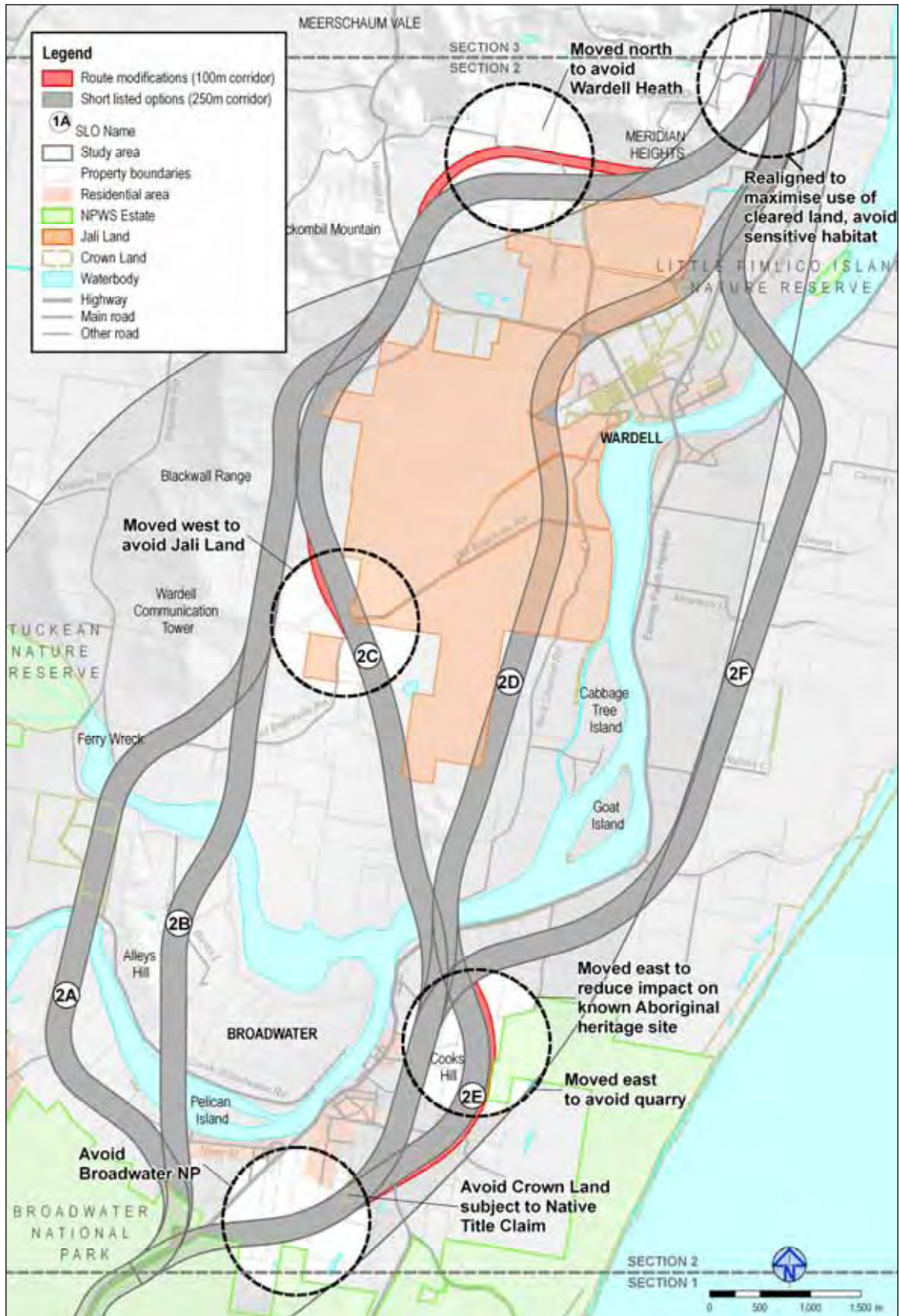


Figure 5-3 Section 2 modifications

In section 2, the assets and operation of the quarry on the eastern side of Cooks Hill were more accurately defined. Option 2E impinged on the operation of the quarry, but with a relatively minor shift to the east this impact was reduced without impacting on Broadwater National Park (refer **Figure 5-3**).

5.4.4 Environmentally sensitive areas

In section 1, when the realignment of Option 1C in response to community concerns about agricultural land severance (refer Section 5.4.3 above) was investigated, an endangered ecological community containing threatened species including the Long-nosed Potoroo, was identified in Lots 140, 148 and 149 DP 755624. The endangered ecological community and threatened species were identified through further ecological investigations that were undertaken on the modified alignment. Therefore, Option 1C was further realigned to minimise impact on this EEC (refer **Figure 5-2**).

In section 2, known Aboriginal heritage sites were identified to the north-east of Cooks Hill. Further Aboriginal heritage investigations were undertaken to determine in greater detail the location of these sites. Option 2E impinged on these sites and thus was moved east to minimise impact on these known sites (refer **Figure 5-3**).

In section 2, an endangered ecological community was identified in the original ecological investigations within the Wardell Heath between Wardell Road and just south of Meridian Heights rural subdivision. Option 2C impacted on this environmentally significant Wardell Heath area. This alignment was altered to ensure the route avoided the Wardell Heath area and optimised the use of cleared land (refer **Figure 5-3**). Additional ecological investigations were undertaken on the new alignment to ensure that the change to the alignment had reduced the impact of Option 2C.

A corridor of existing cleared land was identified in the vicinity of Coolgardie Road. The displayed Option 2C affected an environmentally sensitive habitat in this area and was moved west to maximise the use of the existing cleared land (refer **Figure 5-3**).

5.4.5 Environmental issues summary

Value Management Workshop

During the proceedings of the VMW a number of issues, including ecology issues, were identified where further work was required to enable a better understanding of the impacts of the route options. The issues were documented in the VMW Report which can be found in **Appendix B**. Following the VMW the project team assessed these issues, identified the ones that were relevant to this phase of investigations and undertook further investigations to ensure the issues were addressed in the route selection process. In some cases the further investigations led to modifications to the displayed routes.

Ecology Focus Group

An Ecology Focus Group (EFG) was established in March 2005. This group was formed to provide stakeholders with an opportunity to input to the ecological investigations undertaken for the project. The members of the group have raised a number of issues throughout the process, and have reviewed the ecology reports prepared for the route development phase. Comments provided by the members were considered by the project team, and the reports were subsequently updated to address the issues raised.

Revised route options ecology assessment

The comments and issues raised through various consultation activities have been addressed through a revised route options ecology assessment. This working paper would be further refined throughout the environmental assessment process.

Independent review

As a result of the EFG and comments made during the public display, the RTA requested an independent review of the revised route options ecology assessment. The independent review was undertaken by Mr Andrew Benwell, a well known botanist, who has undertaken many ecological surveys in the North Coast region. The review concentrated on the flora components of the ecology report. Through this review a number of issues were raised and an Addendum to the route options ecology assessment was prepared. Mr Benwell provided a final letter, which can be found in **Appendix D**, stating the adequacy of the revised route options ecology assessment and addendum for use in the route development phase of the project.

Ongoing consultation

As a result of issues raised during the EFG and at other meetings, a number of meetings have been held with Ballina Shire Council and the Department of Environment and Conservation. These meetings were to facilitate discussions with these agencies to ensure that the issues that they raised have been addressed. The project team will continue to liaise with these agencies as the project progresses.

6 Preferred route selection

6.1 Selection approach

The study team undertook the assessment and selection of the preferred option for each of the study area sections, based on the performance of each option under each of the assessment criteria. The analysis included the short list route options that had been displayed in May-July 2005 as well as the modifications to Option 1C and Option 2C. All of these options were assessed against the project assessment criteria by the study team.

The assessment tables are presented in **Appendix C** and indicate a best performer against each of the assessment criteria. In this way, the study team could develop a holistic understanding of the relative merits or impacts of each of the options.

Issues arising from the submissions in response to the display of the route options, and those arising from the VMW were also used to inform the assessment of the options.

During the assessment process, the performance of each option was compared against the performance of the other options during multi-disciplinary workshops involving the study team. It was considered that all assessment criteria could not be considered of equal significance, therefore the preferred route could not be selected solely upon the number of 'best performances' for an option added together.

The workshops further refined the assessment process through the identification of key issues that characterised options. In this way, the team focused on why a particular option was favoured or identified key issues as to why an option should not progress. Options that did not progress for the final analysis were those that displayed significant adverse impacts, or were not favoured from a number of perspectives.

With the key issues identified, the final round of assessment was based on a framework developed to ensure robust judgements were made. This framework was based on guiding principles devised by the study team.

The guiding principles adopted by the study team were:

- 1 **Risk reduction:** including the application of the 'precautionary principle'. Issues of concern related to ground conditions affecting construction and long term operation, zoning and property acquisition potentially delaying progress in commencing construction, legal matters involved with property acquisition or acquiring National Parks and the extent of heritage items buried below the ground.
- 2 **Cost:** capital and road user cost. This relates to construction and maintenance costs over the life of the upgraded Pacific Highway as well as to vehicle operating costs.

- 3 **Mitigability:** the possibility of redressing adverse impacts through altering the concept design or managing impacts through various mitigation techniques and measures.
- 4 **Intergenerational equity:** whether the option raised concerns relating to impacts or imposts on future generations. Such issues concerned resource use, sterilisation of resources, loss of prime agricultural land, visual impacts, restricting opportunities for urban development, effect on cultural heritage and heritage items, high ecological impacts and nature reserves and open space.

The process is outlined in **Figure 6-1** and the results of this process are described in the following sections.

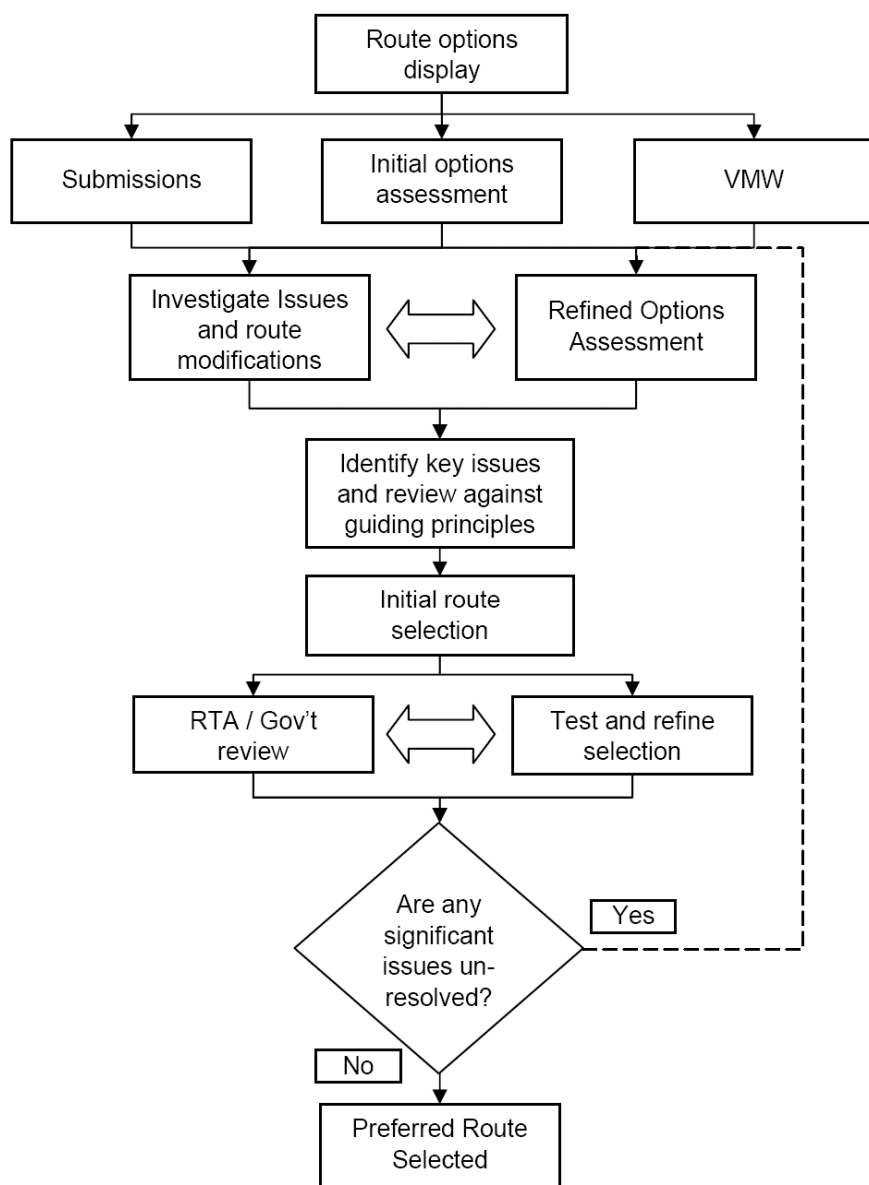


Figure 6-1 Preferred route selection process

6.2 Key issues identified for route options not preferred

The key issues identified and reasons why the route options in each section were not preferred are summarised below.

6.2.1 Section 1

Options 1A & 1B

These options were not favoured for the following reasons:

- Greatest visual impact on Woodburn township.
- Greatest noise impact, in terms of the percentage of the community likely to be bothered by the highway - both for noise change and steady state change.
- Greatest loss of high quality agricultural land.
- Impacts on known and potential indigenous heritage items.
- Greatest length of motorway bridges and floodwater bridging.
- Construction and maintenance risk (soft soils).
- Greatest flooding risk to Woodburn.
- Highest cost.
- Option 1A, greatest area of potential high risk acid sulphate soils.

6.2.2 Section 2

Option 2A

This option was not favoured for the following reasons:

- High impact on sensitive Tuckean Broadwater landscapes.
- Large impacts on EECs.
- Greatest impacts on SEPP 14 and other wetlands.
- Reduction in National Park estate.
- Close to Rileys Hill with consequent visual and noise impacts.
- Impacted by prohibited road zoning.
- Property acquisition of National Park required.
- Crosses largest number of regional/subregional corridors.

Option 2B

This option was not favoured for the following reasons:

- Impact on relatively unspoilt habitats, especially the crossing at Tuckean Broadwater.
- Impact on wildlife corridors.
- Reduction in the National Park estate.
- The number of bridge piers impacting on coastal saltmarsh EEC.
- Impacts on SEPP 14 wetlands.
- Property acquisition of National Park required.

Option 2D

This option was not favoured for the following reasons:

- High visual impact on Broadwater and Wardell.
- Severance of Jali land and loss of cultural heritage (north of the Richmond River crossing).
- High ecological impact on heathland areas and wildlife corridors (north of the Richmond River crossing).
- Impacts on native fauna species (Wallum Froglet and Sedge Frog) which would be difficult to mitigate around Wardell.
- Close to Broadwater and Wardell townships with consequent visual/noise impacts.
- Potential Aboriginal heritage impacts.
- Requires Jali land which cannot be compulsorily acquired without an Act of Parliament.

Option 2E

This option was not favoured for the following reasons:

- Impacts on native fauna species (Wallum Froglet and Sedge Frog) which would be difficult to mitigate around Wardell.
- Close to Wardell township with consequent visual/noise impacts which would be difficult to mitigate.
- Severance of Jali land and loss of cultural heritage (north of the Richmond River crossing).
- High ecological impact on heathland areas and wildlife corridors (north of the Richmond River crossing).
- Requires Jali land which cannot be compulsorily acquired without an Act of Parliament.

Option 2F

This option was not favoured for the following reasons:

- Almost double the construction cost compared to other options.
- Potential to impact upon regional economy and sugar industry due to the loss of high quality agricultural land.
- Highest flooding risk because of scale of mitigation structures required.
- Construction and maintenance risk (soft soils).
- Potential high ongoing maintenance cost due to soft soils and flood mitigation structures.
- Visually less mitigable, due to height of embankments across flood plain, and floodplain landscape character.
- Visual impact of 24 m high river crossing is difficult to mitigate.
- Close to Broadwater and Wardell townships with consequent visual/noise impacts.
- Severance of Wardell township would be difficult to mitigate.
- Loss of land zoned 'Future Urban' at north-east Wardell.
- Requires highest volume of imported fill material (may require significant local borrow sites, reducing local material resources).

6.2.3 Section 3

Option 3A

This option was not favoured for the following reasons:

- Highest cost in section 3.
- Least efficient in terms of road user benefits.
- Indirect impact on Uralba Nature Reserve and fauna corridors.
- Close to Whytes Lane community with consequent visual/noise impacts which are difficult to mitigate.
- Visual effects of cuttings.

6.3 Preferred route options

The preferred route for the Woodburn to Ballina project comprises the following options:

- Section 1** Option 1C modified to avoid land subject to Native Title claim and minimise agricultural impacts.

Section 2 Option 2C modified to pass to the east of Cooks Hill at Broadwater, avoid Jali land near the quarries on Old Bagotville Road, and to minimise ecological impacts on sensitive EEC areas near Meerschaum Vale.

Section 3 Option 3B

Table 6-1 provides a summary of the performance of the option components of the preferred route when assessed against the guiding principles (see Section 6.1).

The summary of why the preferred options were selected is provided in Section 6.4 below.

Table 6-1 Guiding principles selection of preferred options

Option	Risk	Cost	Mitigability	Inter-generational equity
OPTION IC modified	Avoids Crown land subject to Native Title claim. Less flooding risk due to shortest length of bridging required. Provides fire break between National Park and agricultural land.	Is the cheapest option to construct, whilst providing the greatest road user benefits. Has the lowest impact on agricultural lands. Less severance of individual properties.	Has the lowest impact (including potential noise and visual impacts) on existing and future residential areas of Woodburn. Visual impacts would be easier to mitigate Has moderate ecological impacts, for which mitigation could be provided. Improved visual experience along edge of landscape type.	Has the lowest known and potential indigenous heritage impact. Provides a good visual and landscape design outcome. Less community noise burden. Less impact on Langs Hill.
OPTION 2C modified (south of Richmond River crossing)	Less flooding risk.	Provides good road user benefits for a reasonable construction cost.	Less visual/noise impact on Broadwater.	No impact on Broadwater National Park. Provides opportunity to integrate Broadwater businesses (incl. sugar mill) with upgraded highway network. Less regionally significant agricultural land impacts.

Option	Risk	Cost	Mitigability	Inter-generational equity
OPTION 2C modified (north of Richmond River crossing)	Avoids the significant negative impacts of other options (e.g. ecological, heritage, agricultural impacts). Less length of highway in flood areas.	Provides good road user benefits for a reasonable construction cost.	Less noise and visual impact on Broadwater and Wardell than options 2D, 2E, and 2F resulting in better overall amenity. Avoids landscape with high visual sensitivity (Wardell Heath).	Modified Option 2C has reduced impact on EECs compared to the displayed Option 2C (17.1 hectares impacted, previously 24.8 hectares), and requires less native vegetation to be removed than Option 2D. Avoids impact on SEPP 14 wetlands, and has less impact on swamp oak forests and mangrove forest. No impact on National Park. Avoids impact on Jali land. Minimal impact on regionally significant agricultural land. Provides an opportunity for a flood free connection of Evans Head via an interchange on the existing Broadwater Evans Head Road. Less community noise burden.
OPTION 3B	Takes advantage of the fact that the existing corridor of the Pacific Highway is suitable for upgrading.	Is the cheaper option to construct. Provides greatest road user benefits.	Has less noise and visual impact on communities than Option 3A resulting in better overall amenity (e.g. Whytes Lane West).	Has slightly less impact on EECs than Option 3A. (EEC's impacted are already indirectly affected by the existing highway)

6.4 Reasons why the preferred route was selected

The selection of the preferred route is based on technical investigations undertaken, the outcomes of the VMW, assessment of issues raised in submissions during community consultation activities and the refinements of the options undertaken by the study team.

In summary, the preferred alignment has been selected as the preferred route for the upgrade of the Pacific Highway between Woodburn and Ballina on the basis that it:

- Best meets the objectives of both the Pacific Highway Upgrade Program and the Woodburn to Ballina project.
- Provides for the grade separation of the Pacific Highway and local road intersections.
- Provides efficient connections from the upgraded highway towards Ballina, Lismore, and Evans Head through the construction of interchanges.
- Provides reasonable physical separation from existing and proposed residential areas so that, with sensitive urban design, acceptable visual and traffic noise outcomes could be achieved.
- Is the route generally agreed at the VMW and subsequent reviews.

Specifically, the preferred route has addressed a wide range of functional, ecological, heritage, social and economic considerations. Following is a summary of these by section number.

6.4.1 Section 1

Of the three options in section 1, a slightly modified version of Option 1C was selected as it:

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

6.4.2 Section 2

Of all the options in section 2, a modified combination of Option 2C and Option 2E was selected as it:

- Has fewer significant impacts than the options.
- Has less noise and visual impact on Broadwater and Wardell than Options 2D, 2E and 2F, resulting in better overall amenity.
- Avoids impact on SEPP 14 wetlands, and has less impact on high quality vegetation than Options 2A, 2B and 2D.
- Has less ecological impacts than the displayed Option 2C.
- Has less impact on agricultural land, and particularly regionally significant agricultural land than Option 2F.
- Does not require the acquisition of Jali land.
- Has the lowest length in flood affected areas.
- Provides good road user benefits for a reasonable construction cost.
- Provides opportunity for a flood free route connecting Evans Head to the highway.

6.4.3 Section 3

Of the two options in section 3, Option 3B was selected as it:

- Has less noise and visual impact on communities resulting in better overall amenity (e.g. Whytes Lane West).
- Is the cheaper option to construct, whilst providing the greatest road user benefits.
- Retains the highway on its existing route (using the existing asset which is suitable for upgrading).

7 The preferred route

7.1 Description of the preferred route

The preferred route (as illustrated in **Figure 7-1**) commences at the existing Pacific Highway alignment approximately 3.0 km south of Woodburn and extends generally in a north-east direction away from the current highway. An approximately 350 m long bridge crossing would be required at the Tuckombil Canal (Evans River).

Between Woodburn and Broadwater the route continues in a north-easterly direction through agricultural land, skirting the edge of an endangered ecological community and Broadwater National Park. This section of the route consists of embankments and bridges to provide immunity from floodwaters. North of Lang Hill the route follows the western edge of Broadwater National Park before joining the existing highway alignment which bisects the Park. Through the Park, the route would follow the existing highway road reserve, avoiding any direct impact on the National Park.

In the vicinity of Broadwater, the route would be located to the east of Cooks Hill and west of the National Park boundary.

North of Cooks Hill the route would swing north-west and approximately 2.0 km north of Broadwater crosses the Richmond River on a bridge approximately 850 m long with a navigational clearance of 15 m. The route would proceed to the west of Laws Hill on the northern side of the river. North of the river, the highway would head north-west towards the Blackwall Range.

The route would skirt around Jali land and areas of Wardell Heath containing endangered ecological communities before returning east to join the existing highway approximately 4.0 km north of Wardell. For the remaining 6.5 km the route would follow the existing highway corridor, and would be raised up on embankments to be above the floodwaters. The route would connect with the approved Ballina Bypass.

The total length of the preferred route is 36 km.

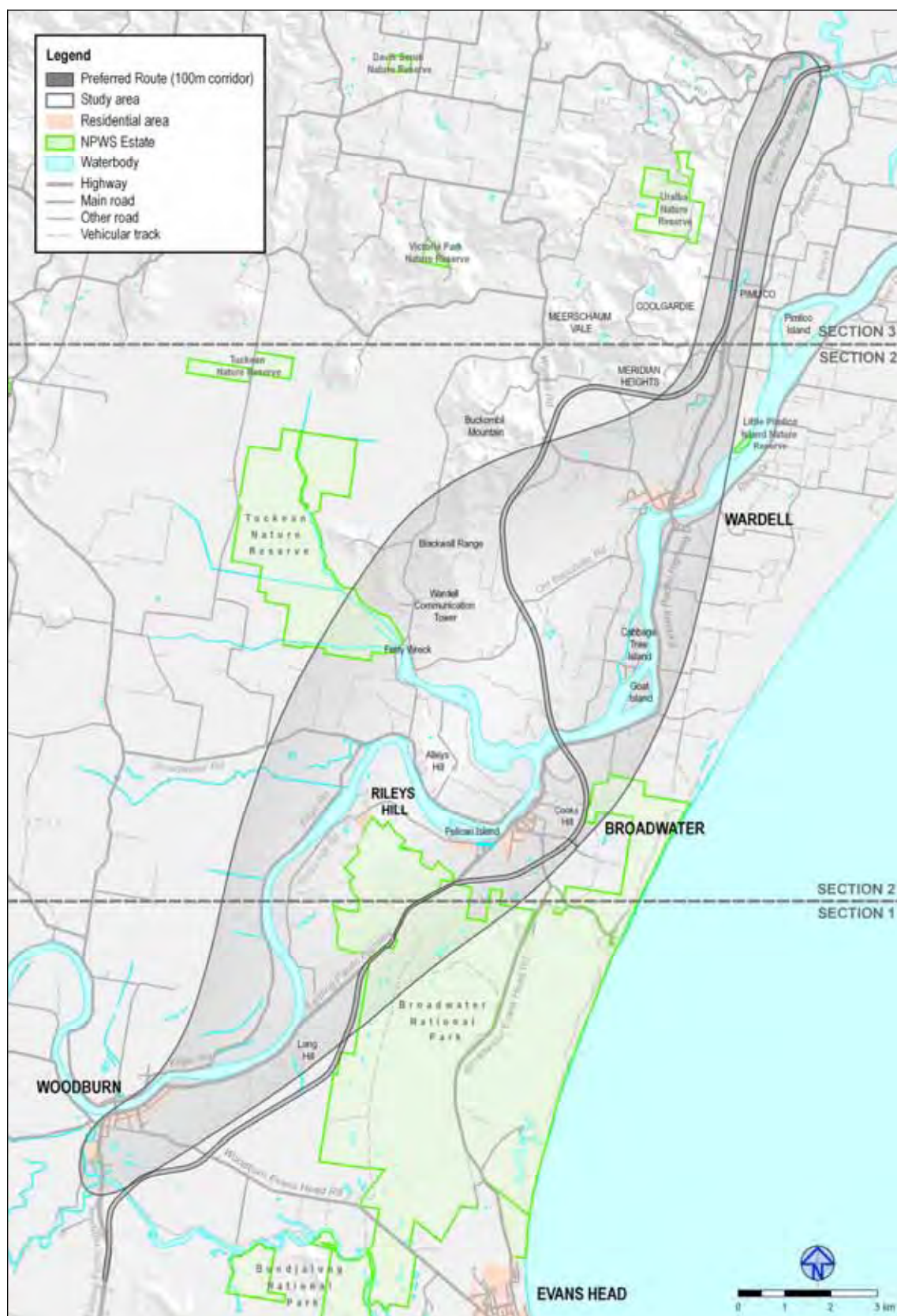


Figure 7-1 Preferred route

Table 7-1 Summary characteristics of the preferred route

Preferred route characteristics⁵																	
Total length (m)	36,155																
Length of bridges* (m)	1,196																
Length of flood alleviation structures* (m)	880																
Speed limit (km/h)	110																
Interchanges	Two alternative options for a possible interchange near Woodburn. Possible interchange at Broadwater																
Preliminary cost estimate* (\$2005)	\$590m - \$645m																
Potential social and landuse impacts																	
Approximate number of land parcels within road footprint	106																
Impacts on land use (hectares)	<table> <tr> <td>Grazing</td><td>100.6</td></tr> <tr> <td>Quarry</td><td>3.4</td></tr> <tr> <td>Rural Residential</td><td>1.8</td></tr> <tr> <td>Sugar Cane</td><td>31.0</td></tr> <tr> <td>Sugar Cane Stockpile</td><td>3.0</td></tr> <tr> <td>Timber</td><td>32.8</td></tr> <tr> <td>Urban</td><td>25.2</td></tr> <tr> <td>Watercourse</td><td>2.6</td></tr> </table>	Grazing	100.6	Quarry	3.4	Rural Residential	1.8	Sugar Cane	31.0	Sugar Cane Stockpile	3.0	Timber	32.8	Urban	25.2	Watercourse	2.6
Grazing	100.6																
Quarry	3.4																
Rural Residential	1.8																
Sugar Cane	31.0																
Sugar Cane Stockpile	3.0																
Timber	32.8																
Urban	25.2																
Watercourse	2.6																
Approximate number of dwellings within road footprint	5																
Approximate number of other buildings within road footprint	10																
Community Noise Burden – Steady State 2035 (predicted % population 'bothered' by traffic noise)	Section 1 – 0.3 Section 2 – 1.8 Section 3 – 0.6																

⁵ Characteristics related to area are based upon the upgrade 'footprint', which is less than the corridor width. The footprint assessed excludes interchanges, local road crossings and rest areas.

Preferred route characteristics ⁵	
Community Noise Burden – Noise Change 2015 (predicted number of dwellings to experience a traffic noise increase)	Section 1 - 10 Section 2 - 114 Section 3 - 34
Impact on towns	Woodburn – increased amenity, decreased access Broadwater – increased amenity Wardell – increased amenity
Flooding* (current design assumption)	Target of less than 50 mm afflux for the 1 in 100 year design flood
Flood immunity	1 in 20 year flood within floodplain 1 in 100 year flood elsewhere
Potential environmental impacts	
Number of known threatened species known or likely to occur in route corridor	85
Extent of Endangered Ecological Communities impacted (hectares)	51.97
Extent of National Park Estate impacted (hectares)	0
Impacts on Aboriginal heritage	4 known sites and potential for sites in the vicinity of Cooks Hill
Impacts on non-Aboriginal heritage	2 known sites and potential for additional sites from farming and early pioneering activities
Water quality	4 waterway crossings

* Subject to refinement of concept design and further studies.

7.2 Potential impacts of the preferred route

7.2.1 Traffic and transport

The preferred route would result in traffic and transport benefits across the study area for both through and local traffic. This would occur as through traffic is removed from the existing Pacific Highway which currently passes through the towns of Woodburn, Broadwater and Wardell. This would result in improved local amenity and traffic safety.

Based on a number of travel speed surveys, the existing time taken from the southern end of the route south of Woodburn to the Bruxner Highway is on average 26 minutes at an average speed of 85 km/h. Forecast travel

times for through traffic on the preferred route is approximately 20 minutes at an average travel speed of 110 km/h. Therefore, the upgrade is expected to reduce travel times from south of Woodburn to the Bruxner Highway.

The upgraded Pacific Highway would result in a high standard road alignment in accordance with the Pacific Highway Upgrade Program objectives. The current accident rate on the existing Pacific Highway between Woodburn and Ballina is 48 crashes per 100 million vehicle kilometres travelled. For the preferred route the target accident rate is 15 crashes per 100 million vehicle kilometres travelled.

The total estimated crashes on the existing Pacific Highway and new highway upgrade have been assessed. The figures suggest a potential to reduce the total number of crashes by up to 65 per cent from the current situation.

The proposed location of grade separated interchanges has not been finalised, and would be developed during the next phase of concept design. Options being considered for development are:

- Woodburn: A possible north facing half diamond interchange on the Woodburn to Evans Head Road with a possible south facing half diamond interchange at the tie-in south of Woodburn, or a full diamond interchange on the Woodburn to Evans Head Road.
- Broadwater: A possible full diamond interchange on the Broadwater to Evans Head Road.
- Wardell: A possible north facing half diamond interchange near Coolgardie Road, with local traffic either utilising a service road adjacent to the highway, or an upgraded Pimlico Road.
- Interchanges at the Bruxner Highway and Teven Road as part of the approved Ballina Bypass project.

Local roads would generally pass over or under the Pacific Highway upgrade dependent on terrain, existing road alignment, geotechnical conditions and urban design principles. These arrangements would be developed during the concept design phase.

Rest areas have not yet been determined for this section of the Pacific Highway upgrade, however it is anticipated there would be one major rest area within the project. Possible sites and layouts would be investigated during the concept design phase.

Truck breakdown bays suitable for B-doubles combined with cross-over facilities would be located approximately every 5 km. Locations for these would be determined during the concept design phase.

7.2.2 Urban design, landscape and visual assessment

The urban design, visual and landscape constraints and opportunities for the preferred route have been assessed in relation to the existing scenic character of the area. It is acknowledged that no project of this nature

occurs without urban design, visual and landscape impacts. The preferred route option either minimises these impacts or is able to mitigate them to an acceptable level. Artistic impressions of the preferred route are shown in **Figure 7-2 to Figure 7-8**.

Within the southern portion of section 1 of the study area, south of Broadwater National Park, the preferred route is predominantly located through open pastureland / floodplain / sugar cane fields with some pockets of woodland around Tuckombil Canal and other pockets associated with the Broadwater National Park edge. While the proposed route requires large embankment heights, the route is distant from the township of Woodburn and skirts the eastern edge of Lang Hill rather than the edge of the Richmond River, thereby reducing severance of the river from the locality and visual impacts in views from the river. The northern portion of section 1 is located on the existing Pacific Highway alignment through Broadwater National Park.



Figure 7-2 Artist impression from south of Tuckombil Canal towards Woodburn

For the portion of the study area in section 2, south of the Richmond River/Broadwater, the preferred route is predominantly located through pasturelands along the northern edge of Broadwater National Park. The route skirts the edge of Broadwater township, east of a small unnamed hill at Montis Gully and east of Cooks Hill. The eastern slopes of Cooks Hill are currently being quarried.



Figure 7-3 Artist impression looking north-east from south of Broadwater



Figure 7-4 Artist impression looking north-west from east of Broadwater

Heading north-west, the route crosses the Richmond River and skirts the western edge of Laws Hill, passing through a degraded quarry landscape area and the visually sensitive Wardell heath and woodland area. The route then mostly traverses pasturelands at the foothills of the Blackwall Range. Some rural residences located along these foothills, particularly around the Wardell Road/Hillside Lane area below Buckombil Mountain, would be visually impacted. There is likely to be an impact on the historic 'Stonehenge' property in particular on the land surrounding the buildings.



Figure 7-5 Artist impression looking north-west from crossing of Old Bagotville Road



Figure 7-6 Artist impression looking north-east from crossing of Wardell Road

As the route heads north-east it skirts the Blackwall Range with the Meridian Heights settlement located on a hilltop above. The visual impact has been assessed as medium low: it avoids Broadwater township, avoids the sensitive landscape of the Wardell heath and woodland, but has some impacts visually due to the bridge crossing of the Richmond River and some cuttings and embankments along the foothills of the Blackwall Range.

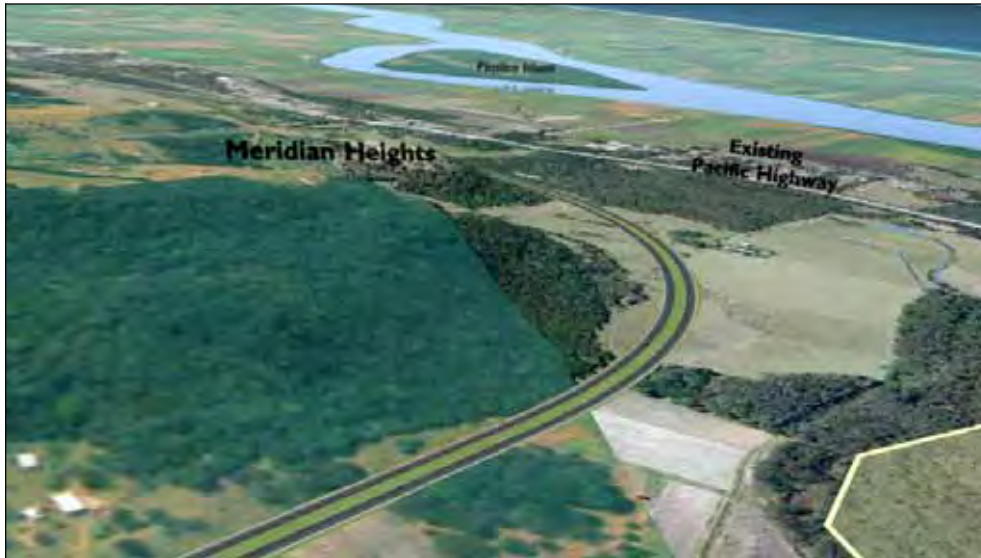


Figure 7-7 Artist impression looking north-east towards Pimlico

Section 3 predominantly uses the existing Pacific Highway corridor. The route passes through the middle of the floodplain valley with sugar cane fields on either side. The visual impact is low. The embankments are relatively low and the route re-uses the existing corridor through a medium visual sensitivity landscape.



Figure 7-8 Artist impression looking north from Whytes Lane

Further investigation of measures required to mitigate the visual impacts of the preferred route would be required as part of the concept design and environmental assessment.

7.2.3 Geotechnical considerations

Geotechnical conditions within the preferred route vary from low lying areas located on deep soft Holocene sediments associated with the Richmond River floodplain, to slightly more elevated 'heathland' areas underlain by Pleistocene-age sands, and to more elevated areas underlain by metasedimentary rocks of the Neranleigh-Fernvale Beds (refer **Figure 7-9**).

Given that construction of approximately 5 km of road embankment would be required over areas underlain by deep soft sediments, minimising the time for embankment settlement and optimising construction timing/costing presents the greatest geotechnical challenge for the project.

Opportunities to reduce the fill requirement for the preferred route would be developed during the refinement of the concept design. However, it is still likely that a substantial amount of material would be required for the project. Options currently under consideration for the source of fill material include obtaining material locally from the vicinity of the route, obtaining material from local quarries, or obtaining material from quarries further a field.

Investigations indicate that at Tuckombil Canal the depth to material assessed as adequate for piled foundations is approximately 13 m. For the crossing of the Richmond River piling depths ranging from 25 m (on weathered sandstone) for the northern abutment, to 35 m (on medium to dense sand) for the southern abutment are indicated. As these bridge sites are in areas underlain by soft clays, particular attention would need to be given to the assessment of settlement and strength characteristics during the concept design.

7.2.4 Socio-economic issues

A preliminary assessment of the social impacts of the preferred route has been undertaken incorporating business impacts; access to opportunities; amenity; social character (of the towns in particular); and the likely level of disruption related to the direct property impacts of the options.

The likely impact on sites of Aboriginal cultural significance and the social impacts of flooding have also been considered.

The preferred route avoids the townships of Woodburn, Broadwater and Wardell, in effect bypassing these towns. Immediately after towns are bypassed, some businesses more reliant on passing trade from motorists, sometimes experience short term impacts on business activity and incomes. In some cases businesses face closure. In the medium to long-term, there are likely to be beneficial outcomes including improved residential amenity, increased tourist trade and convenience of local shopping. The provision of suitable signposting on a new road or upgraded highway attracts the attention of motorists and encourages them to make a detour to visit and enjoy towns no longer on a busy road.

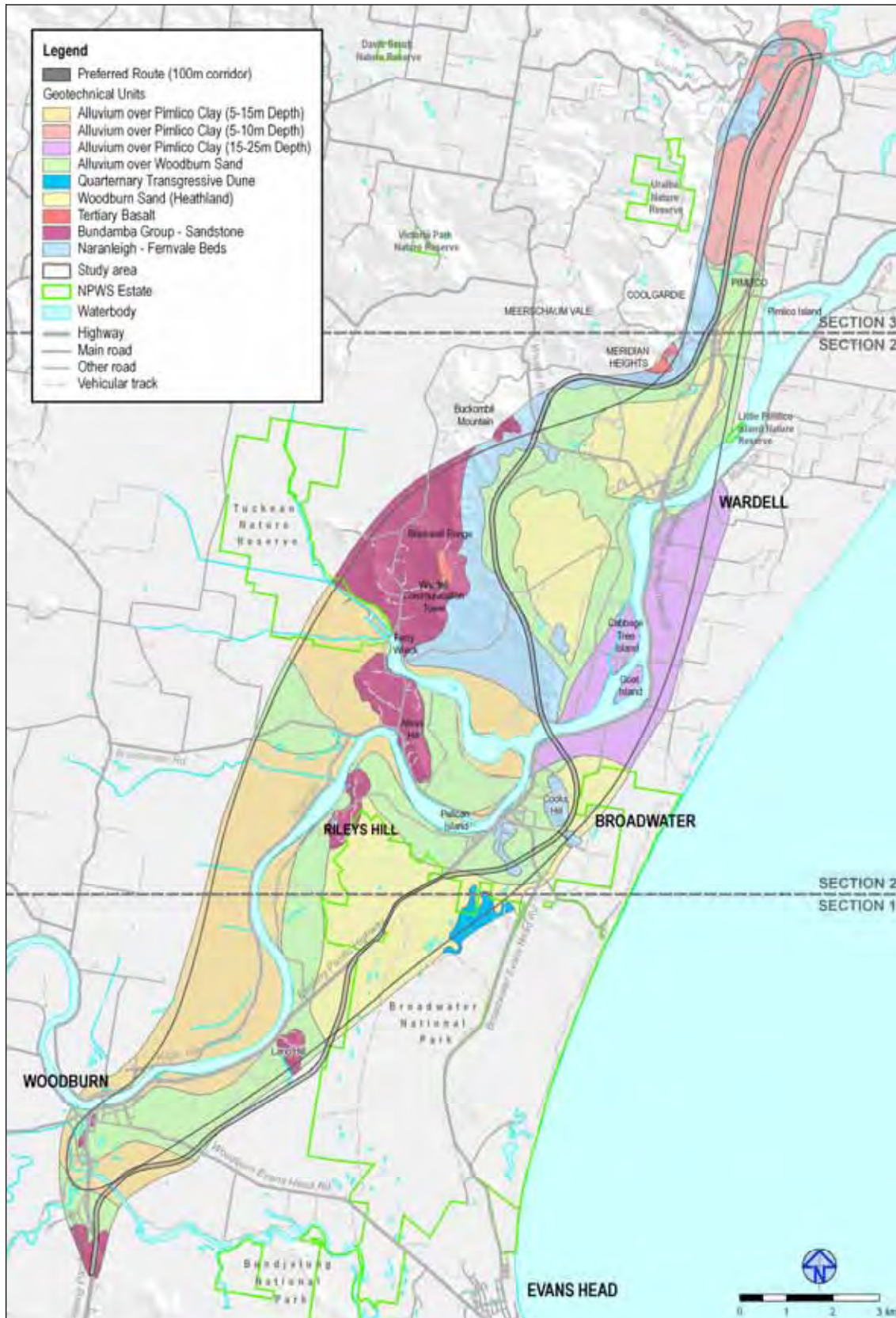


Figure 7-9 Preferred route – geology

Business impacts

Accessibility is one key element in estimating the overall effects, however, the more important factor in determining the overall impact is the ability of the township to adapt and attract motorists from the Highway. The distance from the Highway or accessibility is not as important as creating a town where motorists want to stop, be it as a destination or a stopover.

Access to opportunities

Access to opportunities is considered a function of both physical accessibility to opportunities and the likely future distribution of the opportunities themselves. Opportunities in this context is understood to include employment opportunities, recreation opportunities, access to shopping and, the opportunity to access social and community services, i.e. those opportunities that are primarily located in urban centres.

The preferred route improves access to opportunities throughout the study area.

The preferred route would also improve regional and local accessibility throughout the sub-region. It would largely separate regional from local traffic, freeing up the local road network for more local movements. The preferred route would not cut off access across the route, since local roads would generally continue over or under the new highway. Overall therefore, access to opportunities would be improved as a result of the preferred route.

The extent and distribution of opportunities in the sub-region is likely to be improved by the preferred route. This would be primarily a result of the improved amenity likely to be experienced in the towns through which the Pacific Highway currently passes (Woodburn, Broadwater and Wardell). Improved amenity in the towns is likely to result in them becoming more attractive locations for residential and commercial activities. Although there are limits to the potential expansion of the towns due to flood prone lands and other constraints, there is potential for some residential development growth. Increases in population are expected to result in an increase in the range of goods and services offered in the towns. The population increase may also in some cases provide the required thresholds to provide additional community services and activities (or even to maintain existing services and facilities). Such services, generally provided by Councils, may include, branch libraries and neighbourhood/community centres.

Potential adverse social outcomes of the preferred route are that as a result of the amenity of the towns being improved, there is likely to be an increase in the price of property, leading to increased rents. The price of goods and services in the towns is also likely to increase. For those on fixed incomes and for tenants rather than property owners, this would be a disadvantage. This would however, be a common outcome for all of the route options.

Amenity

As noted above, the amenity of the towns is likely to improve as a result of the preferred route. This is likely to result from the removal of existing

through traffic from the towns, and an associated improvement in the noise environment in particular, but also in the visual environment and in localised air quality. The improvement in traffic related safety conditions in the towns, especially for older people and children, is also a significant expected benefit.

Outside the towns, the effect of the preferred route would vary, depending in particular on the visual effects of the preferred route and on its effect on the noise environment. There are some locations where potentially adverse visual and noise effects would require mitigation, but even with mitigation, the overall effect on amenity would be adverse, compared with the current situation. Where adverse visual and noise effects are found in the same location, the overall effect on amenity would be worse.

In section 1 the overall effect on amenity is likely to depend on the approach to the mitigation of traffic noise from the new route. The preferred route would have a visual impact. This impact may be exacerbated by measures required for noise mitigation. If, however, noise mitigation alongside the route itself was not required, those dwellings that might require noise to be mitigated by treatment to the dwellings themselves may be considered to be adversely affected in terms of overall amenity.

In section 2 some rural residences located along these foothills, particularly around the Wardell Road/Hillside Lane area below Buckombil Mountain, would be affected by the preferred route including the historic 'Stonehenge' property. While the heritage buildings at Stonehenge would not be affected, the surrounding land and access to the property would be affected. Any impact on 'Stonehenge' would be managed during finalisation of the concept design in order to maintain the heritage amenity of the property as far as possible. As the route heads north-east it skirts the Blackwall Range with the Meridian Heights settlement located on a hilltop above. It is likely that residents currently not affected by road traffic noise would be affected by the preferred route and their overall amenity would be reduced.

In section 3, the preferred route is likely to have a low visual impact overall. Residents currently with views looking down on or over the existing highway would view a wider roadway footprint which would have some amenity impact. The impact of the preferred route could be reduced with suitable landscape treatments. Also, it is possible that traffic noise mitigation measures, such as architectural treatments or noise barriers, may be required in this section. Depending on the type of noise mitigation measures adopted for the new road, there would be potential for some reduction in visual amenity.

Social character

The preferred route would change the social character of the towns. This would occur primarily as a result of the changes in amenity and the consequent effect on the provision of local opportunities described above. Associated with this, there is likely to be a change in the demographic character of the towns. Because of improved amenity and changes in the

range of goods and services offered, the towns are likely to become more attractive residential locations for relatively higher income groups.

Until now, the towns of Woodburn and Broadwater, and to a lesser extent Wardell, have largely avoided the pressure of becoming “targeted” as residential locations as has occurred in many North Coast towns. This is likely to change as a result of removing Pacific Highway through traffic from the towns. The social character of the towns is likely to become more “upmarket”.

Apart from the demographic changes, there are likely to be changes to the physical fabric of the towns that would not be possible without removing through traffic from the towns. Some of these changes may be by way of improvements to the public domain, such as streetscape improvements, including local traffic management in the interests of pedestrian safety and landscaping. Changes such as this would also contribute to the changed social character of the towns.

Outside the towns, the character of some rural areas is likely to change as a result of changes in amenity in particular. These are described above under “Amenity”.

Disruption related to property impacts

The preferred route would result in adverse property impacts by directly affecting some properties and dwellings.

Some property impacts would be compensable. The issues considered in determining compensation include:

- The market value of the land on the date of its acquisition.
- Value of structures including houses and other property structures such as sheds and outbuildings affected by the preferred route.
- Property adjustments - fencing, drainage and access directly affected by the preferred route.
- Allowances for the reimbursement of reasonable legal & valuations fees incurred.
- Any special value of the land on the date of its acquisition.
- Any loss attributable to severance.
- Any loss attributable to disturbance.
- Solatium - compensation to a person for non-financial disadvantage resulting from the necessity to relocate their principal place of residence.
- Any increase or decrease in the value of adjoining or severed land.

The most adverse impacts would arise from those impacts that may be mitigated to some extent but which are not compensable, such as dwellings that are adversely affected in terms of amenity (noise, views) but are not directly affected by the preferred route.

Aboriginal cultural significance

Consultation with the local Aboriginal communities has indicated a strong attachment to the land and identified areas within the study area which are important as the last vestiges of Aboriginal land.

The alignment of the preferred route has attempted to respect Aboriginal culture and needs by avoiding these lands where possible.

Consultation has indicated there is potential to affect sites of Aboriginal significance in the vicinity of Cooks Hill. The preferred route passes around the eastern side of Cooks Hill and further investigations of the area would be necessary prior to completing the concept design and environmental assessment of the upgrade.

Social impacts of flooding

There would be changes to the flooding characteristics as a result of the preferred route. However, measures would be taken to ensure that the maximum increase in flood depth is low, thereby minimising the potential impact.

Any change in the flooding regime has the potential to affect an additional number of houses as discussed in Section 7.2.9.

There is potential for an interchange on the preferred route that could provide the Evans Head community with a 'flood free' access to the Pacific Highway, via the Broadwater - Evans Head Road.

7.2.5 Statutory planning and land use considerations

Statutory and strategic planning considerations are discussed in Section 2.6.1. Local planning and land use considerations are discussed below.

Local planning schemes

The preferred route passes through Ballina Council and Richmond Valley LGAs. The route does not go through the Lismore City Council area. Each Council has a Local Environment Plan as described in Section 2.6.1.

Table 7-2 and **Table 7-3** outline the zonings applicable to the preferred route and the permissibility of the route within each zoning. **Figure 7-10**, **Figure 7-11** and **Figure 7-12** show the preferred route overlaid on Council zonings.

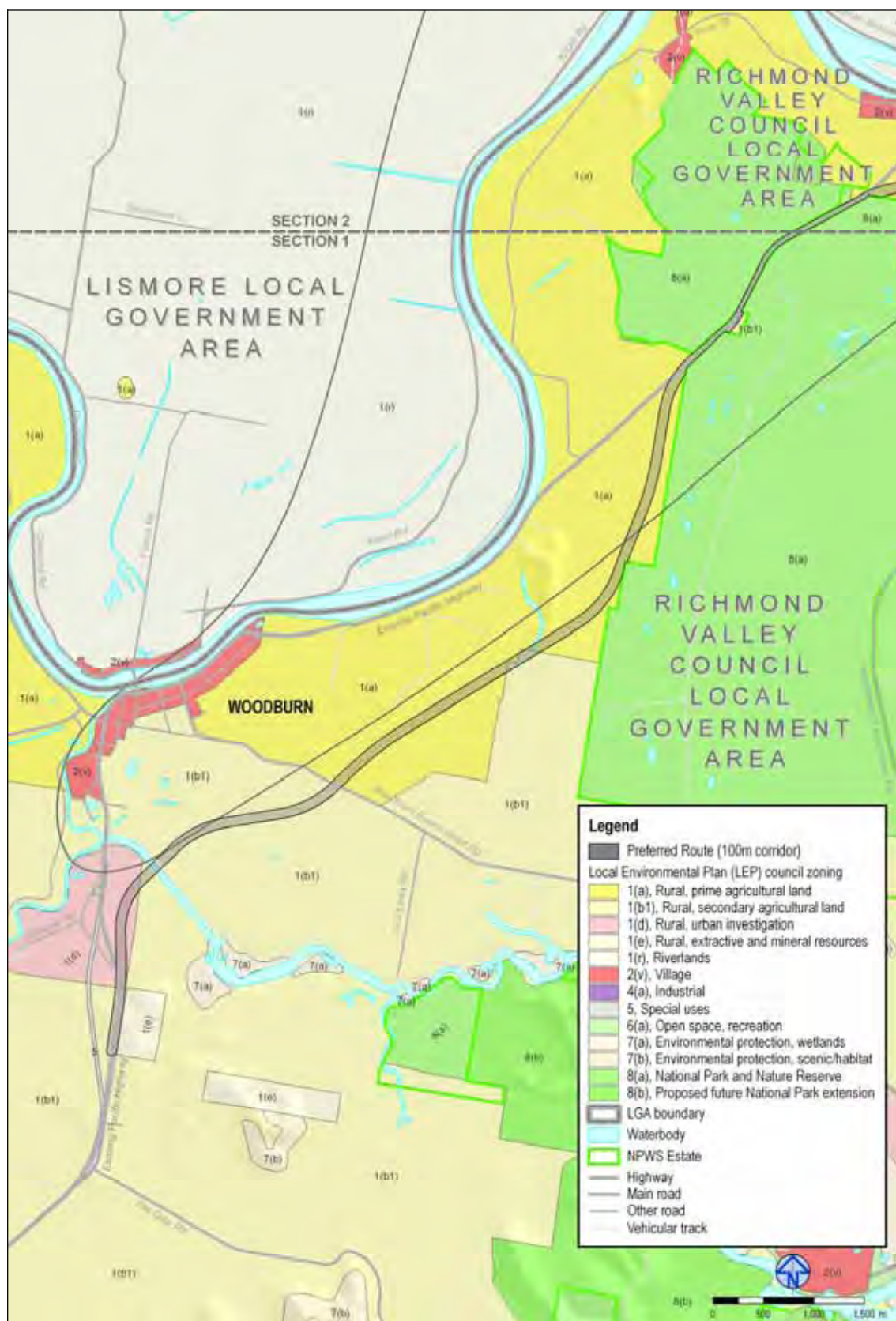


Figure 7-10 Preferred route – land zoning – section 1

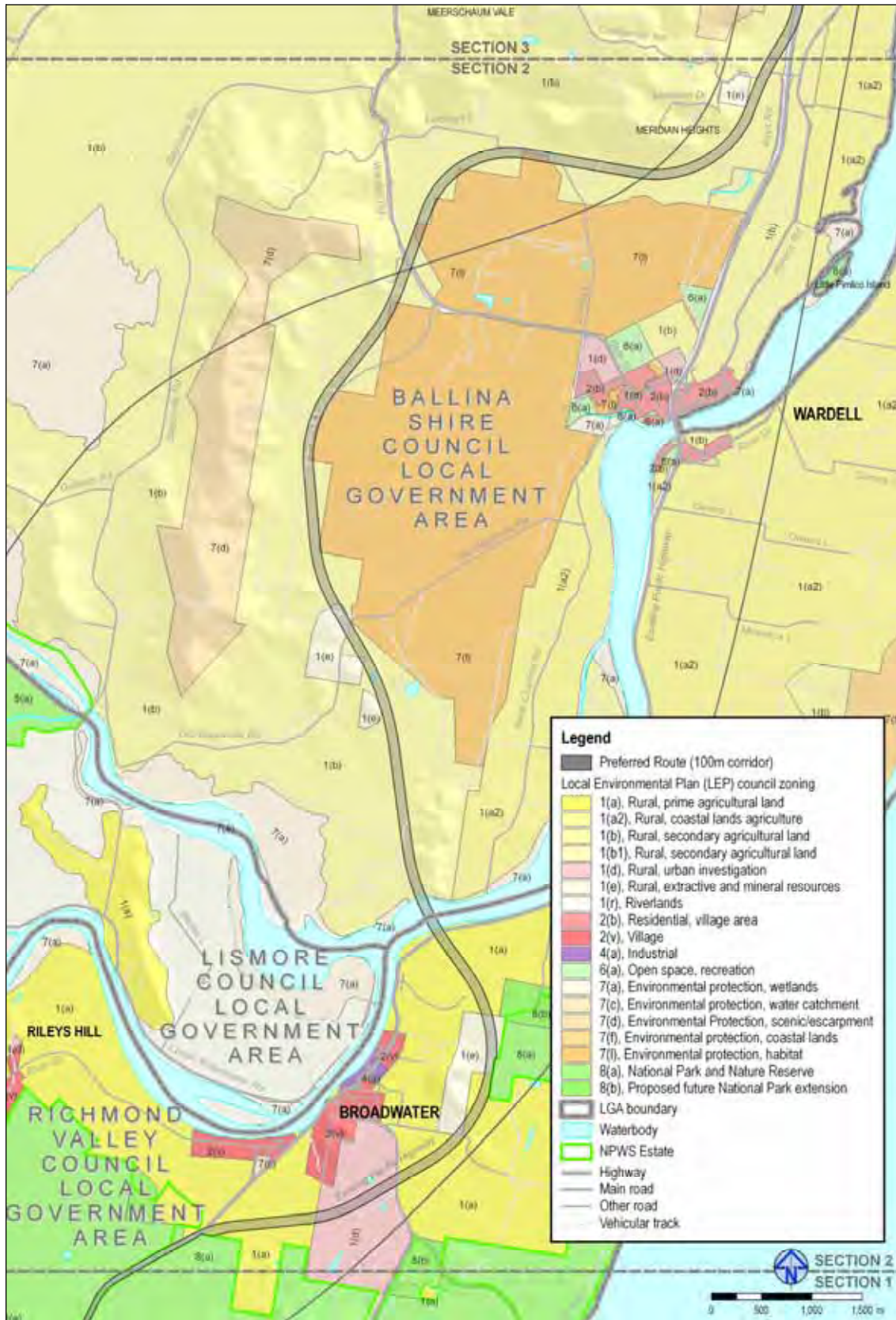


Figure 7-11 Preferred route – land zoning – section 2

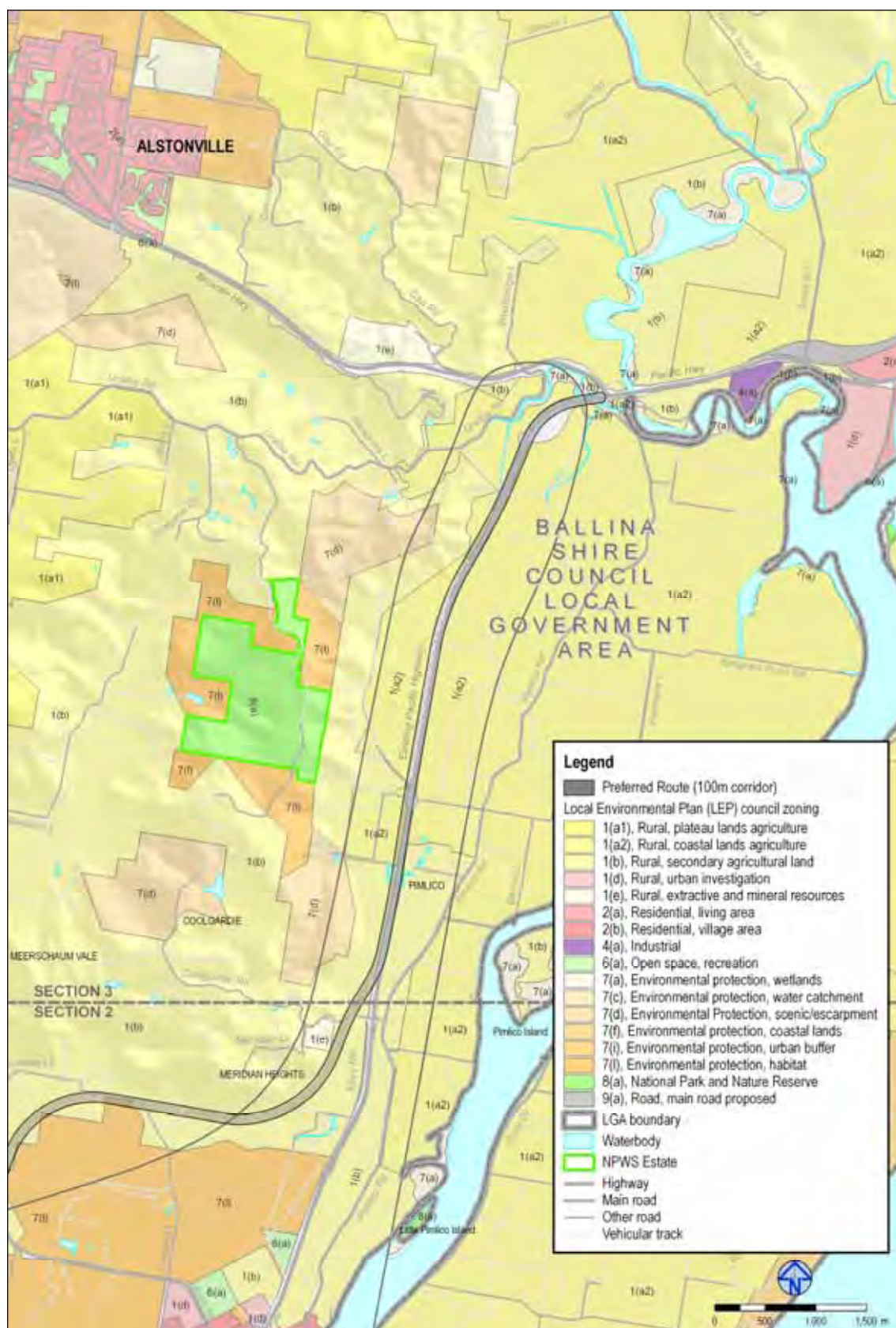


Figure 7-12 Preferred route – land zoning – section 3

Table 7-2 Ballina LEP 1987 - Land use zoning of the preferred route

Zoning	Application	Comment	% of route in each LEP zoning
1a(2) Rural (Coastal Lands Agriculture)	Adjacent to the Richmond River north of Wardell.	Roads are not prohibited and are permissible with Council consent.	2.3
1(b) Rural (Secondary Agricultural Land)	West and north of Wardell Heath	Roads are not prohibited and are permissible with Council consent.	29.6
1(e) Rural extractive and mineral resources)	Near Old Bagotville Road	Roads are not prohibited and are permissible with Council consent.	1.2
7 (l) Environmental Protection (habitat)	Wardell Heath	Roads are not prohibited and are permissible with Council consent.	1.2
General – Existing Main and Arterial Roads	Pacific Highway	Roads are not prohibited and do not require Council consent.	17.3

Roads are permissible within all the zones in the preferred route, with development consent from Council. Any roadworks within existing road reservations, zoned General – Existing Main and Arterial Roads, would be permissible and would not require Council consent.

Table 7-3 Richmond River LEP 1992 - Land use zoning of the preferred route

Zoning	Application	Comment	% of route in each LEP zoning
1(a) Rural (Prime Agricultural Land)	Adjacent to Richmond River	Roads are not prohibited and are permissible with Council consent.	29.6
1(b1) Rural (Secondary Agricultural Land)	South of Woodburn	Roads are not prohibited and are permissible with Council consent.	11.7
1(d) Rural (Urban Investigation)	Near Broadwater	Roads are not prohibited and are permissible with Council consent.	5.3

Zoning	Application	Comment	% of route in each LEP zoning
1(e) Rural (extractive and mineral resources)	Vicinity of Cooks Hill	Roads prohibited, although Model Provisions apply (refer below).	1.8

Under Clause 9(3) of the Richmond River LEP, roads would appear to be prohibited in the 1(e) Rural (extractive and mineral resources) zone. They are not included in the purposes permissible without consent or the purposes permissible with consent. As prohibited development includes all purposes other than those permitted without consent or those permitted only with consent, the prima facie position is that roads are prohibited in this zone.

However, Clause 6 of the Richmond River LEP adopts Clause 35 of the *Environmental Planning and Assessment Model Provisions 1980* (Model Provisions), with a limited exclusion relating to items 2 and 11 of Schedule 1. Accordingly, item 8 of Schedule 1 to Clause 35 of the Model Provisions applies.

Hence, in the terms of the Model Provisions, nothing in the LEP "shall be construed as restricting or prohibiting or enabling the consent authority to restrict or prohibit" the "carrying out of any development required in connection with the construction, reconstruction, improvement, maintenance or repair of any road, except the widening, realignment or relocation of such road."

The Woodburn to Ballina upgrade is a new road and therefore is not characterised as widening, realignment or relocation. The Model Provisions therefore override the prohibition.

Land use impacts

Direct impacts of the preferred route by land use type are summarised in **Table 7-4** and shown on **Figure 7-13**, **Figure 7-14**, and **Figure 7-15**. There are a number of agricultural activities and some drainage infrastructure that may be affected by the preferred route. Replacement of lost infrastructure, assurance of drainage on sugar cane farms; maintenance of access to loading pads for sugar harvest; and access for operations to continue between land parcels may be required.

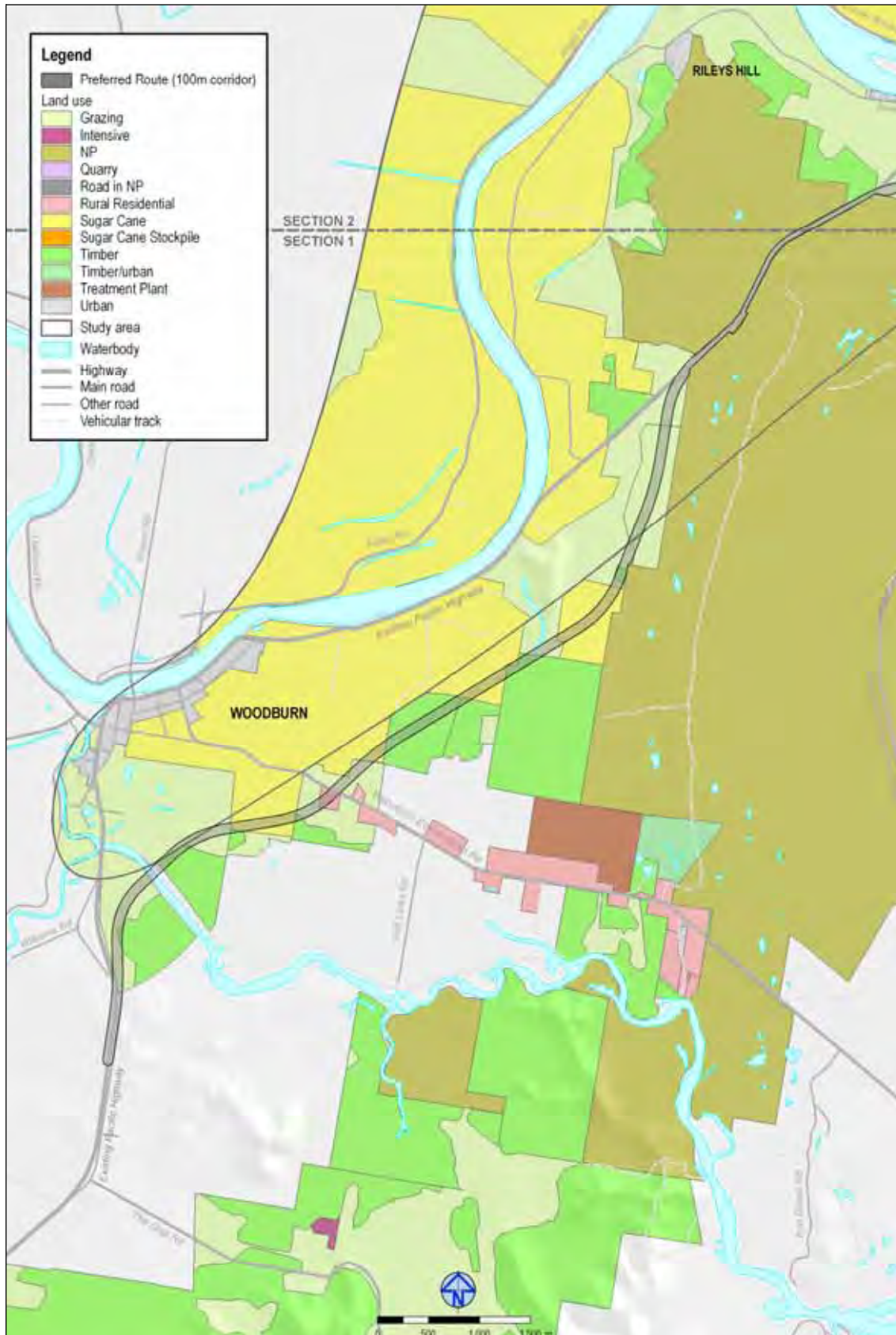


Figure 7-13 Preferred route - land use - section 1

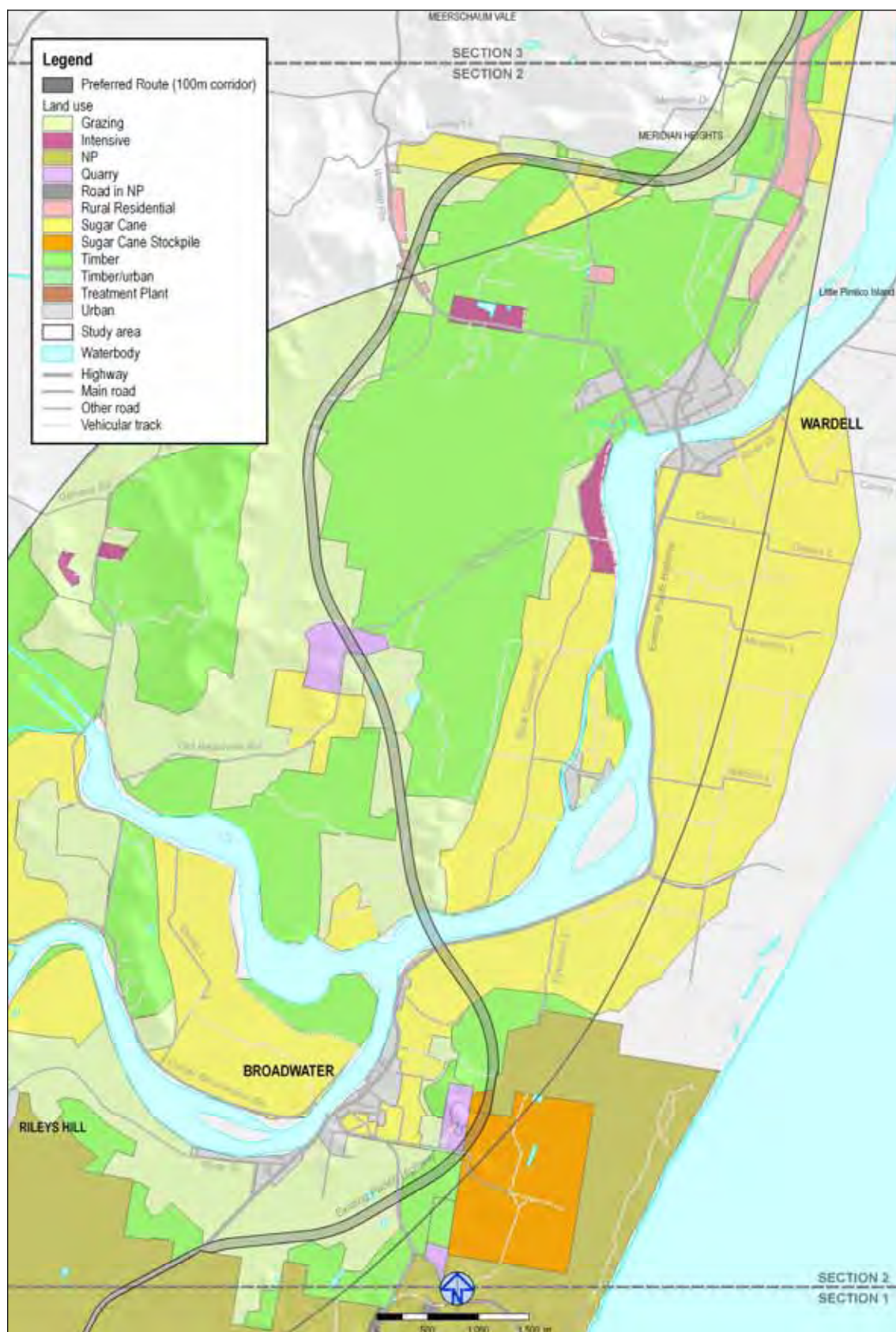


Figure 7-14 Preferred route - land use - section 2

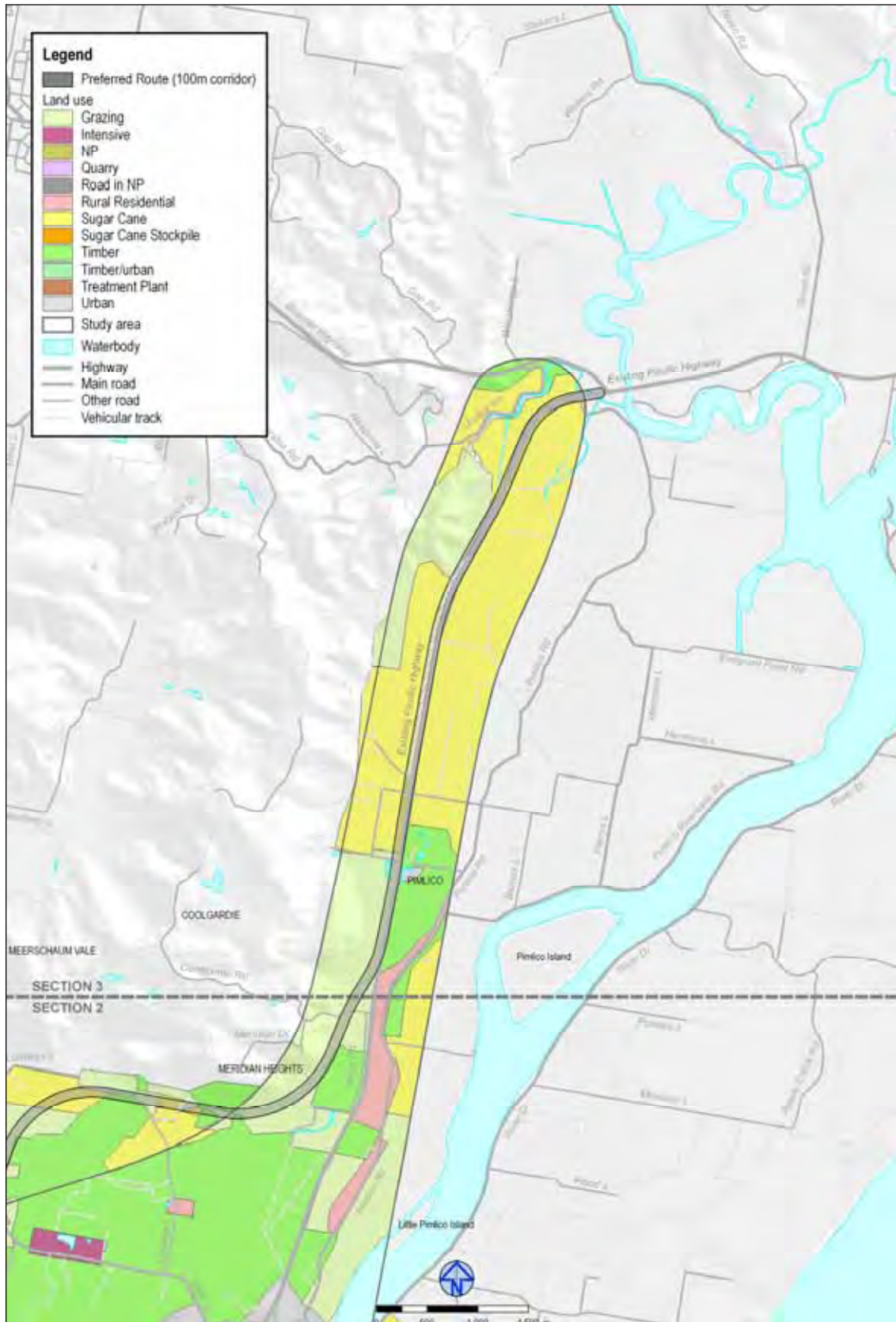


Figure 7-15 Preferred route - land use - section 3

Table 7-4 Land use impacts based upon preferred route footprint

Land use type	Hectares	% of footprint
Grazing	100.6	47
Road reserve through National Park	13.8	6
Quarry	3.4	2
Rural Residential	1.8	1
Sugar Cane	31.0	15
Sugar Cane Stockpile	3.0	1
Timber	32.8	15
Urban	25.2	12
Watercourse	2.6	1

7.2.6 Noise

A preliminary noise impact assessment has been undertaken on the basis of steady-state Community Noise Burden (CNB) for the preferred route. This analysis provides an indication of the likely reaction of residents to traffic noise after a period of adjustment to changes in the noise. The findings for predicted noise impacts extrapolated to 2035 (20 years after road opening) in terms of CNB are shown in **Table 7-5**.

The 'do-nothing' CNB has been calculated for the length of the existing highway through each section based on predicted traffic flows in 2035.

Table 7-5 Community Noise Burden (CNB) in 2035

Section	CNB (% population bothered by traffic noise)	Do-nothing (% population bothered by traffic noise)
Section 1 Woodburn to Broadwater National Park	0.3	6.43
Section 2 Broadwater National Park to Wardell	1.8	8.33
Section 3 Wardell to Bruxner Highway	0.6	0.24

The assessments show that the noise impact associated with the preferred route would be significantly lower, i.e. better, than that of the 'do nothing' scenario, except in section 3.

The noise impact north of Wardell is expected to be worse than the 'do nothing' scenario. This length of the preferred route generally follows the route of the existing highway, such that the same dwellings would be affected by traffic noise from the 'do nothing' scenario and the upgraded highway. The unmitigated adverse noise impact identified is predominantly due to the change to a noisier concrete pavement.

Predictions of the number of dwellings exposed to various range of traffic noise without mitigation in 2035 (20 years after opening) are shown in **Table 7-6**.

Table 7-6 Predicted number of dwellings exposed to a range of traffic noise levels without mitigation (2035)

Preferred Route	Predicted number of dwellings with noise level (without mitigation):		
	55-60 dB(A)	61-65 dB(A)	>65 dB(A)
Section 1	19	2	5
Section 2	63	46	40
Section 3	20	28	9

Some residents might experience changes in traffic noise level due to the upgrade on opening of the road in 2015. Predicted numbers of affected dwellings are shown in **Table 7-7**.

Table 7-7 Predicted numbers of noise affected dwellings

Preferred Route	Predicted number of dwellings to experience a noise increase
Section 1	10
Section 2	114
Section 3	34

Detailed noise and vibration assessments would be undertaken as part of the concept design and the environmental assessment. The detailed assessment would take into consideration any refinements made to the preferred route during concept design, and the impact of interchanges, service roads and local road changes on the surrounding environment.

Where road traffic noise impacts exceed the noise guidelines for the project, possible mitigation measures would be investigated by the RTA. The cost effectiveness and practicality of providing mitigation measures would also be taken into consideration at this time.

7.2.7 Heritage

Aboriginal heritage

No Aboriginal sites on or near the preferred route are listed on the Commonwealth or National Heritage Lists, Register of the National Estate, NSW Heritage Register, heritage schedule of the Richmond Valley Local Environmental Plan or the Department of Environment and Conservation's Aboriginal Heritage Information Management System.

Archaeological surveys undertaken during the route development process have identified a number of Aboriginal heritage sites that are not identified on any registers. **Table 7-8** and **Figure 7-16**, **Figure 7-17** and **Figure 7-18** outline the identified sites occurring on or near the preferred route.

Table 7-8 Aboriginal heritage sites

Location	Site	Significance
Woodburn to Broadwater National Park	Isolated stone artefact	This artefact was found on the level crest of an undulating ridge just west of the Pacific Highway Reserve and has been disturbed by track construction and underground telephone cable installation. The bulk of the crest has been excavated to make way for the existing highway and slopes away to the immediate west of the artefact location. It was concluded that the site has little further archaeological potential and it was recommended that the artefact be collected ahead of any construction disturbance.
	Isolated stone artefact and PAD	This artefact was located on the northern upper slope of an undulating ridge just west of the Pacific Highway road reserve and has been disturbed by track construction and underground telecommunications installation. No additional artefacts were apparent on the two metre wide track. The ridge crest west of the track levels out to form a broad low peninsula fringed by swamp. This crest supports grassy open woodland with negligible surface visibility, and although probably disturbed to some degree by past vegetation clearance, is considered to have substantial potential to contain subsurface archaeological deposits (PAD).
Broadwater National Park to Wardell	Cooks Hill massacre site	Despite an absence of surface evidence, the potential remains for subsurface archaeological deposits on the sand rise bordering the western bank of Eversons Creek.

Location	Site	Significance
	Midden/open campsite/s	Field inspections confirmed the existence of archaeological material across the McGeary's Quarry property traversed by the preferred route. This material occurs with greatest density on and around the northern margin of the existing extraction pit, where stone artefacts and pipi (<i>Donax deltoides</i>) shells are deflating down the pit cutting. Immediately north of the cutting, the grassed surface layer has been removed, creating an eroding sand exposure approximately 200 square metres in extent. The site is estimated to contain upwards of 1,000 surface artefacts, none of which would be in a primary depositional context. The exposure also contains a number of dense pipi shell accumulations set within a low level background pipi scatter. Most of the shell is in a highly fragmented condition. A number of overburden heaps occur on the margins of the extraction pit. Given that they comprise topsoil stripped from the extraction area, these heaps can be expected to contain artefacts and midden shell.
	Scarred trees	A group of four scarred trees are located at the base of a ridge north of Back Channel Road at Bagotville. These trees are assessed to have a high local level of scientific and cultural significance and may be affected depending upon the final alignment of the preferred route.
Wardell to Bruxner Highway	No sites identified	Due to extensive disturbance by sugar cane cultivation, cattle grazing, house construction and development of the existing Pacific Highway this section of the preferred route would not have any substantial archaeological potential.

Additional investigations are required. A number of appropriate management strategies would be implemented to minimise any impacts on all identified sites.

Non-Aboriginal heritage

The preferred route traverses riverine, agricultural and bushland areas and incorporates corridors of land adjacent to the existing Pacific Highway.

Heritage register searches have shown that the preferred route does not contain any items identified as having either local or State heritage significance. However there are known heritage items that could be affected by the preferred route. These are listed in **Table 7-9** and shown in **Figure 7-16**, **Figure 7-17** and **Figure 7-18**.



Figure 7-16 Preferred route - heritage - section 1

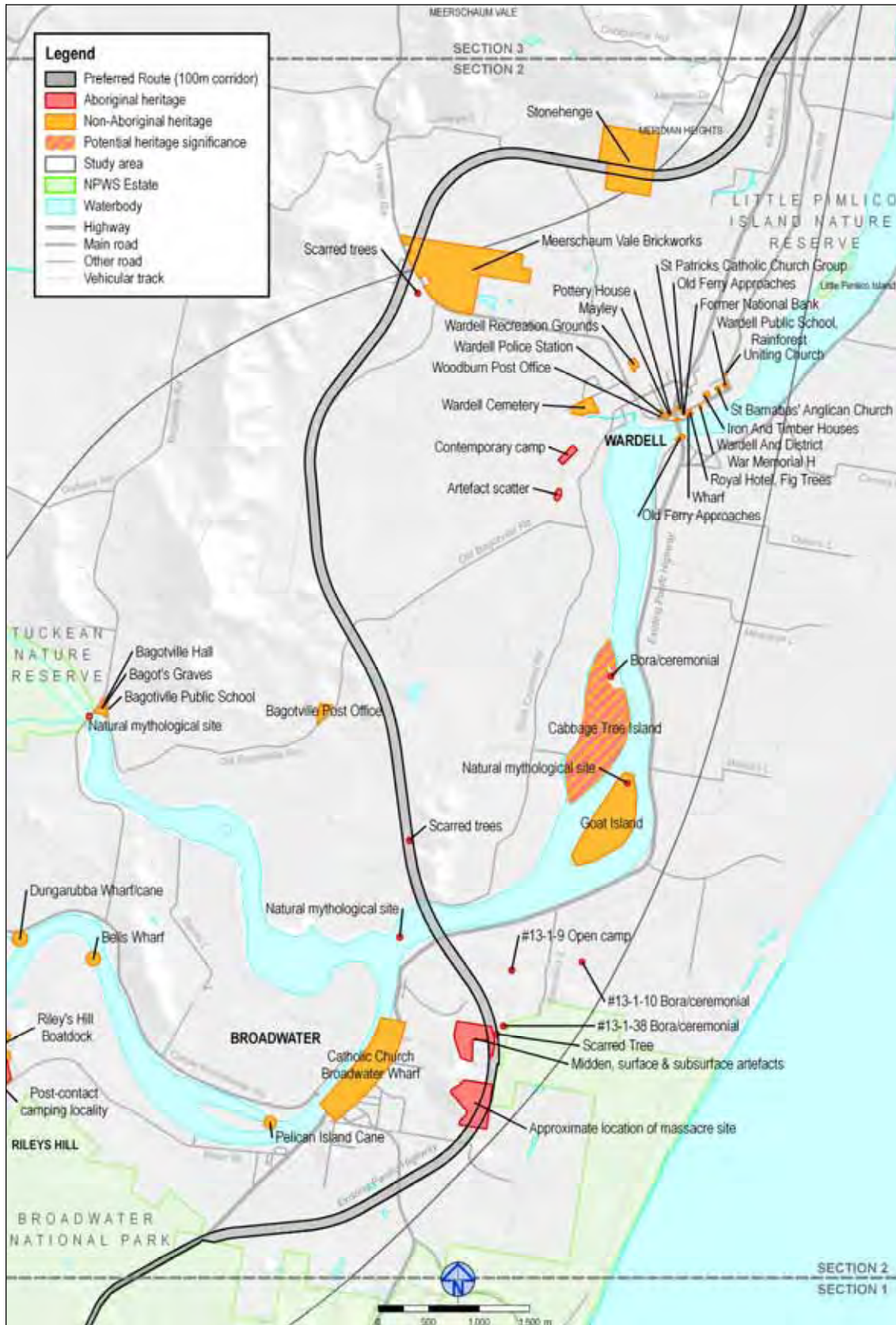


Figure 7-17 Preferred route - heritage - section 2

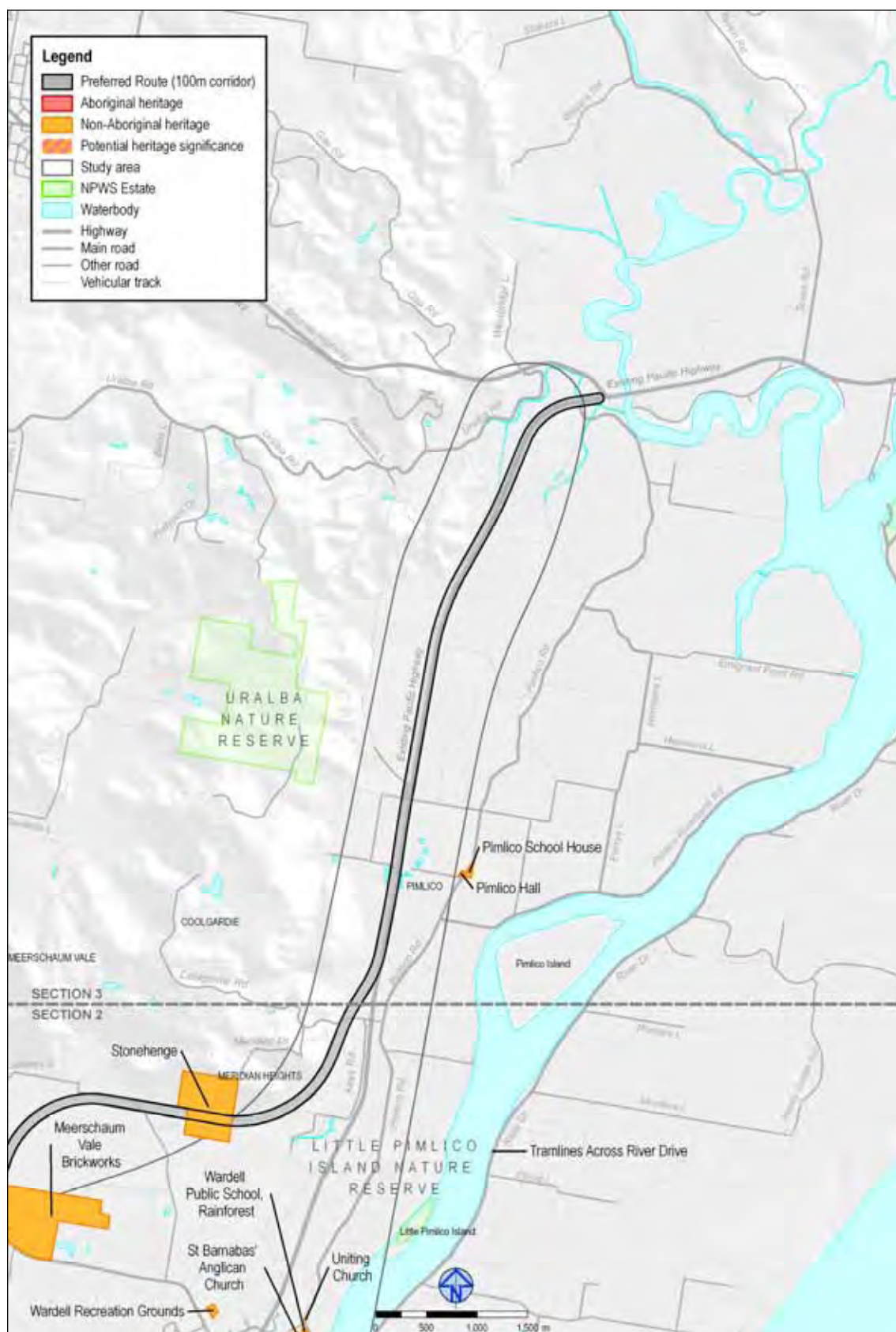


Figure 7-18 Preferred route - heritage - section 3

Table 7-9 Non-Aboriginal heritage sites

Location	Site	Description
Woodburn to Broadwater National Park	Stock route	Connects North Woodburn and Woodburn abattoir. Remains of the construction and any modifications of the stock route could be affected. Remains relating to its usage could also be affected.
	Tuckombil Canal	Remains could be affected on either side of the canal relating to the construction and later modification of the canal. Moorings and punts may also be found along the canal bank. Remains relating to early use of the canal could be affected adjacent to its banks
	Extant buildings	Original dwellings and agricultural buildings are scattered throughout the area. The preferred route could impact on these and evidence of past occupation.
	Lang Hill Quarry	The preferred route is close to Lang Brick Quarry which was recently listed in a draft heritage report for Richmond Valley Council as an industrial site of local significance.
	Drainage channels	Topographic and anecdotal evidence indicate that a number of drainage channels may be located within the preferred route. Many of these canals were constructed in the late 19 th / early 20 th century.
Broadwater National Park to Wardell	Three quarry sites	Road construction works in these areas are likely to impact on remains of quarrying / industrial activity.
	Meerschaum Vale brickworks	Anecdotal evidence indicates that brickworks may have been present. The landowner advises that there are no remnant brickworks on the land and has not given permission for further investigations to occur. If the brickworks do occur and are affected by the preferred route, evidence of early industrial activity is likely to be disturbed.
	Extant buildings	Original dwellings and agricultural buildings are scattered throughout the area. The preferred route could impact on these and evidence of past occupation.

Location	Site	Description
	'Stonehenge'	Potential adverse impact on the land surrounding the buildings but not the buildings themselves. Access to 'Stonehenge' would also be affected.
	'Oakvale'	Oral evidence of a heritage building in Meerschaum Vale area. Exact location is not known, but this building and associated remains of agricultural activities could be affected by the preferred route.
Wardell to Bruxner Highway	No sites identified	The land beside the existing highway is predominantly used for rural purposes, commercial activities and contains pockets of bushland.

Additional investigations are required. A number of appropriate management strategies would be implemented to minimise any impacts on all identified sites.

7.2.8 Biodiversity

As discussed in Section 2.7.1, the study area for the Woodburn to Ballina upgrade contains large areas of important high quality habitat. The preferred route has been selected to minimise the impact on these areas.

The potential ecological impacts of the preferred route are summarised in **Table 7-10** in terms of the sum of areas impacted compared with the total area contained within the preferred route corridor.

Table 7-10 Potential ecological impacts based upon preferred route footprint

Type		
Endangered Ecological Communities	51.97	hectares
Native vegetation	65.77	hectares
Regional and subregional fauna corridors	6.00	number

Flora

Figure 7-19, Figure 7-20, and Figure 7-21 illustrate the potential ecological impacts (vegetation communities) of the preferred route.

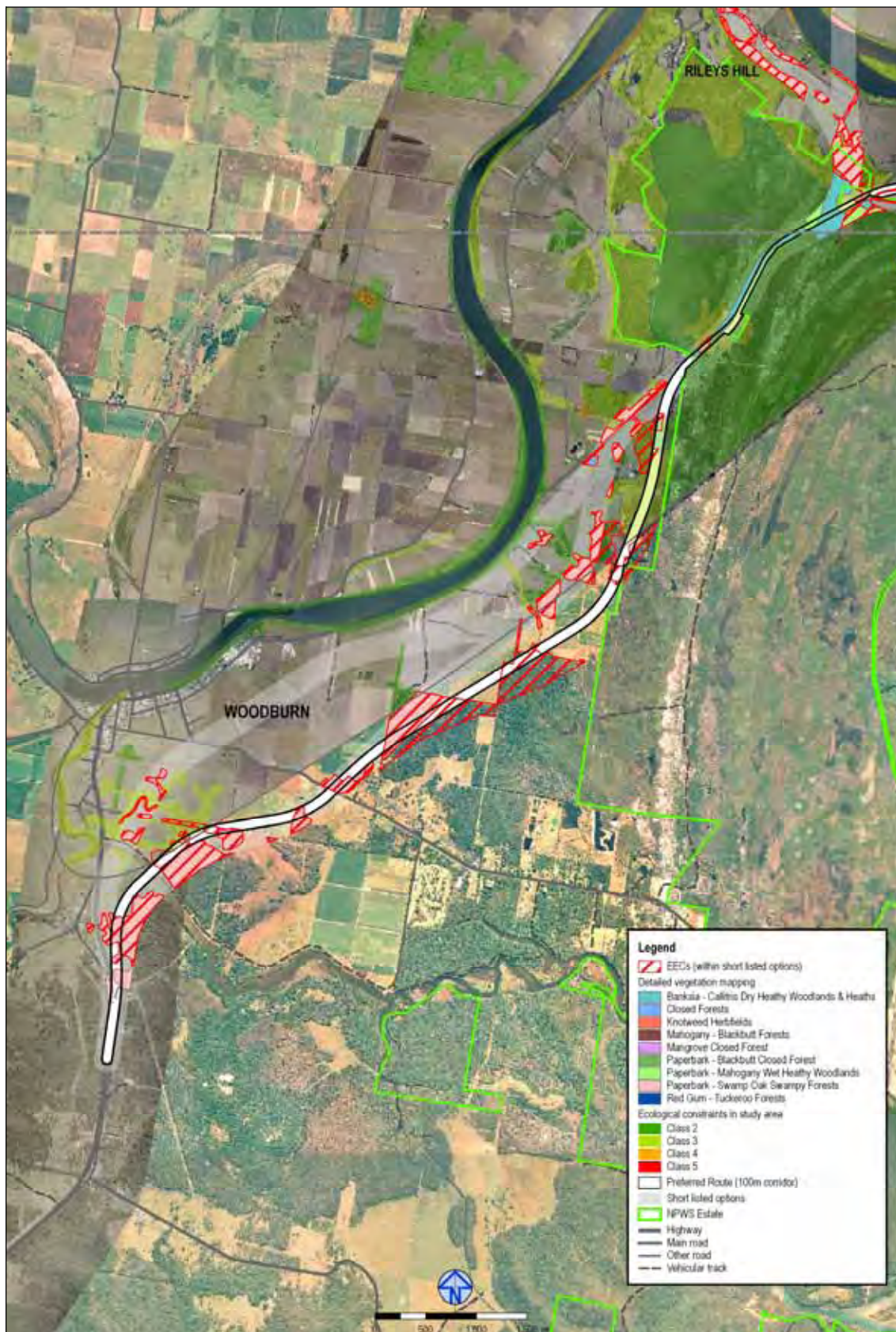


Figure 7-19 Preferred route - ecological impacts (vegetation communities) - section 1

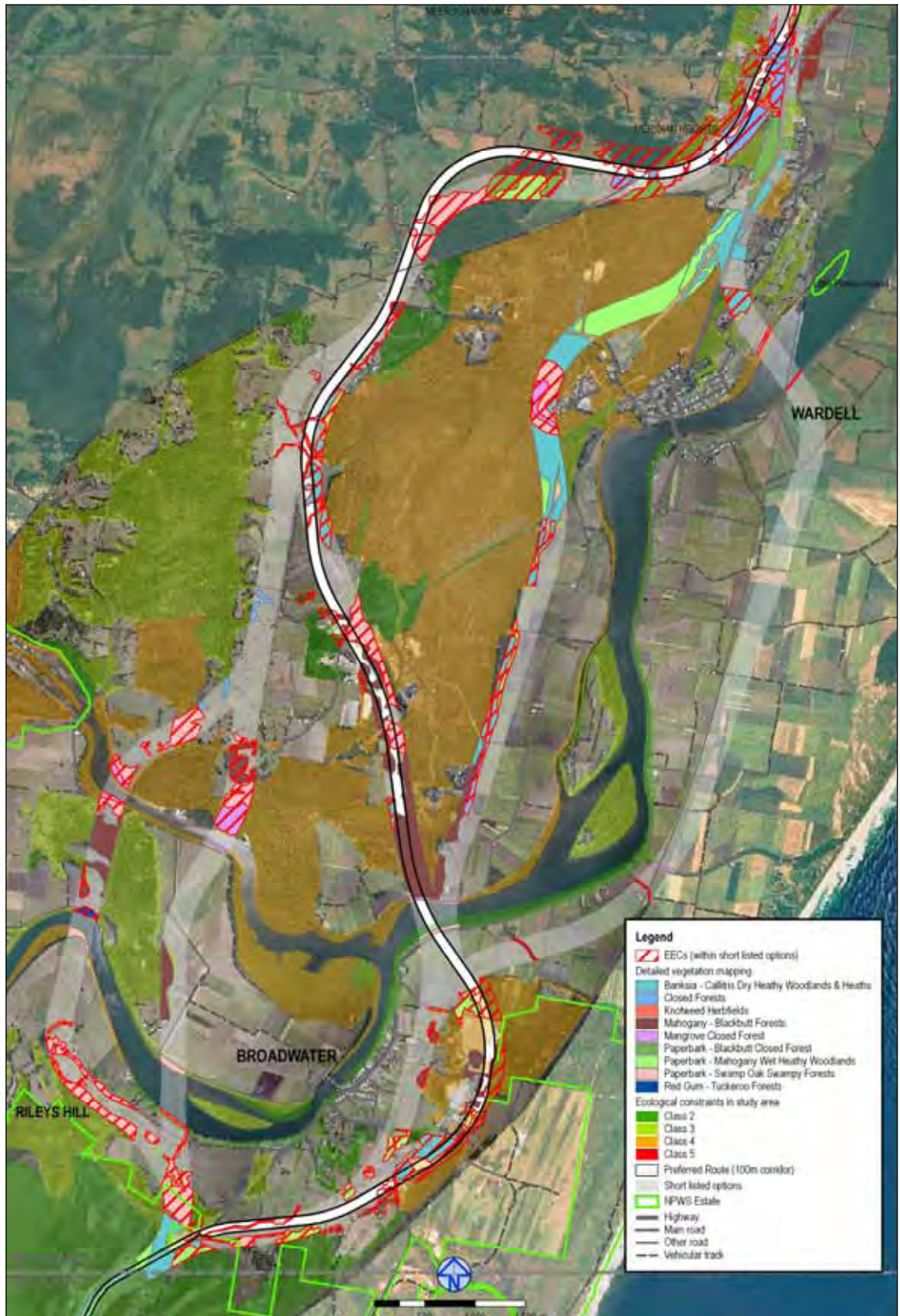


Figure 7-20 Preferred route - ecological impacts (vegetation communities) - section 2

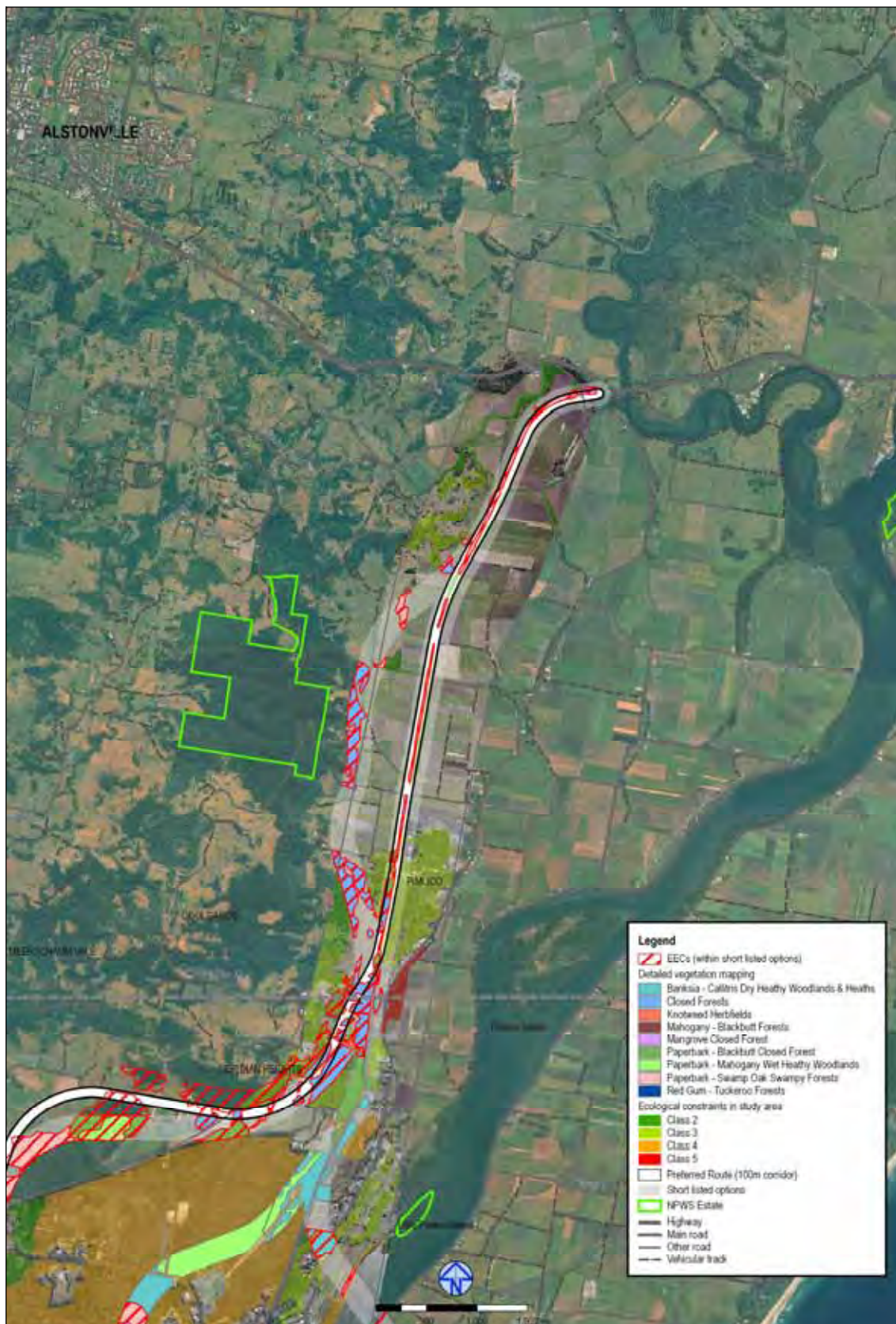


Figure 7-21 Preferred route - ecological impacts (vegetation communities) - section 3

The preferred route would impact on the following broad vegetation communities:

- Banksia – Callitris Dry Heathy Woodlands.
- Paperbark – Mahogany Wet Heathy Woodlands.
- Paperbark – Blackbutt emergent Closed Forest.
- Mahogany – Blackbutt Forests.
- Paperbark – Swamp Oak Swampy Forests.
- Knotweed Riparian Herbfields.
- Closed Forests.
- Mangrove Closed Forests.

The desktop assessment and field surveys undertaken to date have identified several known and potential threatened plant species that would be affected by the preferred route, including but not limited to, those described in **Table 7-11**.

Table 7-11 Potential threatened plant species

Common Name	Species Name
Thorny Pea	<i>Desmodium acanthocladum</i>
White Lace Flower	<i>Archidendron hendersonii</i>
Rough-shelled Bush Nut	<i>Macadamia tetraphylla</i>
No Common Name	<i>Geijera paniculata</i>
No Common Name	<i>Isoglossa eranthemoides</i>
No Common Name	<i>Marsdenia longiloba</i>
Red Lilly Pilly	<i>Syzigium hodgkinsoniae</i>
Rusty Rose Walnut	<i>Endiandra hayesii</i>
Scale Myrtle	<i>Austromyrtus fragrantissima</i>
Lesser Swamp Orchid	<i>Phaius australis</i>

Fauna

The desktop assessment and field surveys undertaken to date have identified several known and potential threatened species that could be affected by the preferred route including, but not limited to those described in **Table 7-12**.

Table 7-12 Potential threatened fauna species

Common Name	Species Name
Birds	
Grass Owl	<i>Tyto capensis</i>
Powerful Owl	<i>Ninox strenua</i>
Masked Owl	<i>Tyto novaehollandiae</i>
Black Bittern	<i>Ixobrychus flavicollis</i>
Bush-stone Curlew	<i>Burhinus grallarius</i>
Rose-crowned Fruit-Dove	<i>Ptilinopus regina</i>
Wompoo Fruit Dove	<i>Ptilinopus magnificus</i>
Superb Fruit-Dove	<i>Ptilinopus superbus</i>
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>
Brolga	<i>Grus rubicunda</i>
Osprey	<i>Pandion haliaetus</i>
Square-tailed Kite	<i>Lophoictinia isura</i>
Alberts Lyrebird	<i>Menura alberti</i>
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>
Mangrove Honeyeater	<i>Lichenostomus fasciogularis</i>
Mammals	
Koala	<i>Phascolarctos cinereus</i>
Long-nosed Potoroo	<i>Potorous tridactylus tridactylus</i>
Squirrel Glider	<i>Petaurus norfolcensis</i>
Common Blossom-bat	<i>Syconycteris australis</i>
Eastern Long-eared Bat	<i>Nyctophilus bifax</i>
Little Bentwing-bat	<i>Miniopteris australis</i>
Common Bentwing-bat	<i>Miniopteris schreibersii</i>
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>
Greater Broad-nosed bat	<i>Scoteanax rueppellii</i>
Grey-headed Flying –fox	<i>Pteropus poliocephalus</i>
Black Flying-fox	<i>Pteropus alecto</i>
Common Planigale	<i>Planigale maculata</i>
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>
Amphibians	
Wallum Froglet	<i>Crinia tinnula</i>
Olongburra Frog	<i>Litoria olongburensis</i>
Common Eastern Froglet	<i>Pseudechis porphyriacus</i>

Common Name	Species Name
Molluscs	
Mitchell's Rainforest Snail	<i>Thersites mitchellae</i>

Additional threatened flora and fauna species and/or communities may be listed under the TSC Act or the EPBC Act during the further development of the preferred route. Listings under these Acts would need to be monitored and the potential impact of the preferred route on additional listed species and/or communities would need to be assessed.

More detailed ecological assessments would be undertaken during concept design and for inclusion in the environmental assessment. Over this time it is possible that, depending on the findings of detailed surveys, the final alignment of the preferred route could be moved to avoid areas of significance within the preferred route corridor. Mitigation measures would be identified during these detailed ecological assessments.

7.2.9 Flooding and drainage

The route option development process for the Woodburn to Ballina Pacific Highway upgrade has modelled the flooding impacts and identified the capital works required to mitigate flooding impacts within the Richmond River floodplain. The hydrological and hydraulic modelling undertaken for the route options assessment has formed the basis for the flooding impact assessment for the preferred route.

The flood model used for the hydraulic modelling was an integrated 1D/2D model (SOBEK). The 1D river cross sections were taken from the WBM (1999) Mike 11 model, and the 2D terrain model was developed from photogrammetry supplemented with ground survey. A two-dimensional model was considered necessary to adequately describe flooding impacts of the route.

The preferred route crosses two major rivers, the Evans River (Tuckombil Canal) near Woodburn and the Richmond River at Broadwater. Each bridge crossing needs as a minimum to span the river channel and to allow for a sufficient floodway to minimise afflux. The preferred route also passes across a flood conveyance/storage area south-east of Woodburn towards the National Park near Broadwater (refer **Figure 7-22**). This area drains to the Evans River, providing an important connection from the Pacific Ocean at Evans Head to the Richmond River at times of flood. Within this area, bridges would be required to allow flood flows to 'balance' by allowing flows from the Richmond River to discharge to the Evans River.

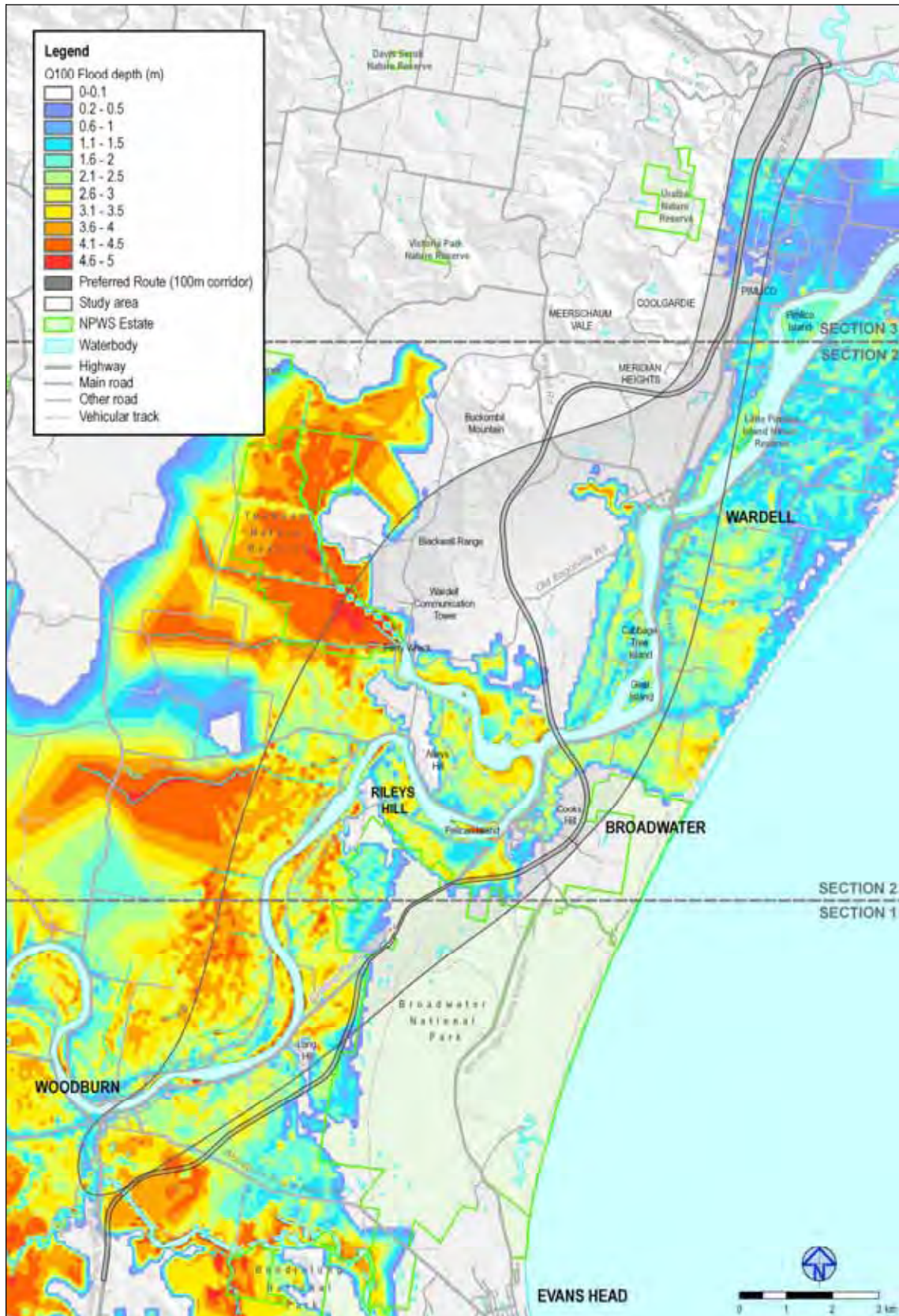


Figure 7-22 Preferred route – Q100 flood depth

Preliminary design has indicated, based upon preliminary concept design assumptions, that the structures shown in **Table 7-13** would be required to limit flood impacts to a target maximum afflux of 50 mm in the 100 year ARI flood. The project would be provided with a flood immunity to the 20 year ARI within floodplain areas and the 100 ARI elsewhere.

Table 7-13 Hydraulic structures required for flood mitigation

Structure	Description	Clear Opening*	Bridge Length*
Bridge	Tuckombil Canal Crossing		350 m
Bridge	Richmond River Crossing		840 m
Floodwater bridging	Floodplain balancing and provision of local drainage south of Broadwater	880 m	

* Bridge lengths and openings listed are minimum openings to maintain a 50 mm afflux. Bridge lengths may be larger to accommodate geotechnical and structural constraints, and are subject to refinement of concept design and further studies.

Data has been obtained for the floor levels of 836 properties (residences and businesses) in Coraki, Woodburn, Broadwater and Wardell to estimate the number of properties affected by an increase in the 100 year ARI afflux. The number of properties affected by various afflux ranging from existing conditions (0 mm afflux) to 100 mm afflux is shown in **Table 7-14**.

The increase in afflux is generally estimated to occur upstream of Broadwater, past Woodburn to Swan Bay, and extend into the Tuckean Swamp.

Table 7-14 Estimate of properties potentially flood affected in Coraki, Woodburn, Broadwater and Wardell

Afflux (mm)	Number of floor levels potentially flooded	Additional floor levels potentially flooded	Max depth of inundation (m)	Mean depth of inundation (m)
No change	449	-	3.24	0.76
50	471	22	3.29	0.77
75	481	32	3.31	0.78
100	490	41	3.34	0.79

The route option assessment modelling has indicated that the preferred route can achieve flood immunity for the 20 year ARI within the floodplain, and for the 100 year ARI elsewhere, where appropriate cross drainage through the floodplain is provided. The section of the preferred route north of the Richmond River crossing at Broadwater is dominated by localised flooding that would be managed by providing cross drainage under the highway.

Hydraulic modelling of the preferred route during the concept design would refine the assessment of floodplain conveyance and structures deemed necessary to mitigate flood impacts.

7.2.10 Economic evaluation

The economic analysis evaluated the preferred route in accordance with NSW Treasury guidelines and is consistent with the NSW RTA *Economic Analysis Manual*.

The project analysis starts in 2005, with construction commencing in 2012 and a projected opening time of 2015. The analysis timeframe is over a 30 year period ending in 2035.

Project development costs include inputs such as investigations, traffic demand analysis, construction and project management. Economic benefits were assessed for impacts on vehicle operating costs, travel time savings, vehicle accidents, recreation and tourism, business and agriculture.

The results, shown below in **Table 7-15**, represent the analysis of the preferred route, relative to the 'Do Nothing' or base case that is the Pacific Highway as it currently stands.

Table 7-15 Economic analysis summary

Preferred route	Low project cost	High project cost
Length (km)	36.1	36.1
Project Cost (\$'000)	589,970	646,712
Development Cost per km (\$'000)	16.321	17,891
PROJECT COSTS (Present Value \$'000)		
Development & Construction Costs	376,071	412,241
SUB TOTAL COSTS	376,071	412,241
PROJECT BENEFITS (Present Value \$'000)		
Vehicle Operating Costs*	(29,223)	(29,223)
Travel Time*	19,458	19,458
Accident Costs*	42,926	42,926
Residual Value	18,628	24,211
Tourism and Recreation	4,050	4,050
Amenity Impacts	33,448	33,448
Ecological Impacts	112	112
Business Impacts	28,069	28,069
SUB TOTAL BENEFITS	117,468	117,468
RESULTS		
Net Present Value (\$'000)	(258,603)	(289,190)
Benefit Cost Ratio	0.3	0.3

* VOCs, travel time and accident costs are expected to overestimate the benefits, since the traffic (kms travelled, travel time) have not been adjusted to reflect the increase in length of the updated route.

The preferred route result indicates a negative Net Present Value (NPV) and Benefit Cost Ratio (BCR) less than 1. However, there are a number of non-quantifiable factors that should be considered in the evaluation decision that have not been accounted for in the economic analysis.

Economic Analysis of Pacific Highway Program

It has been estimated that, following the ten year upgrading program in June 2006, there remains \$6.1 billion of works to complete upgrading the Pacific Highway to a good dual carriageway standard (mixture of highway standard and freeway standard dual carriageway road). A further \$1.9 billion would be required to upgrade the Pacific Highway to a full limited access, freeway standard road with alternative route suitable for local traffic use. This latter work would include retro-fitting interchanges and service roads on lengths of dual carriageway completed before July 2006.

The projects included in the post-2006 \$6.1 billion program are shown in **Table 7-16**. The \$8.0 billion program requires building projects indicated as being highway standard in that table to the freeway standard instead. As well as retro-fitting works on the lengths listed in **Table 7-17**.

Table 7-16 Lengths to be upgraded in \$6.1 billion program

Karuah to Bulahdelah - sections 2&3	Wells Crossing to Harwood
Bulahdelah upgrade	Harwood to Iluka Road *
Coopernook to Moorland *	Iluka Road to Woodburn *
Moorland to Herons Creek *	Woodburn to Ballina
Oxley Highway to Kempsey *	Ballina bypass
Kempsey to Eungai	Tintenbar to Ewingsdale
Warrell Creek realignment *	F3 to Raymond Terrace
Macksville to Urunga	Failford Road to Tritton Road *
Bonville upgrade	Herons Creek to Stills Road *
Sapphire to Woolgoolga *	Coffs Harbour bypass
Woolgoolga to Wells Crossing *	Banora Point upgrade

* Indicates to be constructed to highway standard in this program

Table 7-17 Lengths that require retro-fitting work in \$8.0Billion program

Raymond Terrace to Karuah	Coopernook bypass
Karuah to Bulahdelah - section 1	Hérons Creek Deviation – remainder
Bulahdelah to Coolongolook	Eungai & Allgomera duplication
Coolongolook to Wang Wauk	Raleigh Deviation
Wang Wauk to Bundacree Creek	Lyons Road to Englands Road
Bundacree Creek to Possum Brush	Korora Hill to Sapphire
Rainbow Flat Deviation – remainder	Ewingsdale to Tyagarah
Taree bypass	Chinderah bypass
Taree to Coopernook	

The net present value and benefit cost ratios for the remaining works have been calculated assuming that the works are all completed by 2016. The benefits considered are travel time savings, vehicle operating cost savings and crash cost savings. A breakdown of the costs and benefits as well as the economic return measures are shown in **Table 7-18**.

Table 7-18 Costs, benefits and economic return measures

	Mix of highway and freeway upgrade	Full freeway standard upgrade
Capital Cost (undiscounted)	6,107	8,063
Present Value		
Costs		
Capital	4,085	5,285
Incremental O&M	133	147
Total Costs	4,218	5,432
Benefits		
<i>Road user cost savings</i>		
- Vehicle operating costs		
Light vehicles	985	945
Heavy vehicles	932	931
- Travel time costs		
Light vehicles	2,165	2,514
Heavy vehicles	472	481
- Crash costs	590	654
Sub-total	5,144	5,524
<i>New trips</i>	413	448
Total Benefits	5,557	5,972

	Mix of highway and freeway upgrade	Full freeway standard upgrade
Economic Return Measures		
Net present value	1,339	540
Benefit-cost ratio	1.3	1.1

In addition, there are other benefits that are not included in the traditional road user benefit-cost calculations. These are new or expanded business and employment opportunities arising from the road construction sector expenditures associated with the Program. These expenditures would have output, employment and household income consequences, both directly and indirectly as industries supplying the road construction sector respond to the increased demand for their products and households respond to the additional income earned.

Table 7-19 provides estimates of the generation of employment and induced economic activity from the construction expenditure associated with the upgrade program beyond 2006. These estimates are based on applying multiplier outputs from existing models which incorporate estimation of the economic effects of changes in the output of the road construction industry.

Table 7-19 Estimated Regional Economic Impacts During Construction Period⁽¹⁾

	Hunter SD	Mid-North Coast SD	Richmond Tweed SD	Total
Total employment created ⁽²⁾	9,100-16,000	53,000-68,000	23,000-26,000	85,000-110,000
Increase in output ⁽³⁾	\$540m-960m	\$2,100m-2,700m	\$930m-1,100m	\$3,600m-4,800m
Total household income generated ⁽⁴⁾	\$310m-550m	\$1,500m-2,000m	\$670m-750m	\$2,500m-3,300m

Notes:

- (1) Lower end of range is for \$6.1 billion program, higher end is for \$8.0 billion program.
- (2) In road construction sector and in all sectors after allowing for multiplier effects. Jobs are measured in persons years, where a person year is equivalent to one full-time job for one person for one year.
- (3) In sectors other than road construction (in \$million).
- (4) In all sectors (in \$ million).

Sensitivity analysis

It should be noted that the following factors would significantly affect the actual project BCR:

- capital cost estimates assume a 28% contingency;

- variances in assumed traffic growth rates;
- variances in assumed accident rates;
- variance in the assumed discount rate; and
- scope changes during the development of the concept design.

7.3 Bruxner Highway interchange section of the Ballina Bypass upgrade

Immediately north of the Woodburn to Ballina section of the Pacific Highway upgrade is the Ballina Bypass upgrade. An environmental impact statement (EIS) and concept design was completed for the Ballina Bypass in February 1998. Environmental studies for the project are complete and the project has been approved.

The current design for the Ballina Bypass incorporates a partially grade separated interchange at the Bruxner Highway, refer to **Figure 7-23** and **Figure 7-24**.

Current Pacific Highway design standards require that interchanges be grade separated, therefore a review of this section of the Ballina Bypass upgrade will be undertaken to improve highway safety and short trips between interchanges.



Figure 7-23 Bruxner Highway intersection artist impression (EIS ultimate scheme)

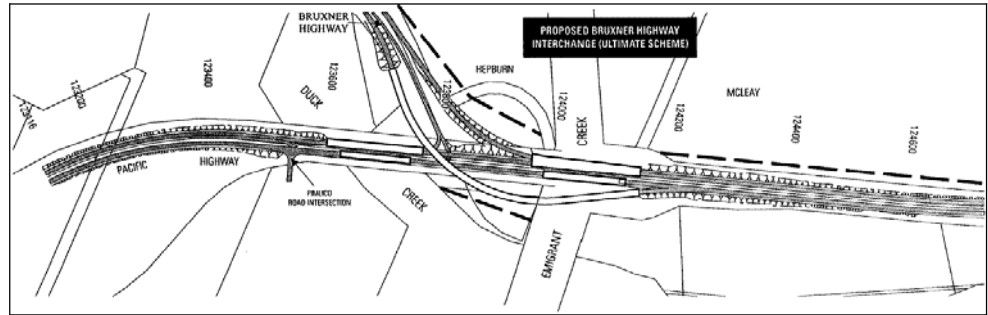


Figure 7-24 Bruxner Highway intersection schematic (EIS ultimate scheme)

8 The next steps

8.1 Woodburn to Ballina upgrade

Following the announcement of the preferred route for the Woodburn to Ballina project the RTA proposes to submit the Woodburn to Ballina project to the Department of Planning for approval under Part 3A of the EP&A Act.

Further survey, geotechnical, ecological and other investigations would also be undertaken to provide input into the refinement of the design and environmental assessment.

The level of environmental assessment (EA) required for a proposal under Part 3A would be determined by the Director-General of Planning, who issues EA requirements after consultation with the relevant public authorities and local Councils. The EA may include a statement of commitments in respect of environmental management and mitigation measures proposed to be undertaken if the project is approved.

When completed, the EA would be publicly exhibited and submissions would be sought. The RTA may be asked to prepare a report on the submissions and revise its statement of commitments. It would also consider modifications to the project to minimise environmental impacts. The Department of Planning (DoP) may request the RTA to display, for public information, a Preferred Project Report which identifies the proposed modifications.

The DoP would consider the EA, the public submissions and any report requested from the RTA in recommending to the Minister for Planning whether the project should be approved.

8.2 Bruxner Highway interchange section of the Ballina Bypass

The current design of the Bruxner Highway interchange section of the Ballina Bypass will be reviewed to assess possible improvements in functionality and safety by reconfiguring the interchange at the Bruxner Highway.

This would be undertaken without amending the Pacific Highway upgrade alignment presented in the Ballina Bypass EIS.

The review will reassess existing information available on a range of engineering, planning, environmental and cost factors in relation to alternative configurations.

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Appendix A

Community Alternative route report



**Woodburn to Ballina
Route Selection Study for
SH10 the Pacific Highway**

**Investigations into the
Community Alternative
Route**

Issue: October 2005

NSW Roads and Traffic Authority

SH10 Pacific Highway Upgrade Woodburn to Ballina

Investigations into the Community Alternative Route

Author: Tanya Coates

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Report no: 5080-NS02500-NSR-06

Date: October 2005

This report has been prepared for NSW Roads and Traffic Authority of New South Wales in accordance with the terms and conditions of appointment for Route Selection Study for SH10 Pacific Highway dated 23 August 2004. Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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Appendix A

CA Route Submission

Appendix B

Stakeholder background information

Appendix C

Vegetation/habitat types

Appendix D

Threatened Fauna Species

Executive Summary

Some members of the Woodburn to Ballina community liaison group (CLG) suggested an alternative route to the east of the identified long list of options because of their concerns of the impact of a new roadway on the existing flooding regimes, known as the Community Alternative route (CA route). This route was considered in the *Route Options Development Report – Stage 1* (RTA, 2005a), however, during the route options display, a detailed submission concerning this route was received by the study team.

The route was suggested by the community because it was perceived to be a “flood free” route from south of Woodburn and to the east of the study area. The route was described as “flood free” because it was believed to be located outside the floodplain. Additional investigations were undertaken based on the strength of this submission.

The purpose of this report is to assess the proposed CA route. The assessment consists of desktop studies of existing information for geology, hydrology, ecology, heritage, other environmental issues and engineering constraints.

The desktop studies were also supplemented by a site visit to the accessible parts of the CA route by a number of key members of the study team. Where key impacts were identified further investigations in the field were undertaken to verify the potential impacts of the route. This included preliminary ecological surveys and preliminary Aboriginal heritage field investigations and consultation with some members of the local Aboriginal community.

To undertake the assessment, a comparison was made with the base case, defined as the upgrading of the existing Pacific Highway from the southern start of the CA route to the substation south of Tuckombil Canal, Option 1C and part of Option 2E to the south of the Richmond River.

The advantages of the CA route include:

- Engineering advantages over the base case route because this route generally follows higher ground and therefore is less flood affected. This reduces:
 - Need for flood viaducts to maintain Richmond River floodplain storage.
 - Need for soft soil improvements.
 - Need for the importation of large quantities of fill material.
- Approximately 10% cheaper than the base case.

The disadvantages of the CA route include:

- Does not satisfy its main objective of being outside of the floodplain.
- Need to acquire and provide compensatory habitat for NPWS estate (55.1 hectares).

- Need to construct an additional 6km of new highway corridor instead of re-using the existing highway corridor, which is otherwise satisfactory in terms of geometry.
- Impacts on the ecology within both Broadwater and Bundjalung National Parks and other vegetated areas south of the Evans River would be much higher than the base case, as there is a larger area of undisturbed native vegetation.
- Ecology surveys identified endangered ecological communities and numerous threatened species within the route.
- The Evans River is of a high quality due to the amount of river that is undeveloped. A crossing over the river would have high impacts on the quality of the river and the important ecological habitats it supports.
- Traverses some areas of high Aboriginal cultural significance around the Evans River. The route passes through more undisturbed land and traverses more landforms of potential archaeological sensitivity than the base case and thus has more potential to intercept archaeological sites.
- Impacts directly on areas of NPWS estate, predominantly the Broadwater National Park. The Department of Environment and Conservation (DEC) has provided preliminary advice that this National Park is of high importance due to the large number of threatened species that occur within the park boundaries. Revocation of National Park status is undertaken through negotiations with DEC and an Act of Parliament. However DEC policy on the revocation of a National Park states that this would only occur if there was no other feasible and reasonable option.

The conclusion of the assessment of the CA route was that it should not be included into the short list of route options due to the environmental and Aboriginal cultural impacts and statutory implications with a route passing through Broadwater and Bundjalung National Parks.

1 Introduction

1.1 Background

During the process of developing an upgrade option for the Woodburn to Ballina Pacific Highway Upgrade a submission for a new route was received from a number of community members. The community members submitting the alternative route state that the intended purpose of this route is to provide a “flood free” route from south of Woodburn and to the east of the study area. The route is known as the Community Alternative route (CA route).

The advantages of this option as stated by community members are:

- Greater level of natural flood immunity
- Avoids major town centres
- Low impact on cane farms, and
- Reduced length of bridge structures.

Appendix A contains a submission that was prepared by some members of the community in support of this route.

1.2 Community Alternative route description

The CA route proposed by community members was provided to the Project Team and is depicted in **Figure 1-1** labelled “draft CA route”. The project team examined this route and adjusted the alignment to provide the required curves, minimise some of the environmental impacts and minimise the extent of Bundjalung National Park within the corridor. Below is a description of the line labelled “CA route alignment” in **Figure 1-1**.

The existing Pacific Highway alignment, south of Turners Road, is the starting direction for the CA route as it heads in a north easterly direction from the Pacific Highway. The alignment forms a gently curvilinear shape between Turners Road and The Gap Road. Approximately 1 km north east of The Gap Road the alignment turns to the north so that it passes through the low point of a ridge at the north western extremity of the Bundjalung National Park, south of Doonbah.

The crossing point of the Evans River has been chosen to minimise river instability, avoid protected SEPP14 wetlands and to keep the river crossing as short as possible. The alignment is weaved between SEPP14 wetlands on the southern and the northern banks of the Evans River.

On the northern bank of the Evans River the alignment turns northward on the western side of Doonbah. The road would be about 125 m west of the small subdivided lots at Doonbah. A full diamond interchange is assumed on the Woodburn to Evans Head Road.

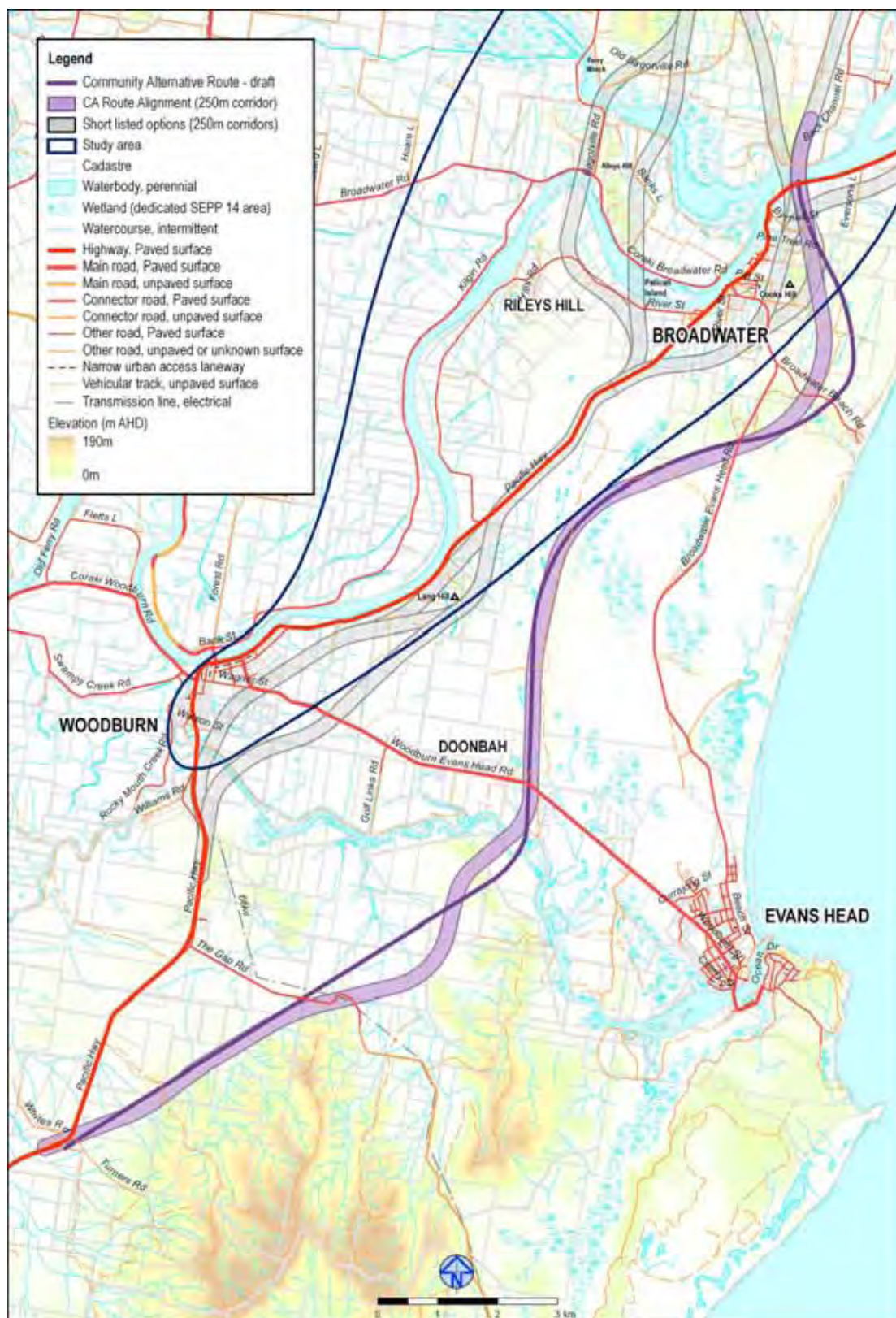


Figure 1-1 CA route alignment

The alignment crosses the Woodburn to Evans Head Road to align with the sand mining dredging path in the Broadwater National Park. The highway then turns gently northward to follow the centre of the dredged path through the Park.

About 1.25 km from the existing Pacific Highway, near McDonalds Creek, the route turns in a north easterly direction and crosses Broadwater – Evans Head Road approximately 125 m south east of the lookout. The Broadwater – Evans Head Road would be constructed over the at grade motorway. From this point the road then curves in a large radius towards Cooks Hill. It then heads to the Richmond River where a full diamond interchange is assumed on the southern side of the Richmond River. The CA route then crosses the river in the same location as Option 2E from the short listed route options.

The route north of the Richmond River generally follows Option 2E or 2D and therefore will not be assessed further as this alignment is discussed in detail in the Route Options Development Report.

1.3 Purpose of this report

The purpose of this report is to assess the proposed CA route. The assessment consists of desktop studies of existing information for geology, hydrology, ecology, heritage, other environmental issues and engineering constraints.

The desktop studies were also supplemented by a site visit to the accessible parts of the CA route by a number of key members of the study team. At this stage private properties were not accessible and due to recent flooding some areas of the Broadwater National Park were also not accessible. The site visit included a trip by boat to investigate the potential crossing of the Evans River.

Where key impacts were identified further investigations in the field were undertaken to verify the potential impacts of the route. This included preliminary ecological surveys and preliminary Aboriginal heritage field investigations and consultation with some members of the local Aboriginal community.

Assessment of the route requires that the interchanges/intersections with other roads are similar to Option 1C for comparison purposes. These assumptions allow a comparison on a cost basis to be made on an equal basis.

2 Characteristics of the CA route study area

2.1 Overview of the CA route study area

The CA route is partly within the Richmond River catchment and partly within the Evans River catchment. Residential rural settlements are scattered along roadways, with larger concentrated townships at Woodburn, Broadwater and Evans Head. Waterways crossed include, from south to north: Sawpit Creek, Brandy Arm Creek, Evans River and the Richmond River. The CA route traverses parts of Broadwater National Park and Bundjalung National Park. **Figure 2-1** shows an aerial photograph of the route.

Evans River

The Evans River is approximately 18 km long and has a catchment area of 6200 ha, most of which is contained within both Broadwater and Bundjalung National Parks. The river supports a large number of threatened species and contains a number of SEPP 14 wetlands. The Evans River catchment has been described by Richmond Valley Council as being largely undisturbed. Approximately 84% of the catchment remains in its natural state and urban development has only occurred at the ocean entrance to the estuary. No sewage or industrial waste is discharged into the river, and no commercial fishing is permitted. (Richmond Valley Council State of the Environment 2004) (WBM Oceanics 2002)

Richmond River

The Richmond River is 170 km in length and has a catchment area of 685000 ha. It includes extensive areas of mangroves and lowland swamp forest as well as significant areas of SEPP 14 wetland.

Broadwater and Bundjalung National Park

Broadwater and Bundjalung National Parks together with Yuraygir National Park and Iluka Nature Reserve to the south, protect much of the long stretch of coastline between the Richmond River in the north and the village of Red Rock in the south. These four areas are recognised as being part of a small number of groupings of protected areas of national and international significance which are found on the east coast of Australia.

Broadwater National Park covers an area of 3,800 ha and consists of an area of heath and wetland that exemplifies the evolution and dynamics of coastal landforms. However some parts of the park have previously been disturbed by sand mining activities, roads and other anthropomorphic activities.

Bundjalung National Park covers an area of 17,000 ha and encompasses a variety of areas including 38 km of beach, littoral rainforest, heathlands, coastal cypress stands, lagoons and wetlands on relatively undisturbed coastal plains.

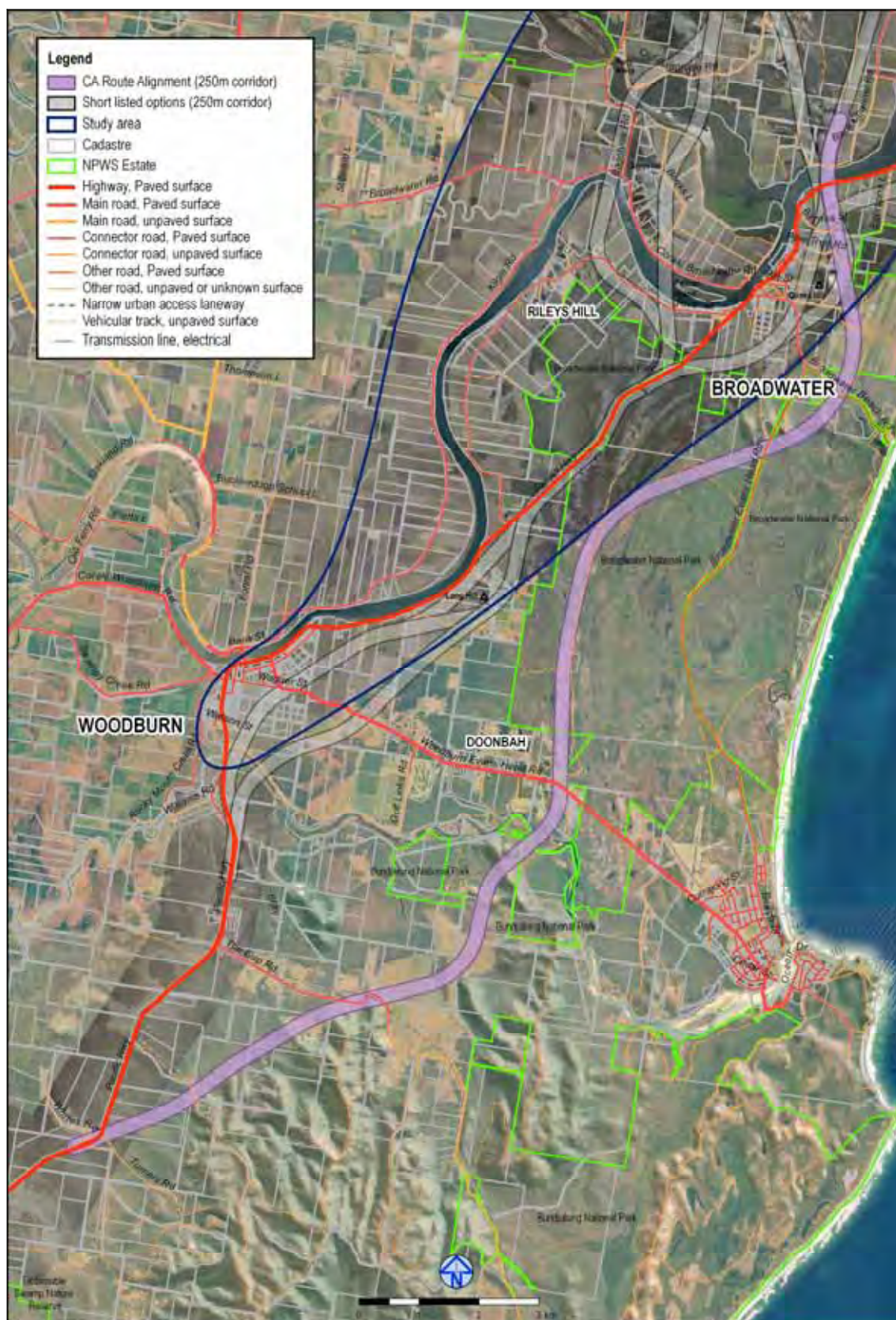


Figure 2-1 Aerial Photograph

2.2 Planning and zoning

This statutory and planning and zoning review identifies the permissibility of the CA route under consideration in relation to current environmental planning instruments that apply within and adjacent to the route.

The CA route encompasses Richmond Valley Council local government area. For the purposes of this review it is assumed that the RTA would be the proponent and determining authority under Part 5 of the Environmental Planning and Assessment Act 1979 and that Richmond Valley Council would be the consent authority under Part 4 of the Act in the situation that any part of a road proposal required Councils' consent.

The recent introduction of Part 3A of the EP&A Act may affect the approval process for the project. The Minister for Planning has declared that Part 3A applies to all projects for which the proponent is also the determining authority and which otherwise would have required an Environmental Impact Statement (EIS) under Part 5 of the EP&A Act. In the event that it is determined by the RTA that the impacts of the project on the environment would be likely to be significant and an EIS would be required for this project, it would become subject to Part 3A of the Act.

If Part 3A does not apply, the project would be subject to environmental assessment by way of a Review of Environmental Factors (REF) prepared in accordance with Part 5 of the EP&A Act.

2.2.1 Richmond River Local Environment Plan (LEP) 1992

The CA route within the Richmond Valley Council area is subject to the provisions of the Richmond River LEP 1992. It should be noted that there is an anomaly between the name of the Council, Richmond Valley, and the title of the LEP, Richmond River. Also, the LEP refers to Richmond River Shire not Richmond Valley Shire.

The Richmond River LEP 1992 is a performance based planning instrument which requires any development proposal to demonstrate that it is consistent with overall aims and objectives, as well as zone objectives, in order to be regarded as permissible. Clause 2 contains several matters of relevance to the proposed upgrading of the Pacific Highway in the Shire. These are:

- to encourage the proper management, development and conservation of the natural and man-made resources within Richmond River Shire, to provide for social and economic welfare of the community and to provide a better environment (1)(a).
- to ensure that development is carried out in such a way as to allow the economic and efficient provision of public services and amenities (2)(c).

- to promote the conservation of productive and potentially productive agricultural land (2)(d).
- to ensure that development occurs or is managed in such a manner that there is minimal risk to sensitive environments, including wetlands, coastal systems, wooded slopes and ridgelines and other similar resources (2)(e).
- to develop a safe, convenient and economic movement system for public and private motor vehicles, cyclists and pedestrians (2)(f).
- to ensure conservation of the heritage items within the Shire, and the historic, architectural and aesthetic character of the villages within the Shire, and the Shire's rural environment (2)(h).

The table below and **Figure 2-2** describes the current land zoning within the study area.

Zoning	Application	Comment
1(a) Rural (Prime Agricultural Land)	Sections around Broadwater	Roads are not prohibited but are permissible with Council consent.
1(b) Rural (Secondary Agricultural Land)	Between Broadwater National Park and the Evans River	Roads are not prohibited but are permissible with Council consent.
1(e) Rural (Extractive and Mineral Resources)	Behind Cooks Hill	Roads prohibited
7(a) Environmental Protection (Wetlands)	Near Evans River	Roads prohibited.
8(a) National Parks & Nature Reserves	Broadwater National Park	Roads prohibited. Road development subject to the requirements of the National Parks and Wildlife Act 1974.
8(b) Proposed Future National Park Extension	Between the eastern and western portions of Bundjalung National Park	Roads prohibited.

There are four zones within the CA route where roads are prohibited in the Richmond River LEP. These are zoned 1(e) Rural (Extractive and Mineral Resources), 7(a) Environmental Protection (Wetlands) which is a SEPP 14 wetland; 8(a) the Broadwater National Park and Bundjalung National Park, and, 8(b) Proposed Future National Park extension, to the north of Broadwater.

With regard to the National Park and Nature Reserves zonings (8(a) and 8(b)), an Act of Parliament would be required to revoke land dedicated or reserved under the Act from within a National Park or Nature Reserve or proposed National Park extension. The Department of Environment and Conservation's Revocation of Land Policy (July, 2002) states that

the revocation of lands reserved or dedicated under the NPW Act will generally be undertaken as an avenue of last resort and only where appropriate, for example to correct a boundary error or encroachment where no other practical options are available.

The Policy provides information as to the process to be followed for development proposal (eg a major highway rerouting or upgrade) to revoke land.

2.2.2 State Environmental Planning Policies (SEPPs)

There are six SEPPs that may apply to the CA route, SEPPs 4, 14, 26, 44, 55 and 71.

SEPP No 4 – Development Without Consent and Miscellaneous Exempt and Complying Development

SEPP No 14 – Coastal Wetlands

SEPP No 26 – Littoral Rainforests

SEPP No 44 – Koala Habitat Protection

SEPP No 55 – Remediation of Land

SEPP No.71 – Coastal Protection

2.2.3 Regional Environmental Plans (REPs)

There is one REP that may apply to the CA route, the North Coast Regional Environmental Plan.

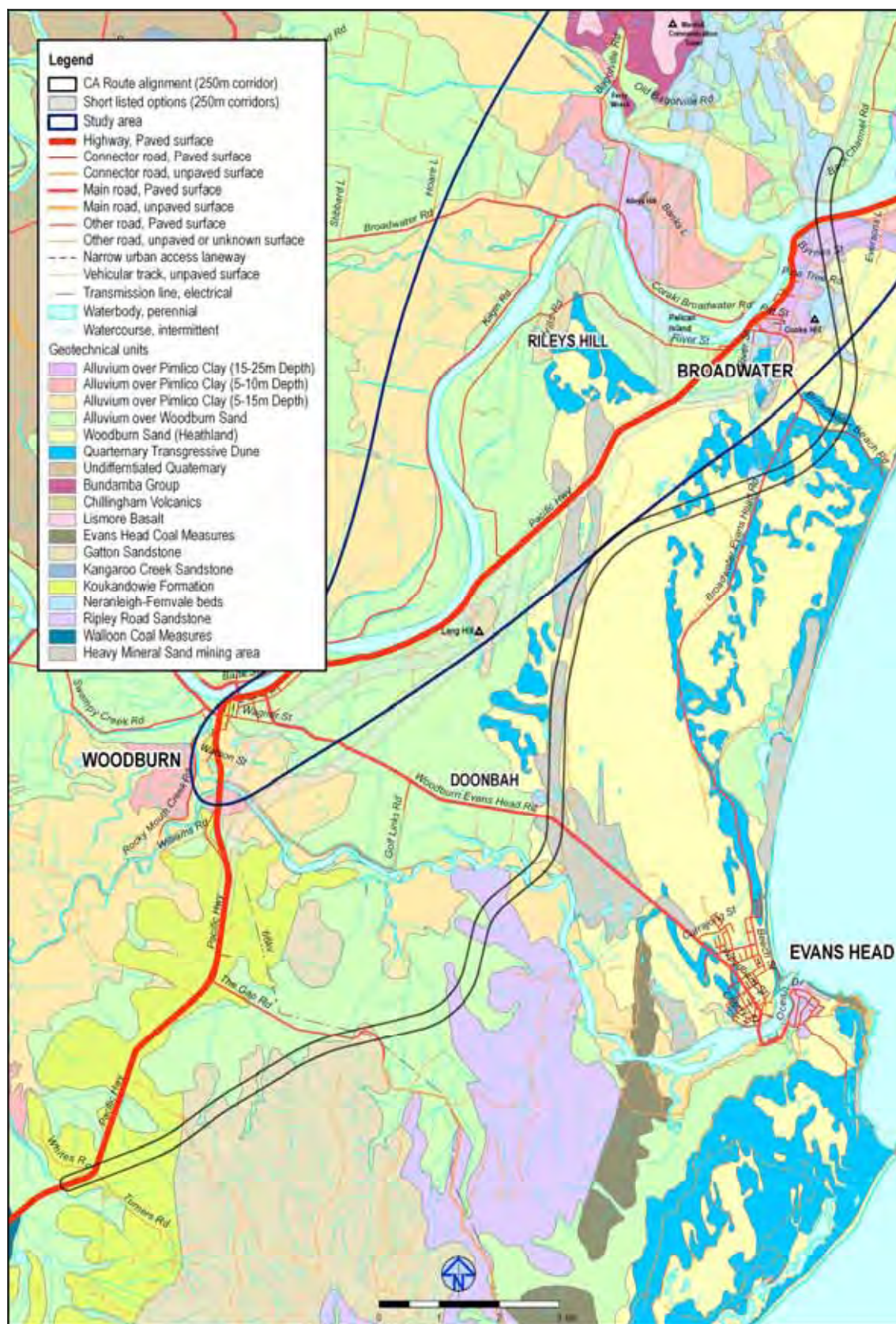
2.3 Biophysical characteristics

2.3.1 Topography, geology and soils

A desktop geotechnical study has been undertaken to assess the potential constraints and considerations of the CA route. The underlying geotechnical units are shown in **Figure 2-3**.

Soil Landscape

In the area extending from the southern end of the CA route to the north near Broadwater, the following nine principal Soil Landscape Units have been identified from the Woodburn 1:100,000 Soil Landscape Series Sheet 9539 (2001).



Unit Symbol	Soil Landscape Type	Unit Name	Brief Description
Gu	Erosional	Gulmarrad	Gently undulating to undulating rises on Koukandowie Formation and Gatton Sandstone. Partially cleared open forest and woodland. Erodible soils, localised outcrops.
OI	Erosional	Olive Gap	Rolling low hills and hills on Gatton Sandstone. Slopes are typically 15% to 35%, with rock outcrop common. Partially cleared open-forest. Steep slopes, rock outcrop, highly erodible, strongly acidic, soils with low permeability.
Pp	Transferral	Pretty Plain	Fans and drainage depressions of alluvium and colluvium derived from Bundamba Group. Slopes 1 to 3%. Extensively cleared. Poorly drained soils, acidic soils, moderately saline.
Du	Alluvial	Dungarubba	Backplains of the lower Richmond River. Slopes less than 1%. Elevation 1-5m. Extensively cleared open forest and swamp complex. High water table. Potential acid sulfate soils. Plastic soils of low bearing strength.
Er	Estuarine/Delta	Evans River	Narrow floodplain of the Evans River. Slopes <1%. Tidal flats & floodplains. Rush, sedge, grassland and some closed-forest. Permanent high water tables, tidal. Potential/actual acid sulfate soils.
II	Aeolian	Iluka	Extremely low level to gently undulating Quaternary sand sheets. Slopes <2%. Relief 1-3m. Mix of uncleared and cleared areas of open forest and closed-forest.
Bj	Aeolian-Swamp	Bundjalung	Extremely low, level to undulating Quaternary beach ridge plains. Slopes <5%. Relief 1-2m. Poorly drained swales and low dunes are a common feature. Uncleared wet heathland in swales and eucalypt open-forest on dunes.

Unit Symbol	Soil Landscape Type	Unit Name	Brief Description
An	Swamp	Angourie	Perched swamps with transgressive dunes and swales of beach ridge plains. Elevations 5-20m. Areas of extremely poor drainage. Waterlogged, organic soils of low strength.
Xxa	Disturbed	Disturbed	Old sand mining areas and other areas of disturbed sand. Highly variable subsurface conditions. Low permeability soils lead to poor drainage, low soil fertility, and presence of toxic materials (acid sulfate soils). High wind erosion hazard.

Acid Sulphate Soils

Acid sulphate soils occur across several lowland areas, both as actual or potential acid sulphate soils. The 1:25,000 Acid Sulphate Soil Risk Map for Woodburn indicates the general extent of these units.

Acid sulphate soils with a High Probability of occurrence are located in Quaternary sediments south of and including the Evans River floodplain. Acid sulphate soils with a High Probability of occurrence also occur in low lying areas adjacent to the Richmond River at the northern end of the route. These areas generally correspond to alluvial areas where the water table is either within 1 m of the surface or between 1 m and 3 m of the surface.

Areas underlain by heathland developed on the Woodburn Sand, are indicated as having either a Low Probability or No Known Occurrence of acid sulphate soils. In these areas aeolian sandplains have the water table located between 1 m and 3 m below the ground surface.

2.3.2 Hydrology

The CA route is located partially within the coastal flood plain of the Richmond River catchment. The Richmond River catchment covers an area of 6,864 square kilometres, from Cape Byron in the north to the coastal plain adjacent to Evans Head in the south and the Border Ranges National Park and the Richmond Range in the west. The catchment also includes the Evans River, which the CA route crosses.

The flood characteristics for the 1 in 100 year Average Recurrence Interval (ARI) flood events (see **Figure 2-4**) were derived from an integrated 1D/2D hydraulic computer model of the Richmond River floodplain, developed as part of the Woodburn to Ballina Upgrade study. This model is based on previous hydrological and hydraulic models developed for the catchment and supplemented with updated survey information for the catchment.

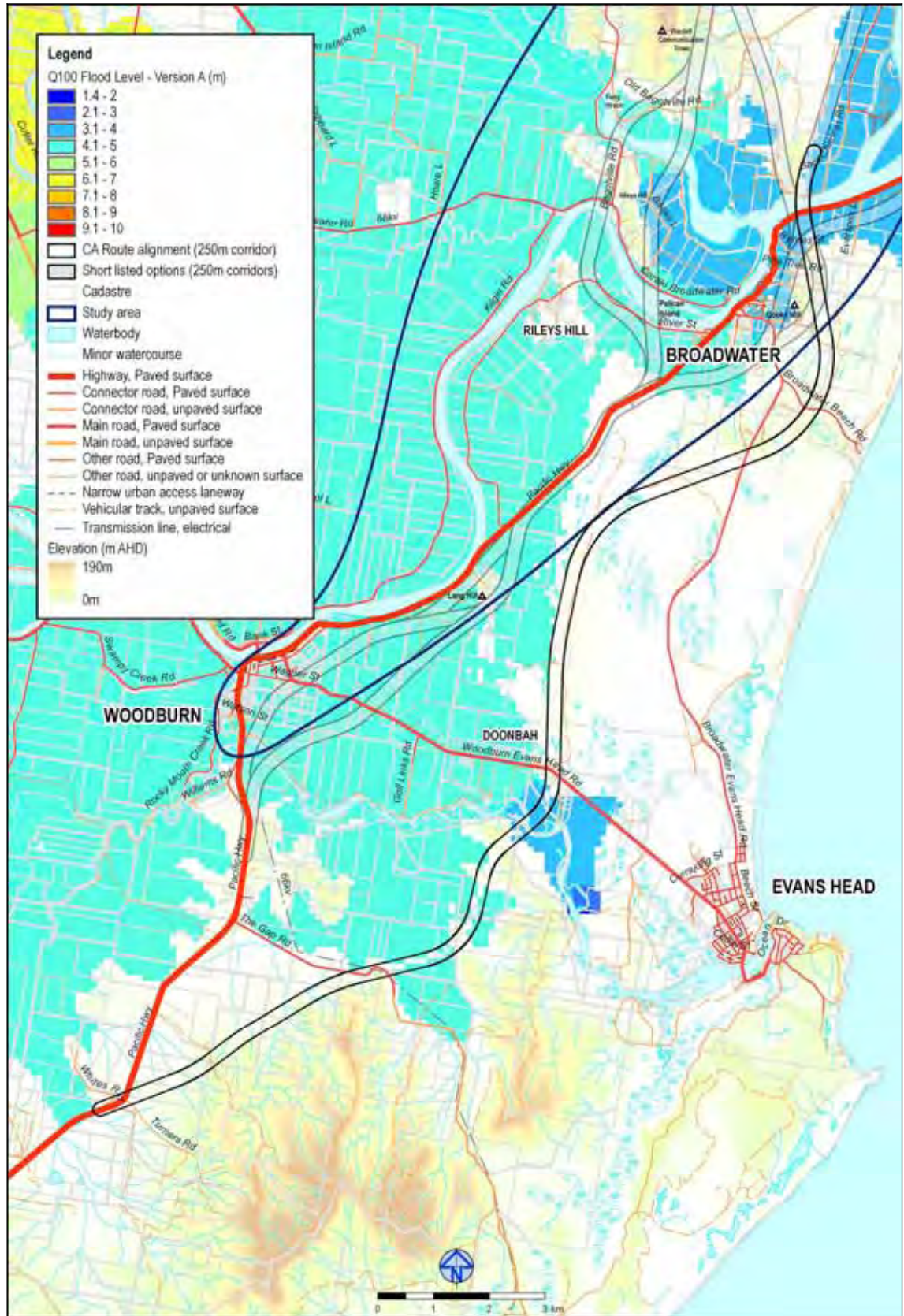


Figure 2-4 1 in 100 year ARI flood levels

Flood level maps for the study area were produced for the 1 in 100 year ARI flood events. This map was included in the Woodburn to Ballina Upgrade Route Options Report and is also included in this report in **Figure 2-4**. Flood level results obtained were also compared to previous studies to ensure that these results were similar. The flood depths and levels obtained demonstrate that much of the area around the CA route is out of the floodplain, however there are some sections still within the floodplain. The 1 in 100 year ARI flood levels vary from approximately 6.5 metres AHD at Coraki, to 4.5 metres AHD at Woodburn and to 3 metres AHD at Wardell.

2.3.3 Utilities

Services

The southern end of the CA route and the Pacific Highway to the south is not covered by any authority's information provided to Hyder at present.

The following authorities assets were investigated for impacts:

- Richmond Valley Council,
- Lismore Council,
- Ballina Shire Council,
- Rous Water,
- Country Energy,
- Optus and
- Telstra.

A number of minor services and utilities have been identified within the vicinity of the CA route. A major service, Telstra's Sydney to Brisbane fibre optic cable, crosses the route in three locations.

2.3.4 Ecology

A preliminary desktop assessment was undertaken to characterise the broad ecological attributes present along the CA route. The following datasets were reviewed as part of the desktop assessment to provide an initial, preliminary characterisation of the ecological attributes present along the CA route:

- Digital 1:10 000 aerial photos of the CA route;
- Vegetation mapping of Broadwater National Park (Griffith, 1985);
- Vegetation mapping of Bundjalung National Park (Griffith, 1983);
- CRAFTI Forest Ecosystem Modelling Data for the Upper North East NSW (DEC, 1999);
- DEC Wildlife Atlas Data (1:100 000 Woodburn 9539; Lismore 9540; Ballina 9640 Map Sheets) October 2004;

- Oxleyan Pygmy Perch habitat data for Broadwater National Park (DEC, 1999);
- Evans River Estuary Management Study – Vegetation Mapping (extract from Kiss, 2002); and

Background information was also provided by members of the Woodburn to Ballina Ecology Focus Group, including the Department of Environment and Conservation representative. This information was taken into account as part of the desktop study and the correspondence can be found in **Appendix B**.

The desktop assessment was supplemented with field work. This included an initial one day field reconnaissance to gain a broad appreciation of the ecological attributes present along the CA route on 5 July 2005 and an eight hour (4 person) field investigation over a 2 day period (23-24 August 2005) to gain an initial broad appreciation of the ecological attributes present along the CA route. The field work comprised predominantly of confirming habitats and vegetation types identified in the desktop review through visual inspection, and some targeted trapping for the Oxleyan Pygmy Perch.

Areas along the CA route that were inspected included:

- Former sand mining trails which ran parallel to the southern portion of the CA route within Broadwater National Park (vehicle and foot traverses);
- Evans River crossing and upslope areas in Bundjalung National Park (boat and foot traverses);
- The Gap Road (vehicle) and Nortons/Turners Roads (vehicle and foot traverses).

Flora discussion

Based on the desktop studies and site inspections undertaken, the CA route traverses through a total of fifteen (15) vegetation/habitat types which are described in more detail including their conservation value in

Appendix C:

- *Banksia aemula* – *Leptospermum trinervium* mid high to tall closed to open Dry Shrubland/Heathland
- *Banksia ericifolia* subsp. *macrantha* +/- – *Leptospermum polygalifolium* subsp. *cismontanum* – *Leptospermum liversidgei* – *Leptospermum whitei* mid high to tall open to closed Swamp Sclerophyll Shrubland
- *Banksia oblongifolia* – *Xanthorrhoea fulva* Wet Heathland/Shrubland
- *Leptospermum polygalifolium* subsp. *cismontanum* – *Melaleuca nodosa* +/- *Banksia oblongifolia* Wet Heathland/Shrubland
- *Baumea teretifolia* – *Restio (Baloskion) pallens* – *Baloskion tetraphyllum* subsp. *meiostachyum* +/- *Melaleuca quinquenervia* Sedgeland/Swamp Sclerophyll Shrubland

- *Melaleuca quinquenervia* open to closed woodland/forest
- *Avicennia marina* var. *australasica* low to mid high open to closed Mangrove Woodland
- *Sporobolus virginicus* – *Sarcocornia quinqueflora* dwarf to mid high closed Tussock Grassland/Chenopod Shrubland
- *Juncus kraussii* tall closed Rushland
- *Melaleuca quinquenervia* (+/- *Casuarina glauca*) tall open to closed Forest (Swamp Sclerophyll)
- *Corymbia intermedia* – *Eucalyptus siderophloia* – *E. tereticornis* (+/- *Lophostemon suavolens*, *L. confertus*) tall to very tall Wet Sclerophyll Open Forest
- Grey Gum (*E. propinqua*) – Grey Ironbark (*E. siderophloia*) – Spotted Gum (*C. variegata*) Open Forest/Forest
- Coastal Blackbutt (*Eucalyptus pilularis*) – Turpentine (*Syncarpia glumulifera*) Forest
- Pink Bloodwood (*C. intermedia*) – Red Mahogany (*E. resinifera* subsp. *hemilampra*) – Tallowood (*E. microcorys*) Dry Sclerophyll Forest
- Swamp Mahogany (*E. robusta*) – Red Mahogany (*E. resinifera* subsp. *hemilampra*) Swamp Sclerophyll Closed Forest

The structural classification for vegetation/habitat type description follows Walker and Hopkins (1984). Subformation names for vegetation types other than rainforest are adapted from the classification prescribed by Beadle and Costin (1952). The subformation categories of Floyd (1990) are used for rainforest descriptions. Botanical nomenclature follows Harden (1990-1993, 2000, 2002) as well as subsequent revisions prescribed by the NSW National Herbarium in Sydney.

Fauna discussion

Based on the desktop review, site inspection and habitat assessments undertaken, a total of 74 threatened fauna species (including aquatic and invertebrate species) are considered as potentially occurring within the locality of the proposed CA route.

These fauna species considered as potentially occurring in the locality of the CA route are contained within **Appendix D**. Oceanic species have been excluded from **Appendix D** due to the lack of appropriate habitats.

The CA route contains habitats which are known or likely to be important for the life cycle of numerous threatened fauna species as this route traverses habitats which are considered appropriate for roosting, feeding, foraging or breeding purposes.

Broadwater National Park

The habitats traversed in the Broadwater National Park are primarily “Wallum” habitats containing mosaics of wetlands, wet and dry heath and

shrublands and swamp sclerophyll forests and associated dry sclerophyll ridge forests. These habitats provide a diverse range of resources for protected and threatened fauna species.

The quality of the habitat within the northern half of the route within Broadwater National Park is high, with high floristic diversity, intact vegetative structure and good recruitment. Habitat quality within the southern section of the CA route in Broadwater National Park in areas previously subject to mineral sands mining exhibited moderate floristic diversity and moderate to high levels of recruitment (relative to similar undisturbed vegetation types).

The range of flowering tree species within the Broadwater National Park section of the CA route include a variety of Banksias species, *Melaleuca quinquenervia* and *Angophora costata* and Eucalypts on higher elevations which would provide nectar resources throughout the year. These habitats therefore represent potential foraging habitat for a variety of nectivorous species including birds, the Squirrel Glider (*Petaurus norfolcensis*) and Megachiropteran bats. The nectar resources within these habitats would also support insect populations which would provide foraging resources for insectivorous species such as the Brush-tailed Phascogale (*Phascogale tapoatafa*) and microchiropteran bat species.

The wetland habitats within this section provide suitable habitats for a variety of frog species and are known to support large populations of the threatened frog species, the Wallum Froglet (*Crinia tinnula*) and the Wallum Tree Frog (*Litoria olongburensis*). The lagoons, swamps and small creek lines within this section are known to provide habitat for the threatened Oxleyan Pygmy Perch.

The forested communities contain preferred Koala feed tree species including Tallowwoods (*Eucalyptus microcorys*), Swamp Mahogany (*Eucalypt robusta*), Small-fruited Grey Gums (*Eucalyptus propinqua*) and some Forest Red Gums (*Eucalyptus tereticornis*).

There is a suitable amount of leaf litter and woody debris within this section to provide habitat for a variety of reptiles. The forest communities occurring on the ridges and the swamp forest communities in low lying areas are known to contain hollows suitable for denning and roosting purposes for a variety of microchiropteran bats and arboreal /scansorial mammals. It may be likely that only some of the hollows would be large enough for the Squirrel Glider or Brush-tailed Phascogale. In the small areas of forest traversed by this route alignment the fallen logs would represent potential denning habitat for species such as the Spotted-tailed Quoll.

Evans River/Bundjalung National Park Section

The area around the Evans River and Bundjalung National Park near the CA route contains a mixture of floodplain forest habitats, riparian habitats and ridge forest habitats including; swamp sclerophyll forest, wet and dry sclerophyll forest, mangrove forest and saltmarsh/wetland habitats.

For the majority of this section, the quality of these habitats is high as they have high floristic diversity, intact vegetative structure, good recruitment and little weed invasion. Some areas within this section are however cleared and these areas are considered as having low habitat values.

The habitats within this section provide a variety of nectar resources throughout the year and as a result provide appropriate habitat for a number of bird and arboreal mammal species including threatened species such as the Squirrel Glider (*Petaurus norfolcensis*) and Regent Honeyeater (*Xanthomyza phrygia*). These nectar resources would also support insect populations which would provide foraging resources for insectivorous species such as the Brush-tailed Phascogale (*Phascogale tapoatafa*) and microchiropteran bat species.

The forested communities also contain high percentages of preferred Koala feed tree species including Tallowwoods (*Eucalyptus microcorys*), Swamp Mahogany (*Eucalypt robusta*), Small –fruited Grey Gums (*Eucalyptus propinqua*) and some Forest Red Gums (*Eucalyptus tereticornis*). These habitats also contain appropriate feeding habitat for the Glossy Black-Cockatoo in the form of the fruits provided by the *Allocasuarina torulosa* and *A. littoralis*.

The forested communities contain abundant hollow bearing resources for hollows suitable for denning and roosting purposes for a variety of microchiropteran bats and arboreal /scansorial mammals. Within the forested habitats fallen trees and rotting logs were observed throughout the forested areas which also represent denning habitat for a variety of terrestrial and scansorial mammal species.

The wetland and saltmarsh communities along the Evans River provide appropriate habitat for shorebirds and waders including threatened species such as the Black Bittern (*Ixobrychus flavicollis*) and the Broad-billed Sandpiper (*Limicola falcinellus*).

Within this section only limited aquatic habitats appropriate for amphibians occur and these are unlikely to provide core habitats for threatened frog species. The level of ground litter is considered appropriate for a variety of reptile species including the White-crowned Snake (*Cacophis harriettae*) and the Pale-headed Snake (*Hoplocephalus bitorquatus*).

Owens Range

This section of the CA route contains a mixture of forest habitats and shrubland /woodland habitats including; swamp sclerophyll forest, wet and dry sclerophyll forest, and swamp shrubland/ woodland communities.

This section contains large areas of mixed aged eucalypts including large percentages of trees in mid to late stages of senescence and stags which contain a variety of hollow resources. This section is considered to have extremely high values for forest dependant fauna species based upon the number and diversity of hollow resources offered and the diversity of Eucalypt species providing foraging resources throughout the year. Due to the large size of some of the hollow resources in this section, these habitats

are considered as likely to provide important habitats for nesting and denning purposes of large forest species such as the Powerful Owl, Glossy Black-Cockatoo and Yellow-bellied Glider.

The forested communities also contain high percentages of preferred Koala feed tree species including Tallowwoods (*Eucalyptus microcorys*), Swamp Mahogany (*Eucalypt robusta*), Small –fruited and Grey Gums (*Eucalyptus propinqua*). These habitats also contain appropriate feeding habitat for the Glossy Black-Cockatoo due to the occurrence of *Allocasuarina torulosa* and *A. littoralis*. Within the forested habitats fallen trees and rotting logs were observed throughout the forested areas which also represent denning habitat for a variety of terrestrial and scansorial mammal species.

Areas within the Wet sclerophyll forest also represents potential habitat for the Green- thighed Frog (*Litoria brevipalmata*) however this section of the CA route has little aquatic habitat features for other threatened frog or fish species.

2.3.5 Water quality

No historical water quality data is available for the Evans River, however due to the largely undisturbed nature of the river it can be assumed that the river would be of a reasonably high standard. The Evans River Estuary Study and Management Plan (WBM Oceanics 2002) states that the water quality of the river is affected by the flows from the Richmond River, especially during peak flow events such as floods, when the floodgates on the Tuckombil Canal are overtopped. Only 16% of the Evans River catchment is used for agriculture or urban development. The rest is mostly in its natural state in the form of National Parks and Council environmental protection zonings.

Groundwater

In low lying areas located adjacent to the Evans River, the water table is generally found within 0.5 metre to 1.0 metre of the natural ground surface. In these areas, the groundwater table is frequently located in shallow clayey alluvium overlying Holocene and Pleistocene clays. The groundwater quality in such areas is often saline.

In heathland areas underlain by Woodburn Sand, the water table is generally located approximately 3 metre to 5 metre from the surface (Drury 1982) and forms a subdued replica of the surface topography. Groundwater in the Woodburn Sand generally has a pH of between 5 and 6.

Within the Woodburn Sand, recharge to the groundwater is predominantly from rainfall, with groundwater flow from the heathland and floodplain discharging to the Pacific Ocean, Richmond River and tributaries. As the Coffee Rock has low permeability, groundwater tends to flow above this unit in the Woodburn Sand.

2.3.6 Air quality

There is limited information regarding existing air quality within the Woodburn to Ballina locality. Areas located away from larger regional centres generally do not have air quality monitoring stations. The main reason for this is that in predominantly rural areas, pollutants do not exist in high enough concentrations to cause adverse environmental or health impacts or concerns. As such, monitoring for such pollutants on a long term basis is not usually undertaken outside metropolitan and or industrial areas.

A number of environmental impact assessments, which have been undertaken for the upgrade of the Pacific Highway include short-term air quality monitoring of carbon monoxide (CO) adjacent to the highway. These results show that CO concentrations measured along the existing Pacific Highway are well below the relevant DEC 8 hour criteria of 9 ppm.

2.4 Community characteristics

The main settlement potentially affected by the CA route is around Doonbah, on and in the vicinity of Evans Head Road. There are dwellings strung out along Evans Head Road to the west of Doonbah, on the northern and southern side of Evans Head Road at progressively decreasing densities, towards Woodburn. On the southern side of Evans Head Road, west of the CA route, is the original “Doonbah” and clusters of dwellings. East of the CA route, south of Evans Head Road, in the area known as Doonbah Heights, there is a mobile home park, with places for around 45 dwellings, and a number of rural residential lots. There are few dwellings east of Doonbah Heights.

There are a few rural residences and buildings scattered south of the Evans River.

2.4.1 Aboriginal heritage

The Aboriginal heritage impacts of the CA route were investigated using a desktop assessment, consultation with the local community and local Aboriginal groups and a sample field survey with the assistance of Jali Local Aboriginal Land Council (LALC) Sites Officer Artie Ferguson was conducted on the 30th and 31st of August 2005. The survey involved the inspection of a 2.3 kilometre stretch of the route, including coastal barrier dunes and sand plains in Broadwater National Park, the Ponderosa property and McGeary's Quarry.

Registered Aboriginal sites

No sites are listed on the Department of Environment and Conservation Aboriginal Heritage Information Management System on or near the CA route.

No Aboriginal sites are listed on the Commonwealth or National Heritage Lists, Register of the National Estate, NSW Heritage Register or the heritage

schedule of the Richmond Valley Local Environmental Plan on or near the CA route.

Potential Aboriginal sites

There are a number of potential Aboriginal sites within and around the CA route as shown in **Figure 2-5**. These include:

- The Evans River has a close mythological association with Goanna Headland and is of high significance to Bundjalung people from a wide geographic area.
- North of Broadwater Headland Road the CA route traverses the Ponderosa property where three Bora/ceremonial grounds are reported to have been bulldozed during the early 1970s (Edwards-Booth 2001).
- As discussed previously (Collins 2005:16), sand-based ground east of Cooks Hill has been assessed by Aboriginal informants to be highly significant and culturally sensitive, and is believed to contain campsites, burials, and evidence of a massacre of Aboriginal people by the Native Mounted Police.
- The CA route also crosses the McGeary sand quarry land, which is known to contain a “large-scale open campsite ... with a large concentration of Aboriginal relics including stone tools and shell midden” (Edwards-Booth 2001).
- There is moderate potential for Aboriginal campsites on spurs edging swamps south of The Gap Road and on the ridgeline south of the Evans River. Depending on erosion and drainage conditions, sites may also occur on the banks of the Evans River.
- Significant undisturbed (subsurface) campsites and middens may occur on dunes and sand rises in the unmined northern section of Broadwater National Park.

Survey Results

Two sites were positively identified during the sample field surveys.

Reported Cooks Hill massacre site

Despite an absence of surface evidence, the potential remains for subsurface archaeological deposits on sand-based ground at the eastern foot of Cooks Hill, between Gittoes Quarry and McGeary's Quarry.

Midden/open campsite/s

Field inspection confirmed the existence of archaeological material across the McGeary's Quarry property, including on the CA route alignment. As outlined in relation to Option 2E the McGeary's Quarry property contains pipi (*Donax deltoides*) midden scatters and a large number of stone artefacts. However, it is anticipated that many of these materials will have been disturbed and dispersed as a result of sand extraction and vegetation clearing, and it remains unknown whether intact subsurface deposits survive in the area.

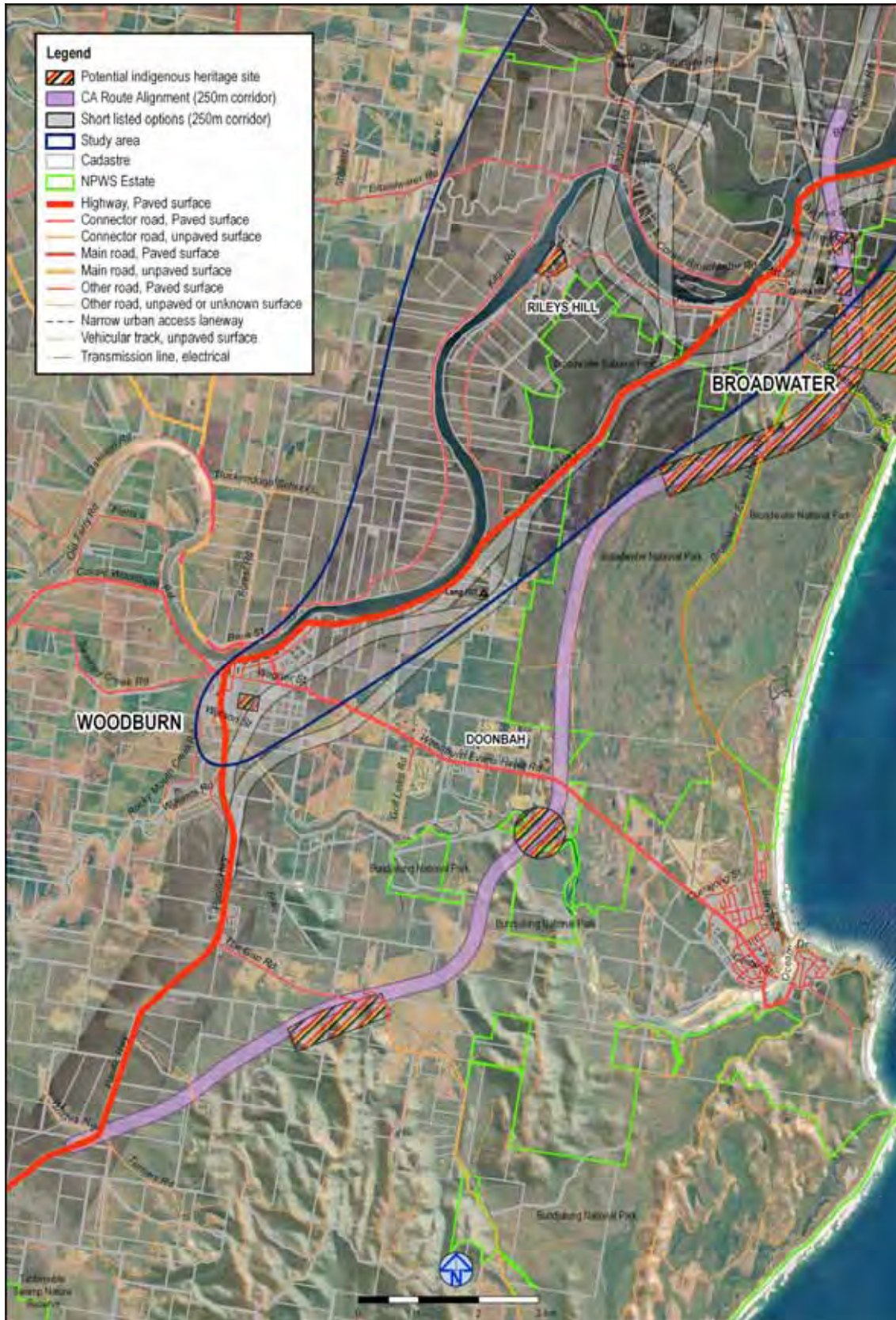


Figure 2-5 Potential Aboriginal Sites

2.4.2 Non-Aboriginal heritage

The CA route falls within the Richmond River Local Government Authority (LGA). The table below shows the heritage listings within or in the near vicinity of the CA route.

Listing	Item
Richmond River Valley Draft Heritage Study	World War II RAAF Bombing Range Observation Bunker contained within Broadwater National Park. Now a look out
	Ancient fossilised coral reef (120,000 years old) on southern bank of Evans River
	Sign on bank of river, evidence of oyster industry
	Paddon Grave on Iron Gates site. (Exact lat. long. position of grave not recorded.)
Commonwealth Heritage Register Listings	No items are currently listed on either the Commonwealth Heritage List, the National Heritage List or on the Register of the National Estate (RNE).
NSW State Heritage Register listings	There are currently no heritage items within the study area listed on the NSW State Heritage Register (SHR)
Richmond River LEP 1992 listings (Schedule 1, Heritage items)	There are no items listed as heritage items in Schedule 1 of the Richmond River LEP
National Trust listings	There are no items listed with the National Trust (NSW) for this area

2.4.3 Landuse

Analysis of aerial photography and verification in the field indicates that the area in the vicinity of the CA route incorporates urban land, agricultural land, timber and National Park. The area is characterised predominantly by the National Parks and timbered reserves that exist along the route. The table below shows the type of landuse traversed by the CA route.

Type	Area (Ha)	Percentage (%)
Grazing	19	15
National Park	49	40
Quarry	0.008	0.01
Rural Residential	4	3

Type	Area (Ha)	Percentage (%)
Sugar Cane	4	3
Sugar Cane Stockpile	10.5	8
Timber	40	30

2.4.4 Visual Amenity

The CA route straddles the Richmond Ranges and Valley Region of New South Wales. It is an existing natural and cultural environment whose natural beauty and unique assets attract both locals and visitors. Important natural and man-made features of the area can be seen in **Figure 2-6**.

Generally the landscape in the vicinity of the CA route consists of flat floodplain adjacent the Richmond River and Brandy Arm Creek with the Richmond and Moonimba Range forming a backdrop to the southern portion of the route.

Smaller hills punctuate the floodplain and a localised ridge extends north-south through the Broadwater National Park forming a natural fire break for the fire trail located to its east.

Sugar cane farms hug the flat floodplain and residential rural settlements are scattered along roadways, with townships at Woodburn, Broadwater and Evans Head. Smaller communities are located at Doonbah. The Richmond Range east of the existing Pacific Highway is heavily forested up to the edge of Bundjalung National Park.

Broadwater National Park is located to the southeast of Broadwater and Bundjalung National Park is located to the west and south of Evans Head and is adjacent the coastline.

Visual Characteristics

The visual character of the study area is best described in terms of those features that stand out, are memorable and, in turn, assist to register the traveller's progress along the route. Both natural and built-form landmarks punctuate the otherwise flat landscape. Though important landscape elements, the Richmond and Evans Rivers do not have a strong visual presence except up close or from height.

Important cultural (built) landmarks in the study area include Langs Hill Water Tank and the Sugar Mill steam stack in Broadwater, which can both be seen from long distances on clear days.

Important natural landmarks include the Broadwater National Park Lookout, Cooks Hill, Laws and Langs Hill which stick out of the flat floodplain predominantly. Vegetation excludes other landmarks such as Rileys Hill and Sawpit Hill from view at ground level. The wooded Blackwall and Richmond Ranges form a backdrop to the north and south of the study area respectively.

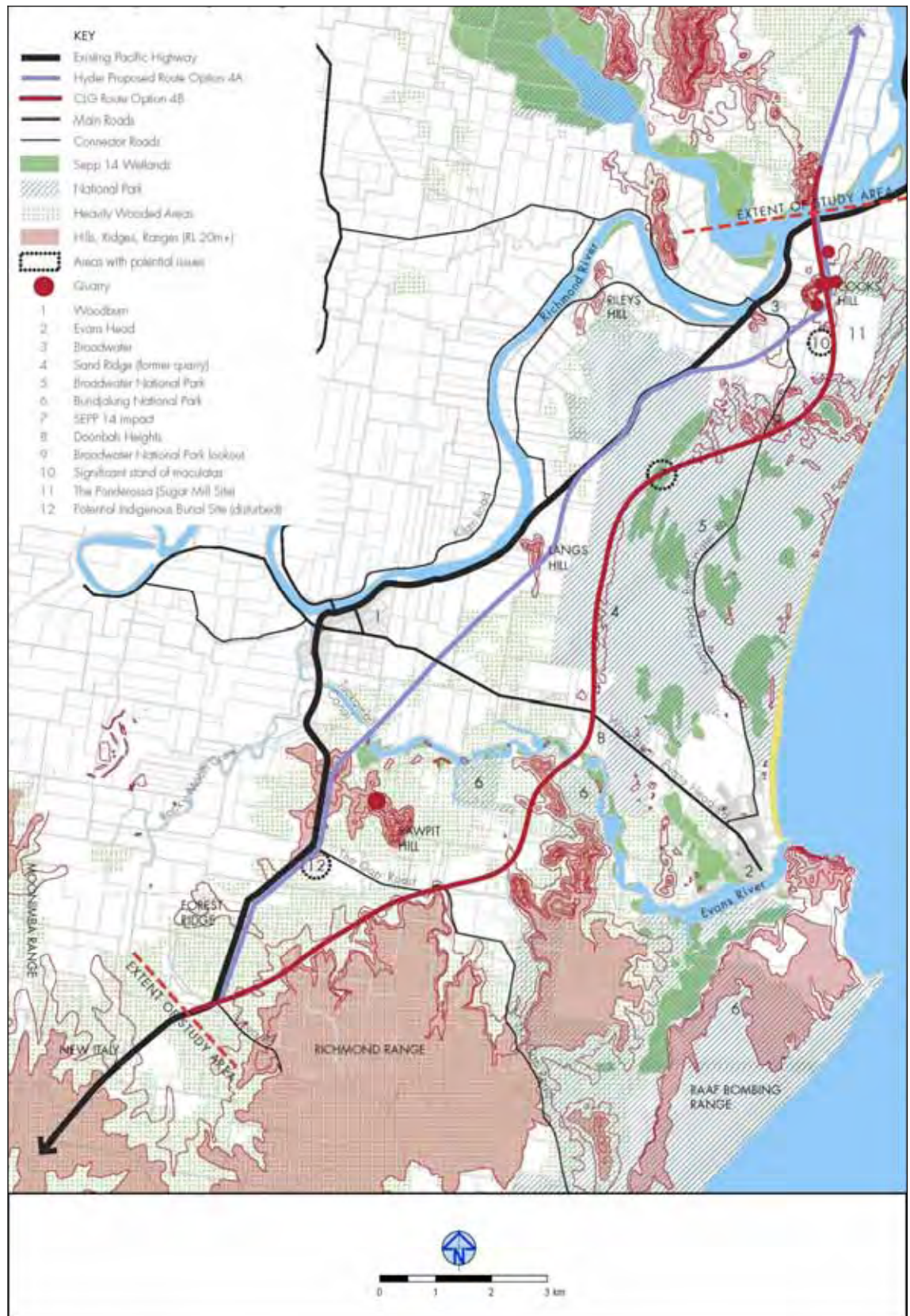


Figure 2-6 Visual features

2.4.5 Noise

The CA route traverses Broadwater National Park for a large section of the route. However outside of the national parks there are a number of residential dwellings, some of which are clustered together, while others are more widely dispersed. The area around the crossing of Woodburn to Evans Head Road contains a cluster of new residential/subdivided properties.

The northern part of the CA route would have a similar noise impact on Broadwater as Option 2E.

3 Evaluation of the CA route

This section evaluates the CA route based on the information presented in Section 2. The purpose of the evaluation is to determine the constraints and opportunities that the CA route presents.

Where relevant the evaluation includes comparison with the base case alternative of:

- upgrading the existing Pacific Highway from the southern start of the CA route to the Woodburn to Ballina section which commences near the substation south of Tuckombil Canal;
- Option 1C; and
- Part Option 2E to the Richmond River.

3.1 Planning and zoning

The zoning characteristics of the CA route (refer to the table below) are similar to the base case alternative route. However there is a much larger impact on land zoned 8(a) National Parks and Nature Reserves and 8(b) Proposed Future National Park Extension.

Option	LGA	Zoning	Roads Permissible Use?	Comment	Part 5 assessment process?
CA route	Richmond Valley	1(a)	Yes, with Council consent	SEPP 4 would apply	Yes
		1(b)	Yes, with Council consent	SEPP 4 would apply	Yes
		1(e)	No. Roads are prohibited around the mining areas at Cooks Hill	SEPP 4 would not apply. Land would need to be rezoned to permit roads or the Project included in a specific SEPP	Yes – but not until Council amend Richmond River LEP1992) or Project included in a specific SEPP

Option	LGA	Zoning	Roads Permissible Use?	Comment	Part 5 assessment process?
		7(a)	No – roads are prohibited.	SEPP 4 would not apply. Land would need to be rezoned to permit roads and then the SEPP14 provisions would need to be addressed . or Ministerial Order to assess project under 3A of the EP & A Act	No – Council would need to amend the zoning to permit roads and then consider a Development Application to affect a SEPP14 wetland under Part 4, EP&A Act. Or Yes- Depending on Ministerial Order to Assess project under 3A of the EP & A Act
		8(a)	No. Roads are prohibited in Broadwater National Park	If any part of a proposed road corridor affects the National Park the area of land would need to be revoked from the Park by an Act of Parliament. Then the area of land required would need to be rezoned to an appropriate use.	Yes – but not until the Act of Parliament revoking an area of the Park is gazetted and the zoning amended (subject to Council amending Richmond River LEP1992).
		8(b)	No – roads are prohibited	SEPP 4 would not apply. Land would need to be rezoned to permit roads or the Project included in a specific SEPP.	Yes – but not until Council amend Richmond River LEP1992) or the Project included in a specific SEPP.

3.2 Biophysical characteristics

3.2.1 Topography, geology and soils

Topography

The CA route traverses undulating land on the southern side of the Evans River, and skirts around some outcrops between the Evans River and the Richmond River. The majority of the CA route is on slightly higher ground than the base case, which has implications on flooding on the alignment. Flooding is discussed in the next section.

Geology and soils

Generally the CA route presents a better alignment with regards to soil conditions, as the route traverses less soft soils than the base case. However there may be some constraints within the vicinity of the areas that were previously sand mined. This is a result of the potential for differential settlement due to the ground disturbance which may have altered the density of the sand.

Potential acid sulphate soils

In those areas where the water table is within 1m of the surface (eg. alluvial plains adjacent to the Evans River) there is a severe environmental risk if acid sulphate materials are disturbed by activities such as shallow drainage, excavation or clearing. In those areas where the water table is between 1 metre and 3 metre of the surface (eg extensive alluvial plains to the east of Woodburn) there is an environmental risk if acid sulphate soils are disturbed by activities such as deep excavation for pipelines, dams/sediment ponds or deep drains.

The CA route passes over potential acid sulphate soils (PASS) from Ch 5800 to 7500 and in the vicinity of the Evans River with a total length affected of 2100 metres. The more a route passes over these high risk areas the more likely that an adverse environmental impact would occur during construction. Construction risks will be managed with the development and implementation of an Acid Sulphate Soil Management Plan.

A comparison of areas of road footprint passing through PASS is:

- CA route - 9 hectares; and
- Base case alternative route - 55 hectares.

3.2.2 Hydrology

Flooding Management Objectives

The hydraulic modelling objectives adopted for this route was as per the other route options and included:

- Ensuring afflux during a 100 year ARI flood was restricted to a maximum of 50 mm (although localised afflux near structures greater than 50 mm was considered acceptable near road embankments located away from towns).
- Limiting the effects on existing flood inundation times across the floodplain.

Route option modelling

A total of three design storms (100, 20 and 5 year ARI) were modelled for the CA route. The flood mitigation works were only optimised for the

100 year ARI storm as it was anticipated that by managing the 100 year ARI storm, the minor storms would also be catered for. **Figure 2-4** shows the 100 year flood level modelling for the CA route.

The flood impacted lengths for routes are:

- CA route 2.6 km
- Base case alternative route 12.3 km.

Inundation time differences between routes

Differences in duration of flooding between the pre and post scenario was found to be negligible for this route.

Flood mitigation works

Potential impact upon the existing flood plain conditions due to the proposed route options would be mitigated for this option by increasing the size of the bridges crossing the Evans and Richmond Rivers. The table below summarises the major flood mitigation structures for the CA route compared with the base case alternative.

Assumed Corridor	Major flood mitigation structures
CA route	450 m bridge across the Evans River
Base case alternative	350 m bridge across Tuckombil Canal 880 m viaduct

3.2.3 Utilities

The isolation of the CA route from towns in the south has minimised the impact on services.

The impacts to known existing services in the southern part of the CA route are limited to two Rous Water water main crossings between Woodburn and Evans Head and one Richmond Valley Council sewer. A potentially significant impact exists on the Sydney – Brisbane fibre optic cable which runs adjacent to the CA route. A detailed ground survey and refinement of the route alignment would be required to establish the extent of any impact on this cable.

The CA route around Broadwater is fairly consistent with the line of the shortlisted Option 2E. Using this as a guide the impacts on authorities' assets reflect those of Option 2E. The CA route remains isolated from any service towns, which minimises the impacts in this area.

The CA route affects services from Richmond Valley Council, Ballina Shire Council, Telstra and Optus to the same extents as the base case.

There are no known impacts on any of the other authorities along the route.

3.2.4 Ecology

Flora assessment

The ecological attributes summarised in Section 2.3.4 were subsequently factored into an ecological constraints assessment developed by Perkins (1992) and adapted by NSW DEC for assessing conservation value of bushland remnants. The objective of the constraints assessment is to identify or rank the CA route into broad categories of low, moderate or high ecological constraint using a constraints matrix.

A total of four factors including habitat quality, habitat recovery potential, occurrence of threatened species and endangered ecological communities and connectivity were used to undertake a constraints assessment of the CA route.

The results of the constraints assessment found that the CA route as a whole poses a high ecological constraint. The cleared cropping lands to the north of Owens Range is considered a low ecological constraint if assessed alone. It should be noted that the above assessment was based on the assumption that there has been significant soil profile disturbance as a result of sand mining Broadwater National Park. Further detail of flora impacts are detailed in Appendix C of this report.

Previous work undertaken for the Woodburn to Ballina Upgrade found that the base case would pose a high ecological constraint, however the area of native vegetation removed would be considerably less than the CA route as shown in the table below.

Route	Native vegetation impacted (approximate)
CA route	89 hectares
Base case	40 hectares

Endangered Ecological Communities (EECs)

Five EECs listed in the TSC Act are considered likely to occur along the CA route. These include:

- Swamp Sclerophyll Forest
- Coastal Saltmarsh
- Coastal Floodplain Swamp Sclerophyll
- Subtropical Coastal Floodplain Forest
- Lowland Subtropical Rainforest

The section of the CA route that appears to contain the highest degree of ecological constraint is the Evans River crossing where a total of three EECs occur, these being Coastal Saltmarsh, Coastal Floodplain Swamp Sclerophyll Forest and Subtropical Coastal Floodplain Forest. Potential

impacts to these EECs as a result of the CA route include direct habitat removal and indirect changes to hydrological regimes and edge effects.

Another vegetation 'hot spot' along the CA route which would be subjected to similar potential direct and indirect impacts is the 'Wallum' of Broadwater National Park. 'Wallum' vegetation is a term used to describe the regionally significant dry and wet heathlands/shrublands and freshwater/estuarine sedgeland and swamp sclerophyll shrublands and forests unique to the large coastal sandmasses on the North Coast of NSW.

Three EECs are thought to occur along the base case route, and considerably less area of EEC would be removed as a result of the base case.

Threatened Fauna Discussion

It is considered that the CA route is likely to cause a major impact upon local populations of threatened species. This is due primarily to the large areas of known and/or potential habitat for these species that will be removed and/or become isolated as a result of the CA route. Large areas of this habitat are located within Broadwater National Park. Appendix D of this report details the potential impacts on each of the 74 threatened species expected to occur along the CA route.

The proposed route will result in the removal of a large area of known and/or potential habitat for threatened species, with large areas of this habitat being located within Broadwater National Park. The majority of the known and/or potential habitats that will be isolated as a result of the proposed CA route are also considered to be core areas of habitat, or areas of high quality value for numerous threatened and protected fauna occurring within the locality.

The northern extents of Bundjalung National Park are currently separated by vegetated land that has been considered for future inclusion in the park. The habitats within this land are considered to be high quality and are known, or represent potential for a variety of threatened fauna. The CA route passes through this connecting area, thereby causing isolation of the existing area of the park to the west, and also resulting in habitat removal from the area proposed to be included as part of Bundjalung National Park. This is also considered to largely defeat the purpose of dedicating the connecting area as a future part of Bundjalung National Park.

The area within and adjoining the southern section of the CA route, which includes the Dry and Wet Sclerophyll Forest of Owens Range is considered to contain a large area of high quality potential habitat for variety of threatened fauna species known to occur within the locality. The proposed CA route will cause isolation of this habitat, and also result in the removal of a large area of this potential habitat.

The proposed CA route may also result in the alteration of local hydrological/hydraulic regimes which, in turn, may cause modification of the adjoining vegetation communities and inundated areas. This has the potential to cause a significant impact upon known and potential habitat for

a variety of threatened species including threatened amphibian and fish species such as the Wallum Froglet, Olongburra Frog and the Oxleyan Pygmy Perch through alteration of water quality, including change of pH and potential impacts from sedimentation as a result of construction works.

Further, other threatened species habitat is likely to be affected indirectly over time through a change in floristic and/or vegetation community structures as a result of altered local hydrological/hydraulic regimes.

Although the base case traverses some areas of habitat for threatened species, the extent of the impact would be less than the CA route, as the area of habitat impact is much less. Some of the vegetation traversed in the base case occurs in isolated patches, while other areas are on the edge of large contiguous patches, whereas most of the CA route traverses large contiguous patches.

3.3 Community characteristics

3.3.1 Social Impact

Social impacts have been considered in terms of access to opportunities, the likely effect on amenity (largely a function of the combined noise and visual effects), the effects of social character and possible implications for social disruption as a result of direct property impacts.

Access to opportunities

The CA route will have the same beneficial effects on access to opportunities as any of the other short listed options. This would be due to two main factors. First, as a result of improved amenity in Woodburn and Broadwater following the removal of Pacific Highway through traffic, the range of activities available in these towns is likely to increase. Second, there will be improved local access to these activities along the existing Pacific Highway and the local road network. The degree of physical access to centres currently available to the population east of Woodburn and Broadwater will not be diminished, as a range of interchanges and local road overpasses would be provided.

With regards to access to opportunities and potential impacts on businesses in Woodburn, no distinction can be made between the CA route and the base case.

The CA route would however improve access to opportunities at Evans Head for those using the CA route. Normally this might be regarded as a benefit for a town such as Evans Head. In this case however, it may be seen as a disadvantage, as part of the population of Evans Head has expressed the view that they would prefer to remain less accessible and less known to outsiders, in order to protect their existing high level of amenity.

The actual accessibility of Evans Head may only be marginally enhanced as compared with the base case, but being closer to Evans Head, the CA

route may be seen to improve the attractiveness of Evans Head as a travel destination and possibly a residential location. While this may be considered a benefit by part of the Evans Head population, it is likely to be considered a loss by another part of the population.

The CA route would provide flood free access to and from Evans Head during times of flood, assuming that an interchange would be provided at the intersection of the new route and Evans Head road. (It is noted, however, that an interchange on the Broadwater/Evans Head Road, not necessarily associated with the CA route, would also provide this flood free access.)

Amenity

The amenity of Doonbah and Doonbah Heights would be adversely affected as a result of the combined visual impact of the CA route and noise effects. The amenity effect of any noise impact may depend on the way in which noise is mitigated. The provision of noise barriers may have an adverse visual effect but may improve the amenity of dwellings, compared with the treatment of dwellings themselves for purposes of noise mitigation.

The amenity of dwellings in the vicinity of Woodburn would be positively affected as a result of the road being located further to the east, out of visual and aural range of the Woodburn locality.

Towards Broadwater the CA route coincides with Option 2E and the amenity effects would therefore be the same, as far as the residential population is concerned.

Social Character

The CA route would have the same effects on the social character of Woodburn and Broadwater as other options as these depend on the removal of the existing Pacific Highway routes from the towns.

The settlement of Doonbah does not have an identifiable social character to the same degree as the larger towns in the region. However, to the extent that it presents as a rural residential area, albeit along a busy road, this character will change as a result of there being a major road alignment in the vicinity with a significant intersection at Evans Head Road. It is likely that the increase in the intensity of traffic activity at the intersection and the change in the accessibility of Doonbah will lead to pressure for land use change, to more intensive uses. There would be a change in the character of Doonbah as a result.

Social Impacts of Flooding

As noted above, the CA route has the potential to provide flood free access to and from Evans Head. This would be an important social benefit for a town of around 2,600 people. On the other hand, this access may be able to be provided on the Broadwater/Evans Head Road with other proposed options such as the base case.

Summary

In summary therefore the CA route has the potential to have a greater amenity impact on the area around Doonbah than the base case, depending on the degree to which noise mitigation is required and the way in which noise is mitigated.

3.3.2 Aboriginal heritage

The CA route traverses some areas of high cultural significance including the Evans River and sand-based ground east of Cooks Hill which may contain campsites, burials, and evidence of a massacre of Aboriginal people by the Native Mounted Police. Advice from the Jali Aboriginal Land Council indicates that the area around Cooks Hill is of high cultural importance to the local Aboriginal community

Preliminary advice from Elder and Native Title claimant Lawrence Wilson indicates that a bridge across the Evans River would be likely to attract strong opposition from the Aboriginal community due to the cultural value of the river.

The CA route passes through more undisturbed land and traverses more landforms of potential archaeological sensitivity than the base case and thus has more potential to intercept archaeological sites.

3.3.3 Non-Aboriginal heritage

Predicted/potential heritage impacts

A preliminary non-Aboriginal assessment of the CA route found six areas of potential impact in the vicinity of the alignment. The table below outlines these potential impacts:

Potential impact	Description
Agricultural areas	The potential heritage impact of the route on agricultural areas may include the detection of early methods of agriculture and land management utilized in the area. There is also the potential to uncover the remains of early farmsteads and associated outbuildings and infrastructure
National Parks	Activities like sand mining were practiced throughout the areas of both National Parks (however not in the area of Bundjalung National Park potentially impacted by the CA route) and these have potentially left traces that may be disturbed by the proposed new route. Similarly, existing roads and trackways through these areas may be quite early in date and may be considered heritage items. Both the extant trackways and any associated evidence of their construction may be impacted upon by the CA route
Wetlands	The area of preserved wetland that is directly impacted by the CA route may contain relics of early agricultural/fishing or land management practices.

Potential impact	Description
	Pathways, jetties, bridges or items such as fish traps may be preserved within this area
Creek and River Crossings	Similarly to the area of wetland, the location of the creek and river crossings may uncover evidence of early fishing practices, the remains of jetties, bridges or any sunken boats etc.
Habitation	The CA route traverses the east side of the village of Doonbah. There is the potential to uncover evidence of early homesteads, early land grants and land divisions or activities and infrastructure associated with this village
Extractive & Mineral Resources	The area in the northern portion of the CA route may contain relics associated with mineral extraction

3.3.4 Landuse

The CA route minimises the impacts on prime agricultural land by traversing large areas of National Park and other vegetated areas. The route also traverses the rural residential area of Doonbah on the northern side of the Evans River. The CA route has a much higher impact on National Park estates and impacts on more residential buildings than the base case.

3.3.5 Visual Amenity

Opportunities

This option is more “scenic” with greater richness of experience than the base case. Scenic highlights include:

- The Richmond Range with significant woodland forest, probably re-growth from logging activity which is still continuing
- Contrast of Broadwater National Park (heathland scrub) and Bundjalung National Park (woodland)
- A relatively high (5-10 m) bridge at the Evans River
- Shorter embankment lengths required
- Route is located further away from Broadwater Township and behind Cooks Hill

Constraints

- The CA route creates a fourth corridor through Broadwater National Park dividing the park into five parts.
- Limited visual experience of the cane fields and Richmond River – which are important characteristics of the Richmond Valley Region.

- Major impact on the Richmond Range and its significant woodland forest – although the forest is currently being logged to some extent. Relatively large cuttings through Richmond Range of 5-10 metres.
- The potential extension of Bundjalung National Park would be split in two, creating a visual disturbance between the two parts.
- The route passes within 50 metres of the residential properties at Doonbah Heights and other rural residences located around this point on Evans Head Road.
- Major impact on the integrity of the Broadwater National Park Lookout – the CA route sweeps across the foreground of the pristine view over the park to the ocean and has a proposed 11 metre cutting.

3.3.6 Noise

Analysis of the aerial photograph for the CA route and from information gathered from the site visit it appears that the route is within 500 metres of approximately 20 houses/buildings and a small lot residential subdivision that could potentially be impacted by noise from the CA route. This is much higher than the number of houses/buildings potentially affected by the base case. Hence the noise impact of the CA route would be higher than the base case.

The northern part of the CA route would have a similar noise impact on Broadwater as Option 2E.

Any option to upgrade the Pacific Highway within this area would result in potential for either new or increased noise impacts to nearby residences.

3.4 Road design

3.4.1 Local access

The CA route crosses a number of roads and accesses to properties. The modifications to the local road system are:

Road Type	Treatment
Existing highway	Existing high overpass bridge, south facing entry/exit ramps
Turners Road	Divert 400 m gravel road
Quarry access	Divert 200 m gravel road
Residential access	Local road overpass
The Gap Road	Local road overpass and divert 400 m sealed road
Woodburn – Evans Head Road	Full diamond interchange. Local road overpass.
Broadwater – Evans Head Road	Local road overpass
Broadwater Beach Road	Local road overpass
Broadwater – Quarry Road	Local road overpass

A number of fire trails in the Broadwater National Park will be bisected. This assessment assumes these tracks are cut. Fire fighting access is available from the motorway or a fire track would be provided to link the severed fire track.

3.4.2 Constructability considerations

Ground Improvements

A desk top study of geological units combined with a field walk over at localised areas by an experienced geotechnical engineer was the basis for identifying the various treatments and their locations for cost estimating purposes. The geotechnical desk top study identified sub-surface conditions. These areas and the allowances made are:

- South of Evans River the CA route generally passes through good ground conditions where sub-surface treatments are not required. Excavations will encounter rock that may require ripping or blasting.
- North of the Evans River through the sand mined section of the Broadwater National Park deep compaction of sand backfill may be required.

- Freshwater swamp in Broadwater National Park assumes geotextile fabric with a bridging layer allowed.

Earthworks

The cut and fill balance is a construction issue as material needs to be sourced locally. The greater the shortfall the greater the effect on the local environment because more material will be sought and haulage will most probably be via on-road vehicles. The Evans River bridge construction period will constrain the movement of material from the south of the Evans River to the northern half via the upgrade.

The table below shows the total fill volume required to ensure the option is above the 100 year flood level and the imported fill volume component.

Option	Fill Material (cubic metres)	Imported Material (cubic metres)
CA route total	1,000,000	-
Base case total	1,140,000	735,000

Bridges

For a comparative assessment generic structure types have been used for the Evans River crossing, standard viaducts to mitigate the effects of flooding, medium span under/over passes and miscellaneous structures such as culverts and fauna crossings.

In addition to the major structures there would be numerous overpass or underpass bridges for local and minor roads. It is envisaged these would be constructed from standard arrangements of super T or PSC planks supported upon precast driven piles. Several cross drainage culverts and fauna crossings would also be required along the route.

The Evans River bridge would be a high level multi-span 450 metre long (minimum drainage requirement) viaduct. It would be 10 m high on the southern bank to minimise the cutting through the saddle in the Bundjalung National Park.

Where necessary local road structures would be raised to accommodate minor road crossings of the motorway.

3.4.3 Costs

The main costs for the CA route and the base case alternative, using the base case alternative as 100 is:

- CA route – 90.9 units
- Base case alternative – 100 units

3.5 Evaluation Summary

	Base Case	Community Alternative route
Environmental	Some impact on endangered ecological communities Crosses Tuckombil Canal	Much larger impact on endangered ecological communities and threatened species Crosses Evans River Large impact on Broadwater National Park
Heritage	Traverses an area of high Aboriginal cultural significance east of Cooks Hill	Traverses some areas of high Aboriginal cultural significance including the Evans River and sand-based ground east of Cooks Hill. Passes through more undisturbed land and traverses landforms of potential archaeological sensitivity and thus has potential to intercept additional archaeological sites
Functional	Route crosses extensive soft soils Majority of route in floodplain Utilises parts of the existing highway	Generally follows higher ground and therefore is less flood affected and has better soil conditions Reduced utilisation of existing highway
Social and Noise	Reduced impact on Woodburn	Reduced impact on Woodburn Greater impact on Doonbah and rural residential properties
Business and Economics	Large impacts on sugar cane farms Higher cost	Reduced impact on sugar cane farms Increased impact on grazing land

4 Conclusions

The major engineering advantages of the CA route over the base case route occurs because this route generally follows higher ground and therefore is less flood affected. This reduces:

- the need for flood viaducts to maintain Richmond River floodplain storage;
- soft soil improvements; and
- importation of large quantities of fill material.

The construction cost savings of the CA route compared with the base case route arising from these benefits however are offset with the need to provide compensatory habitat for 55.1 hectares of impacted National Park land.

The impacts of the CA route on the ecology within both National Parks and other vegetated areas south of the Evans River would be much higher than the base case route, as there is a larger area of undisturbed native vegetation. The ecology surveys identified endangered ecological communities and numerous threatened species within the route. The Evans River is of a high quality due to the amount of river that is undeveloped. A crossing over the river would potentially have a greater impact than a crossing over Tuckombil Canal.

The CA route traverses some areas of high cultural significance including the Evans River and sand-based ground east of Cooks Hill. The route passes through more undisturbed land and traverses more landforms of potential archaeological sensitivity than the base case and thus has more potential to intercept archaeological sites.

The CA route impacts directly on areas of National Park, predominantly the Broadwater National Park. The Department of Environment and Conservation (DEC) has provided preliminary advice indicating that this National Park is of high importance due to the large number of threatened species that occur within the park boundaries. Revocation of national park status is undertaken through negotiations with DEC and an Act of Parliament. However DEC policy on the revocation of any national park estate would only occur if there was no other feasible and reasonable option.

The conclusion of this report is that the CA route should not be included into the short list of route options due to the environmental impacts and statutory implications with a route passing through Broadwater and Bundjalung National Parks.

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Appendix A

CA Route Submission

We the undersigned members of the CLG (Community Liaison Group)
support this flood free option:-

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J. Mathers

Rick Nutt

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Francine Hitchens

F. Hitchens

Murray Shergold

M. Shergold

Ray Collyer

R. Collyer

David Judge

D. Judge

Julie Coyle

J. Coyle

Colin Duncan

C. Duncan

Darren Woolage

D. Woolage

David McDonald

D. McDonald

John Degotardi

J. Degotardi

Trevor Monti

T. Monti

Tony Carusi

T. Carusi

Jeff Phillips

J. Phillips

Bill Salopic

B. Salopic

Natasha Heath

N. Heath

Steve Flatley

S. Flatley

Paddy Wilde

P. Wilde

Bill Walker

B. Walker

THE FLOOD FREE ROUTE

If the "Flood Free" route is adopted it will leave the existing highway approximately 8 kilometres south of Woodburn and veer in a north easterly direction and will meet the Evans River approximately 6 kilometres east of Woodburn and east of the Riverside Park.

There is a quarry near the old "Wireless Station" site which happens to be the southern end of the old mining road, which is used as a fire trail. This fire trail is beside a high ridge on the edge of the flood plain, it is this ridge we suggest is used for the bi-pass. It will pass on the eastern side of Cooks Hill then turn North West and cross the river at Laws Hill. On the western side of the river it will pass on the southern side of the hill and follow the high land around the hill and along the edge of the bush land beside the cane fields. Then it would move slightly to the west to avoid some houses near the end of Old Bagotville Road and meet the Wardell - Meerschaum Vale Road at Lumleys Lane, turn north east until it meets up with the existing highway. It will keep west of the Sports oval and east of the Jali Land and the Jali housing estates.

We would like to see an interchange located at the corner of Lumleys Lane and the Wardell-Meerchaum Vale Road and the existing highway run along the eastern side of the freeway as a service road.

STRENGTHS

- **No impact at all on peoples everyday activities**

The route will not interfere with the existing highway and will only cross the existing Highway once. If the bridge is reasonably high, the existing highway should be able to pass under the approaches on the eastern side of the river. Hopefully the approach could be on piers for part of the way at least so that it wouldn't create a levee effect in time of flood, and at the same time it would not dissect the only cane farm affected in the entire route.

- **No impact at all on peoples everyday activities**

The route will not impact on any vehicular movements (including cane truck movements in and out of the mill) for the entire study area from Burns Point Ferry to South of Woodburn on the eastern side of the river, and the entire route on the western side of the river except for the area on the western side of the highway from Wardell to the double bridges at the northern end of the study area.

GeOLINK

Received 4.7.05
Project
☐ to be returned
☐ reviewed
☐ approved for use
☐ noted file-no action required
☐ action, as follows

- **Big saving – no bridging**

The route will not have to cross any of the small drains that the existing highway does now. There are about 12 on the existing highway between Woodburn and Wardell

- **Big saving – land acquisitions**

The route takes in the narrowest possible strip of cane land, approximately 700m just before it crosses the river on the eastern side.

- **Great fire control – Broadwater National Park and Bundjalung National Park**

The route has the potential to offer an excellent fire break in the Broadwater National Park. Particularly for the Rileys Hill area. When a fire starts near Evans Head, when there is a strong southerly wind blowing it almost always finishes up in the Rileys Hill corner. This will also provide a great protection for the sugar mills stock pile at the Ponderosa if the route is kept as far east as practicable. In the "Plan of Management" for the Bundjalung National Park south of the Evans River, it stresses the need to reduce the frequency and severity of the fires in the National Parks. A highway through this area south of the Evans River, would certainly be a major bonus in fire control. There would only be a small area of the National Park affected (approximately 1.2kms), but a highway through a large area of bushland that surrounds the National Park would certainly assist in controlling fires in that area.

- **Big Saving**

The route would be approximately 98% flood free and because it is almost entirely on highland a minimum of fill would be required.

- **Abundance of material at close proximity**

There are numerous quarries in the immediate areas near this route namely McGearys, Byrnes, Blue Pool. Bagotville, Airforce Wireless Station.

- **Evans Head the big winner**

The route would only have 500m of bridge and bridging where it crosses the Evans River. We would like to see the Southern interchange located where it crosses the Woodburn – Evans Head Road, and if this happens it will be the first time in history that the village of Evans Head has not been isolated in time of flood. It would also mean that emergency vehicles such as fire ambulance S.E.S. etc can be linked at all times to the major centres such as Lismore and Ballina.

- **The human element in time of flood**

Here we have created a route with many good and important features, but in doing so we are conscious of the fact that we have found it necessary to impact, to a degree, on the National Parks and maybe some indigenous areas, however there has to be some compromise and it is so important that we do not lose sight of the terrible impact on peoples lives when their homes are flooded. The financial losses such as income and property can be measured in dollar terms, but there is no way the affect of trauma, stress, heartache etc can ever be measured. Anybody that has ever suffered the experience of having their home violated by flood know that nothing should ever be built in a flood plain, which would exacerbate the situation. The R.T.A. can do nothing at all on the Richmond River to assist flood mitigation, but they can do untold harm by doing anything at all in the flood plain.

- **Hopefully avoiding indigenous areas**

Because there are 3 different maps showing conflicting information regarding indigenous sites it is extremely difficult to select an appropriate route around Cooks Hill area so we are presenting 2 options.

- **No 1**

Using the original map and the amended map page 82 (route options development Report No1 February 2005) the route should pass through 13 a former camp site, which is probably more historical than sacred.

- **No 2**

Using map figure 5-16 page 92 (route options Development Report Stage 1 June 2005) the route should pass through an area near 11 & 16.

- **Big saving and avoid social impact**

There may be only one house affected in the entire route.

- **Social benefit and big saving**

Because there appears to be a real problem with the access on the Woodburn – Illuka section the flood free route would help considerably for the first 8 kilometres south of Woodburn.

- **Huge financial and social saving**

An absolute minimum of prime agricultural land needed

Original

THE FLOOD FREE ROUTE

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STRENGTHS

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The route will not interfere with the existing highway and will only cross the existing Highway once. If the bridge is reasonably high, the existing highway should be able to pass under the approaches on the eastern side of the river. Hopefully their approach could be on piers for part of the way at least so that it wouldn't create a lever affect in time of flood, and at the same time and it would not dissect the cane farm which is the only cane farm affected in the entire route.

- **No impact at all on peoples everyday activities**

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- **Big Saving**

The route would be approximately 98% flood free and because it is almost entirely on highland a minimum of fill would be required.

- **Abundance of material at close proximity**

There are numerous quarries in the immediate areas near this route namely McGearys, Byrnes, Blue Pool, Bagotville, Airforce Wireless Station.

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- **The human element in time of flood**

Here we have created a route with many good and important features, but in doing so we are conscious of the fact that we have found it necessary to impact, to a degree, on the National Parks and maybe some indigenous areas, however there has to be some compromise and it is so important that we do not lose sight of the terrible impact on peoples lives when their homes are flooded. The financial losses such as income and property can be measured in dollar terms, but there is no way the affect of trauma, stress, heartache etc can ever be measured. Anybody that has ever suffered the experience of having their home isolated by flood know that nothing should ever be built in a flood plain, which would exasperate the situation. The R.T.A. can do nothing at all on the Richmond River to assist flood mitigation, but they can do untold harm by doing anything at all in the flood plain.

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Because there appears to be a real problem with the access on the Woodburn – Illuka section the flood free route would help considerably for the first 8 kilometres south of Woodburn.

- **Huge financial and social saving**

An absolute minimum of prime agricultural land needed

URN

REFER TO THIS MAP AS SHEET 9539 (EDITION 1)
SERIES R 651



1 K 1
2 K

CONVERSION TABLE

FEET	METERS
1	0.305
2	0.610
3	0.914
4	1.219
5	1.524
6	1.829
7	2.134
8	2.438
9	2.743
10	3.048

1 FOOT = 0.3048 METERS

Appendix B

Stakeholder background information

Kim.Forsyth

To: Tanya.Coates

29/06/2005 03:03 PM

Subject: Re: Woodburn to Ballina CLG Proposed Route

Afternoon Tanya,

Further to your e-mail on 20 June 2005 and our initial discussions with Harry Batt on 15 June 2005, please find some preliminary advice from DEC on the proposed route developed by the Community Liaison Group (CLG). Please be aware that this advice provided should only be viewed as preliminary as a detailed assessment of this proposal has not been undertaken.

A number of concerns are raised over the location of this proposed route option, specifically;

- New and additional impacts to the DEC Reserve System - specifically Broadwater NP and Bundjalung NP. These impacts can include (but are not limited to) creation of a new road corridor, direct vegetation clearing, new edge effects, increased fragmentation, increased weed invasion and increased roadkills. Please be aware that this option would require the revocation of a potentially large area of the DEC reserve system. All matters identified within the DEC Revocation Policy must be addressed.
- Impact on a large number of known (and potential) threatened species records such as: Koala, Common Planigale, Grass Owl, Wallum Froglet, Wallum Sedge Frog, Black-necked Stork, Little Bent-wing Bat and Ground Parrot. It is understood that the Oxleyan Pygmy Perch has also been recorded within some of these areas.
- Impact on a number of Endangered Ecological Communities listed under the Threatened Species Conservation Act 1995.
- Sever a number of Key Habitats and Corridors identified by the DEC.
- Impact to a number of Forest Ecosystems which are considered to be inadequately reserved in the conservation reserve system.
- Impacts on a number of conservation zones identified within the Richmond Valley Council Local Environmental Plan including - National Parks and Nature Reserves (zone 8a), Proposed future National Park Extensions (zone 8b) and Environmental Protection Wetlands.
- The location for the Evans River crossing is proposed on a natural section of the river where as the other proposed route options cross at the Tuckombil Canal. The canal is the preferred location for the crossing as this area has already been disturbed. The CLG option also proposes to cross the river through a gazetted SEPP 14 wetland which should be avoided.
- The CLG options appears to impact on more vegetation than the other options, therefore increasing the risk of erosion and water pollution where as the other proposed options follow more closely the existing road corridor.
- It is unclear what potential impacts this option may have on sensitive noise receivers which are currently not affected by the existing highway. However on the positive, the CLG option is further away from the township of Woodburn and should therefore have less impact on these sensitive noise receivers than options closer to town.

Should you wish to discuss this matter further, please contact myself or Scott Hunter

Regards

Kim Forsyth
Senior Threatened Species Officer
North East Branch
Environment Protection and Regulation Division
DEPARTMENT OF ENVIRONMENT AND CONSERVATION (NSW)

"Greg Davey"

To: Tanya.Coates

Subject: Re: Woodburn to Ballina CLG Proposed Route

24/06/2005 11:25 AM

Hi Tanya,

Many thanks for the opportunity to comment on the extra route currently being looked at for the Woodburn to Ballina Project. DPI Fisheries has reviewed the document and is concerned with the potential impacts to the Evans River aquatic habitat in the proposed route/ bridge crossing area and the associated potential disturbance to the riparian vegetation in the Bundjalung NP area. There is also known and potential Oxleyan Pigmy Perch (OPP) habitat in the area between the Evans River and the Woodburn - Evans Head Road. The potential to directly impact on OPP and habitat in the Broadwater National Park is also a concern with this proposed route.

Please note, I have also forwarded this to the local DPI Agricultural Environment Officer, Mr. Rik Whitehead, to provide any additional comments for consideration.

Call if any problems or further info required.

Cheers

Greg

Greg Davey
Conservation Manager
Pacific Highway Upgrade
Dept. of Primary Industries
Fisheries Branch
Ballina

"John Moye"

To: tanya.coates

Subject: CLG Woodburn/Ballina

29/06/2005 03:34 PM

I have "roamed" through several areas on the northern bank of the Evans R. over the years. Some of the wetlands, which have an environmental protection status, do contain some interesting plant species. From an "orchid" perspective, I have seen *Dendrobium melaleucaphyllum*, endangered species listing, and *Oberonia palmicola*, vulnerable, both in significant numbers in one "wetland" and in another numerous plants of *Calanthe triplicata*. Often, in near coastal situation, *Calanthe* and *Phaius*, endangered, grow side by side, although I haven't seen either species in flower on the lower Evans R. Numerous smaller terrestrial orchids have also been seen in these localities.

As the proposal shows the highway passing through a "wetland" area a "detailed" survey of this area would need to be undertaken for any of these Endangered/Vulnerable orchids species and of course any other significant plants.

As a one-time member of the Evans Head-Woodburn Golf Club I have seen koalas on the course on numerous occasions. A small number of Phascagales were also known to be in this locality.

A housing development was proposed for an area to the west of Evans Head and in an area locally referred to as the "Iron Gates". Approval for this development to proceed was rescinded partly on "environmental" grounds. From memory, Pygmy Perch and Koalas were both cited by the "environmental lobby" as occurring in this area.

I have not done any plant surveys in this area of the proposed route for several years.

The ridge-swale systems in the western section of the Broadwater NP are well-developed and could pose some engineering problems with respect to both surface and ground water. The impact of a major road system in through here on the flora and fauna would be significant.

Regards
John Moye

Garry Stephen Owers

To: tanya.coates

Subject: CLG submitted route

06/07/2005 07:58 PM

Hi Tanya,

In relation to the mapped route dated 27th June, the aim of this route appears to be: -

- * Destruction of the maximum amount of native vegetation possible.
- * Fragmentation of Bundgalung & Broadwater NP.
- * Isolation and destruction of koalas through fragmentation of habitat.
- * Maximum destruction of threatened species.
- * Community anger directed to the RTA, CLG, Hyder and the cane industry who appears to be behind it.
- * Completely ignoring the four principles of ESD.

Why has all cane land been listed as prime agricultural land when under the Soil Conservation Service of NSW Rural Land Capability Mapping it is actually classified as class IVc or VIc. Prime agricultural land falls under class I and II and will be found on the Alstonville Plateau. Cane land is classified as land unsuitable for regular cultivation and only suitable for specialist cropping. Has this land been wrongly classified after pressure from the cane industry in order to prevent it being impacted by roadworks? What is the hidden agenda here, it is certainly not choosing the best route?

Cheers, Garry & Angela
Friends of the Koala
Lower Richmond

Appendix C

Vegetation/habitat types

Banksia aemula – *Leptospermum trinervium* mid high to tall
closed to open Dry Shrubland/Heathland

This vegetation/habitat type dominates higher ground throughout Broadwater National Park typically on well drained sand podzol soils derived from Pleistocene barrier sands of marine-aeolian origin. The heathland increases in height to a shrubland where the vegetation/habitat type is less exposed to prevailing onshore winds. This vegetation/habitat type grades into wet heathland downslope as soil waterlogging increases.

This vegetation/habitat type occurs throughout the CA route within Broadwater National Park and has recruited into some of the areas subject to sand mining (albeit at lower floristic diversity levels relative to remnant undisturbed areas).

This vegetation/habitat type is considered to be relatively well conserved in the North Coast Bioregion with occurrences in Broadwater, Bundjalung, Yuraygir, Hat Head and Crowdy Bay National Parks as well as Moonee Beach and Limeburners Creek Nature Reserves (Griffith 1983, 1984, 1985).

Potential habitat for the TSC listed shrub, *Olex angulata*, although no records are known for this taxa on the NSW far north coast.

Equivalent Vegetation Types – Forest Type No. 107 (Forestry Commission NSW); Community No. 29 (Griffith et al 2003)

Banksia ericifolia subsp. *macrantha* +/- *Leptospermum polygalifolium* subsp. *cismontanum* – *Leptospermum livesidgei* – *Leptospermum whitei* mid high to tall open to closed Swamp Sclerophyll Shrubland

This vegetation/habitat type occurs in poorly drained podzolised sands with a shallow watertable (ie. watertable remains close to the surface for extended periods). This vegetation/habitat type is often replaced by dry heathland or dry sclerophyll shrubland upslope as soil drainage improves and conversely by sedgeland downslope where standing water accumulates.

This vegetation/habitat type occurs throughout the CA route within Broadwater National Park and has recruited into some of the areas subject to sand mining (albeit at lower floristic diversity levels relative to remnant undisturbed areas).

This vegetation/habitat type is considered to be relatively well conserved in the North Coast Bioregion with occurrences on the major sandmasses in Broadwater, Bundjalung, Yuraygir, Hat Head and Crowdy Bay National Parks (NRAC data, undated; author's pers. obs.).

Wet heathlands of the coastal sandmasses of the far north coast are considered to be potential habitat for the TSC listed shrub *Prostanthera palustris*.

Equivalent Vegetation Types – Forest Type No. 223 (Forestry Commission NSW); Communities 24, 34 (Griffith et al 2003)

Banksia oblongifolia – *Xanthorrhoea fulva* Wet Heathland/Shrubland

This vegetation/habitat type occurs in low lying open depressions in inter dunal swales associated with sandy podzolised soils where the water table remains close to ground surface for extended periods. This vegetation/habitat type grades into *Banksia aemula* heathland/shrubland on higher ground as soil drainage improves and into sedgeland where soil water logging increases. *Banksia ericifolia* var *macrantha* occasionally overtops the dominant species of this community to form an open to closed shrubland (author's pers. obs.).

This vegetation/habitat type occurs throughout the CA route within the northern portions of Broadwater National Park and has recruited into some of the areas subject to sand mining (albeit at lower floristic diversity levels relative to remnant undisturbed areas).

This vegetation/habitat type is considered to be relatively well conserved in the North Coast Bioregion with occurrences in Broadwater, Bundjalung and Yuraygir National Parks, as well as Limeburners Creek Nature Reserves (Griffith et al, 2003) and on Crown Land at Evans and Lennox Heads (author's pers. obs.).

Wet heathlands of the coastal sandmasses of the far north coast are considered to be potential habitat for the TSC listed shrub *Prostanthera palustris*.

Equivalent Vegetation Types – Forest Type No. 223 (Forestry Commission NSW); Community no. 26 (Griffith et al 2003)

Leptospermum polygalifolium subsp *cismontanum* – *Melaleuca nodosa* +/- *Banksia oblongifolia* Wet Heathland/Shrubland

This vegetation/habitat type occurs in low lying open depressions in inter dunal swales associated with sandy podzolised soils in which a relatively shallow, weakly indurated or incipient pan retards, but doesn't prevent, vertical drainage. This vegetation/habitat type grades into *Banksia aemula* heathland/shrubland on higher ground as soil drainage improves and into sedgeland where soil water logging increases. *Banksia ericifolia* var *macrantha* occasionally overtops the dominant species of this community to form an open to closed shrubland (author's pers. obs.).

This vegetation/habitat type occurs patchily throughout the CA route within Broadwater National Park and has recruited into some of the areas subject to sand mining (albeit at lower floristic diversity levels relative to remnant undisturbed areas).

This vegetation/habitat type is considered to be relatively well conserved in the North Coast Bioregion with occurrences in Broadwater, Bundjalung and Yuraygir National Parks, as well as Limeburners Creek Nature Reserves (Griffith *et al*, 2003) and on Crown Land at Evans and Lennox Heads (author's pers. obs.).

Equivalent Vegetation Types – Forest Type No. 223 (Forestry Commission NSW); Community no. 23 (Griffith *et al* 2003)

Baumea teretifolia – *Restio* (*Baloskion*) *pallens* – *Baloskion tetraphyllum* subsp. *meiostachyum* +/- *Melaleuca quinquenervia* Sedgeland/Swamp Sclerophyll Shrubland

This vegetation/habitat type occurs in periodically inundated, interdunal depressions throughout Broadwater National Park. Pressey and Griffith (1992) note that this community is generally inundated to a lesser degree than other sedgelands supporting *Lepironia articulata* or *Baumea rubiginosa*.

This vegetation/habitat type occurs as small scattered stands throughout the CA route within Broadwater National Park.

This vegetation/habitat type is considered to be relatively well conserved in the North Coast Bioregion with occurrences in Broadwater, Bundjalung, Yuraygir, Crowdy Bay and Booti Booti National Parks (Griffith, 1983; 1984; 1985; Griffith *et al*, 2000). This vegetation/habitat type forms a component of SEPP 14 wetlands within Broadwater National Park including a relatively large SEPP 14 wetland through the central portion of the CA route.

Wet heathlands of the coastal sandmasses of the far north coast are considered to be potential habitat for the TSC listed shrub *Prostanthera palustris*.

Equivalent Vegetation Types – Forest Type No. 231 (Forestry Commission NSW); Community No. 9, 36 (Griffith *et al* 2003).

Melaleuca quinquenervia open to closed woodland/forest

This vegetation/habitat type occurs in low lying, open depressions on Pleistocene backbarrier deposits of estuarine origin where standing water is present for extended periods. This vegetation/habitat type often borders *Baumea teretifolia* – *Restio pallens* sedgeland or open water.

This vegetation/habitat type occurs primarily in the central portion of the CA route within Broadwater National Park.

This vegetation/habitat type is considered to be relatively well conserved in the North Coast Bioregion with occurrences in Broadwater, Bundjalung, Yuraygir, Crowdy Bay and Myall Lakes National Parks (Griffith, 1983; 1984; 1985; Myerscough and Carolin 1986). This vegetation/habitat type forms a component of SEPP 14 wetlands within Broadwater National Park including a relatively large SEPP 14 wetland through the central portion of the CA route. This vegetation/habitat type is structurally and somewhat floristically similar to the Swamp Sclerophyll Forest EEC listing under the TSC Act. It is noted, however, that this listing is meant to capture coastal floodplain remnants on alluvial soils and as such, if interpreted literally, is not representative of, or meant to capture, sandplain/dunal vegetation on the major coastal sandmasses of the NSW north coast.

This vegetation type provides habitat for the Endangered Swamp orchid, *Phaius australis*. Two records for the TSC listed species occur in Broadwater National Park, about 4 km to the east of the CA route.

Equivalent Vegetation Types – Forest Ecosystem No. 112 – Paperbark (NPWS 1999).

Avicennia marina var. *australasica* low to mid high open to closed Mangrove Woodland

This vegetation/habitat type is found on interbedded Quaternary estuarine sediments in the lower intertidal zone. This vegetation/habitat type grades into saltmarsh communities (*Sporobolus virginicus* tussock grassland/*Juncus kraussii* rushland) in the mid to upper intertidal where inundation usually only occurs at spring high tides.

This vegetation/habitat type forms a component of one of two (2) estuarine wetlands which occur within the Evans River section of the CA route. The route traverses through the two wetlands, situated on the eastern and western sides of the corridor. The mangrove woodland forms a component of the wetland situated within the western portion of the route corridor. An additional two estuarine wetlands occur just outside the route. The wetlands have been mapped by West *et al.*, (1970) in a state-wide inventory and more recently by Kiss (2002) in survey and mapping of the vegetation of the Evans River. This vegetation/habitat type forms a component of SEPP 14 coastal wetlands.

This vegetation/habitat type is conserved in the North Coast Bioregion (total = 513 ha) with occurrences in Bundjalung, Yuraygir, Hat Head, Crowdy Bay National Parks (Griffith 1983, 1984, 1985) as well as in Ballina, Richmond River and Limeburners Creek Nature Reserves (NRAC, undated). Approximately 3600 hectares of SEPP 14 wetland have been mapped in the Richmond Valley (Richmond Shire Council SOE Report, 2004).

Equivalent Vegetation Types – Forest Ecosystem No. 333 – Mangroves (Forestry Commission NSW 1989)

Sporobolus virginicus – *Sarcocornia quinqueflora* dwarf to mid high closed Tussock Grassland/Chenopod Shrubland

This vegetation/habitat type is found on interbedded Quaternary estuarine sediments in the mid to upper intertidal zone. This vegetation/habitat type grades into mangrove woodland in the lower intertidal and into *Juncus kraussii* rushland in the upper intertidal which is only occasionally inundated by spring high tides.

This vegetation/habitat type forms a component of the two (2) estuarine wetlands which occur within the Evans River section of the CA route. The route traverses through the two wetlands, situated respectively on the eastern and western sides of the corridor. An additional two estuarine wetlands occur just outside the route. The wetlands have been mapped by West *et al.*, (1970) in his state-wide inventory and more recently by Kiss (2002) in his survey and mapping of the vegetation of the Evans River. This vegetation/habitat type forms a component of SEPP 14 coastal wetlands.

Very limited areas of this vegetation/habitat type is conserved in the North Coast Bioregion (total = probably < 100 hectares, NRAC, undated; author's pers. obs.) with small, isolated occurrences in Broadwater, Bundjalung and Yuraygir National Parks (Griffith, 1983; 1984; 1985). Benson (1989) considers this vegetation/habitat type to be inadequately reserved in NSW. This vegetation/habitat type forms a component of Coastal Saltmarsh, listed as an Endangered Ecological Community (EEC) under the NSW *Threatened Species Conservation Act* 1995 (TSC Act).

Equivalent Vegetation Types – N/A

Juncus kraussii tall closed Rushland

This vegetation/habitat type is found on interbedded Quaternary estuarine sediments in the upper intertidal zone. This vegetation/habitat type grades into *Sporobolus virginicus*– *Sarcocornia quinqueflora* grassland/chenopod shrubland in the mid to upper intertidal and into *Baumea juncea* Sedgeland or *Casuarina glauca*–*Melaleuca quinquenervia* Swamp Woodland/Forest above the level of tidal influence.

This vegetation/habitat type forms a component of the two (2) estuarine wetlands which occur within the Evans River section of the CA route. The route traverses through the two wetlands, situated respectively on the eastern and western sides of the corridor. An additional two estuarine wetlands occur just outside the route. The wetlands have been mapped by West *et al.*, (1970) in a state-wide inventory and more recently by Kiss (2002) in a survey and mapping of the vegetation of the Evans River. This vegetation/habitat type forms a component of SEPP 14 coastal wetlands.

Very limited areas of this vegetation/habitat type is conserved in the North Coast Bioregion (total = probably < 100 hectares, NRAC, undated; author's pers. obs.) with small, isolated occurrences in Broadwater, Bundjalung and Yuraygir National Parks (Griffith, 1983; 1984; 1985). Benson (1989) considers the reservation of this vegetation/habitat type in NSW to be fair.

This vegetation/habitat type forms a component of Coastal Saltmarsh, listed as an Endangered Ecological Community (EEC) under the NSW *Threatened Species Conservation Act 1995* (TSC Act).

Equivalent Vegetation Types – N/A

Melaleuca quinquenervia (+/- *Casuarina glauca*) tall open to closed Forest (Swamp Sclerophyll)

This vegetation/habitat type occurs on periodically inundated alluvial flats associated with the Evans River coastal floodplain in the vicinity of the CA route. This vegetation/habitat type grades seaward into saltmarsh communities and upslope into wet sclerophyll forest (subtropical coastal floodplain forest) on the northern and southern banks in the vicinity of the CA route.

While this vegetation/habitat type is reasonably well conserved in the North Coast Bioregion DEC Estate (with occurrences in Broadwater, Bundjalung, Yuraygir, Crowdy Bay National Parks as well as Lake Innes and Limeburners Creek Nature Reserves), its occurrence is primarily on the large dunal sandmasses which are not technically on floodplains (Griffith, 1983; 1984; 1985). The vegetation type has been extensively cleared on floodplains including the Richmond Valley which reflects its recent listing as an EEC under the TSC Act (Coastal Floodplain Swamp Sclerophyll).

This vegetation type provides habitat for the Endangered Swamp orchid, *Phaius australis*. Two records for the TSC listed species occur in Broadwater National Park, about 4 km to the east of the CA route.

Equivalent Vegetation Types – Forest Type No. 31 (Forestry Commission NSW 1989)

Corymbia intermedia – *Eucalyptus siderophloia* – *E. tereticornis* (+/- *Lophostemon suavolens*, *L. confertus*) tall to very tall Wet Sclerophyll Open Forest

This vegetation/habitat type occurs on periodically inundated alluvial flats and river terraces associated with the Evans River coastal floodplain in the vicinity of the CA route (northern and southern riversides). One of the dominant vegetation types in Bundjalung National Park fringing the CA route. This vegetation/habitat type grades downslope into *Melaleuca quinquenervia* (+/- *Casuarina glauca*) Woodland as soil waterlogging increases or Coastal Saltmarsh and upslope into drier forest types of the coastal foothills and ranges (eg. Grey Gum – Spotted Gum Open Forest).

This vegetation/habitat type is poorly conserved in the North Coast Bioregion with only very small occurrences in DEC Estate lands, the largest being about 300 hectares in Bundjalung National Park just outside the western and eastern boundaries of the CA route on the southern side of Evans River and 200 hectares in Yuraygir National Park. Very small occurrences (< 10 hectare patches) have been reported for Ukerebagh

Nature Reserve in Tweed Valley and Limeburners Creek Nature Reserve in Hastings Valley (Pressey and Griffith, 1992). The vegetation type has been extensively cleared on floodplains including the Richmond Valley which reflects its recent listing as an EEC under the TSC Act (Subtropical Coastal Floodplain Forest).

It is noted that this vegetation type situated just outside the CA route on the southern bank of the Evans River is mapped by Kiss (2002) as Lowland Subtropical Rainforest, another EEC listing under the TSC Act. The vegetation type in question may more closely represent the subtropical rainforest alliance No. 3 of Floyd (1990), this being *Cryptocarya obovata* – *Ficus spp.*, - *Araucaria cunninghamia*, which is the dominant rainforest alliance on coastal alluvial floodplains north of the Manning River. Field reconnaissance would be required to confirm this community type.

Subtropical Coastal Floodplain Forest and Lowland Subtropical Rainforest (Alliance No. 3) provide habitat for the TSC listed rainforest trees, *Austromyrtus fragrantissima* and *Endiandra hayesii*, the Vulnerable shrub, *Desmodium acanthocladum*, the Endangered fern *Belvisia mucronata* var. *mucronata* and the epiphytic orchid, *Oberonia titania*. Two records of *Austromyrtus fragrantissima* occur within about 4-5 km to the west and north of the CA route on the Richmond River. This species is generally seen in the riparian zone and occur from the lower Richmond River at Woodburn to Currumbin Creek, Qld (Floyd 1990). A single record of *Desmodium acanthocladum* occurs within about 2-3 km to the west of the CA route (north of the Evans River). This species is closely associated with riverside habitats from Grafton to Lismore (Harden 1991, 2002). The closest two records of *Endiandra hayesii* occur approximately 3 and 8 km to the west of the CA route in lowland subtropical rainforest along the Richmond River. A single record of *Belvisia mucronata* var. *mucronata* and *Oberonia titania* occurs within 3 km to the east of the CA route in dry/wet sclerophyll forested habitat of the Gumma Garra sandstone range (these taxa are not restricted to rainforest habitats).

Equivalent Vegetation Types – Forest Type No. 53 (Forestry Commission NSW 1989).

Grey Gum (*E. propinqua*) – Grey Ironbark (*E. siderophloia*) – Spotted Gum (*C. variegata*) Open Forest/Forest

This vegetation/habitat type is widespread on sandstones in the Clarence-Moreton Basin often on mid to upper hillslopes and ridges and is likely to be a dominant forest type along the central and southern sections of the CA route based on the author's knowledge of vegetation of the Richmond and adjoining coastal ranges. This vegetation type was dominant on the hillslopes south of the Evans River within and adjoining Bundjalung National Park on bedrock.

By virtue of its occurrence on relatively poor sandstone soils in generally rugged country, this vegetation/habitat type remains widespread in the Clarence-Moreton Basin with an extant area of about 80% (NPWS, 1999).

Equivalent Forest Type = 52 (NPWS 1999); 74 (Forestry Commission NSW, 1989)

Coastal Blackbutt (*Eucalyptus pilularis*) – Turpentine (*Syncarpia glumulifera*) Forest

This vegetation/habitat type is widespread on the sandstones in the Clarence-Moreton Basin from the southern Richmond Range east to the Coast Ranges (NPWS, 1999) on lower to mid hillslopes on more protected aspects and is likely to be a dominant forest type along the CA route based on the author's knowledge of vegetation of the Richmond and adjoining coastal ranges.

By virtue of its occurrence on relatively poor sandstone soils in generally rugged country, this vegetation/habitat type remains widespread in the Clarence-Moreton Basin with an extant area of about 90% (NPWS, 1999).

Equivalent Forest Type = 40 (NPWS 1999); 39 (Forestry Commission NSW 1989)

Pink Bloodwood (*C. intermedia*) – Red Mahogany (*E. resinifera* subsp. *hemilampra*) – Tallowood (*E. microcorys*) Dry Sclerophyll Forest

This vegetation/habitat type is restricted to sandstones of the Coast Range north of the Corindi River (NPWS, 1999) typically on lower hillslopes and is likely to be a dominant forest type along the CA route based on the author's knowledge of vegetation of the Richmond and adjoining coastal ranges.

This vegetation/habitat type has been subject to more widespread clearance than the previous two forest type due to its occurrence on slightly more fertile soils with an extant area of about 33 % (NPWS, 1999).

Equivalent Forest Type = 23 (NPWS 1999)

Note: Owens Range vegetation/habitat types are all considered to be potential habitat for the Threatened taxa *Belvisia mucronata* var *mucronata* and *Oberonia titania*.

Swamp Mahogany (*E. robusta*) – Red Mahogany (*E. resinifera* subsp. *hemilampra*) Swamp Sclerophyll Closed Forest

This vegetation/habitat type was recorded on sandy loams in lower lying areas within Owens Range where drainage is impeded (eg. fire trail off Turners Road).

This vegetation type is structurally and floristically similar to coastal floodplain swamp sclerophyll forest, listed as an EEC under the TSC Act.

Equivalent Forest Type = 30 (Forestry Commission NSW 1989)

Appendix D

Threatened Fauna Species

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Emu <i>Dromaius novaehollandiae</i> (North Coast Bioregion) E2	Emus inhabit a range of predominantly open habitats, including plains, grasslands, woodlands and shrubs, and may occur occasionally in forest (NPWS, 2004). Emus are omnivorous, feeding upon a variety of leaves, grasses, fruits from native plants, and also a variety of insects. Males incubate the eggs, and raise the hatchlings (Readers Digest, 1997).	Very high in northern section. Known population within Broadwater National Park. Low to Medium in central section. Limited appropriate habitat for the Emu in the areas of Bundjalung National Park impacted by the CA route. Most records in Bundjalung National Park are located to the south and east of the proposed CA route; however potential habitat occurs to the west of the proposed CA route.	Removal and isolation of known and potential habitat areas. Isolation of known Emu population. Mitigation measures would be required.	High
Magpie Goose <i>Anseranas semipalmata</i> V	Magpie Geese generally occur in water bodies associated with shallow swamps and associated grassland. This species feeds on seeds and tubers from native grasses, wild rice and spike rush (Australian Museum, 2003). The commencement of breeding is influenced by water level (NPWS, 2000). Limited information on habitat usage within the study area.	Low in water bodies within northern and southern sections. May utilise paddocks (that occur to the south of the Evans River crossing) when inundated.	Removal of potential habitat. Alteration of hydrology may impact upon potential habitat.	Low
Black Bittern <i>Ixobrychus flavicollis</i> V	Generally found in dense vegetation alongside streams, estuarine habitats, swamps, tidal creeks and mudflats.	Medium in central section. May occur in riparian areas and tidal creeks near Evans River crossing. Recorded in Bundjalung National Park approximately 15 km to the south of the Evans River crossing. Low northern section. May utilise inundated areas within Broadwater National Park	Alteration and removal of a small area of potential habitat.	Low

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Australasian Bittern <i>Botaurus poiciloptilus</i> V	Generally requires permanent freshwater wetlands with tall dense vegetation including bulrush and spike rush. Also occurs in brackish wetlands, and salt marsh. Recorded in Bundjalung National Park approximately 15 km to the south of the Evans River crossing.	Low to medium in central section. May occur in riparian areas around Evans River crossing Low to medium in northern section. May utilise inundated areas within Broadwater National Park	Alteration and removal of a small area of potential habitat.	Low
Black-necked Stork <i>Ephippiorhynchus asiaticus</i> E1	Occurs in freshwater swamps, mangroves mudflats and dry floodplains (NPWS, 2000). Nests are large flat piles of sticks, and reeds, and are usually located at the top of a tree near water (NPWS, 2000; Readers Digest, 1997). Feeds upon fish, frogs, reptiles, rodents, invertebrates, carrion and sometimes small water birds (NPWS, 2005b; Readers Digest, 1997).	Medium to high in central section – riparian areas of Evans River crossing High in water bodies within northern section. Recorded within 1 km of the proposed CA route in Broadwater National Park.	Alteration and removal of potential habitat.	Medium

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Osprey <i>Pandion haliaetus</i> V	The Osprey feeds almost entirely on fish which it predominantly hunts along open coasts. Ospreys will hunt over fresh, salt or brackish water and have a feeding range between 5km and 20km (Readers Digest, 1993; Lindsey, 1992). Breeding occurs between August and November in the southern hemisphere, and between July and September in the north. Nests are a large pile of sticks placed up to 30m above the ground in trees, cliff tops or rock ledges, with clutch sizes between two and three (Lindsey, 1992). Known to utilise the Evans River and environs for fishing.	High to very high in central section. Known to utilise the Evans River and environs for fishing. High in northern section, particularly nesting habitat. Medium to high in southern section for nesting purposes.	Alteration and removal of a small area of potential and known feeding habitat. Removal of potential nesting habitat.	Low
Square-tailed Kite <i>Lophoictinia isura</i> V	Square-tailed Kites occur in a variety of habitats including open forest, woodland and heath, in areas with greater than 500 mm rainfall per annum (NPWS, 2000). The most important habitat feature appears to be an abundant supply of passerines upon which they forage (Olsen, 1995; NPWS 2000). Breeding pairs of Square-tailed Kites occupy very large territorial ranges estimated at to be at least 100 square kilometres (NPWS, 2000).	Medium to high in all sections. Recorded in the vicinity of the existing Pacific Highway near Woodburn. No known nest sites within the proposed CA route.	Alteration and removal of potential foraging habitat. Removal of potential nesting habitat.	Low to medium
Red Goshawk <i>Erythrotriorchis radiatus</i> E1, Vu	Occur sparsely in coastal and subcoastal tall open forests and woodlands.	Medium in all sections. Small number of records within Broadwater and Bundjalung National Park to the east of the proposed CA route, however; most recorded locations of this species are historic records.	Alteration and removal of potential foraging habitat. Removal of potential nesting habitat.	Low to medium

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Brolga <i>Grus rubicunda</i> V	Extensive open wetlands generally; plains grasslands, crops and stubbles, irrigated pastures salt flats. (Serventy, 1985).	Medium in central section. Likely to occur within riparian areas of Evans River crossing, and has been recorded within 3 km to the east of this area. Medium to high in water bodies within northern section. Known foraging habitat in the Broadwater National Park.	Alteration and removal of a small area of potential habitat.	Low
Bush-hen <i>Amauornis olivaceus</i> V	Occurs in a variety of habitats including rainforest fringes, swamp forests, low scrub in flooded areas, tall grass, lantana thickets and roadside vegetation (Pizzey and Knight, 1997). Also known to utilise Sugar Cane fields in North Queensland.	Medium in all sections. Two records within 4 km east of the Evans River crossing.	Alteration, removal and fragmentation of potential habitat (to the east of Evans River crossing). Increased chance of road strike.	Medium to high
Painted Snipe <i>Rostratula benghalensis</i> V, Vu,	Prefers fringes of swamps, dams and marsh areas with a cover of grasses, lignum, low scrub or open timber.	While the nearest record on the NPWS Atlas of NSW is located approximately 16 km inland near Bungawalbin National Park, some areas within and adjoining the proposed CA route may represent potential habitat. Low to medium occurrence in riparian areas of Evans River crossing, and Low to Medium occurrence in water bodies within northern section.	Alteration and removal of a small area of potential habitat.	Low

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Comb-crested Jacana <i>Irediparra gallinacea</i> V	Lives amongst vegetation floating on the surface of slow moving rivers, swamps lakes, dams and lagoons.	Very low in Northern Section. May potentially occur in suitable water bodies containing floating vegetation such as water lilies, however limited appropriate habitat occurs within or adjoining the proposed CA route.	Alteration and removal of a small area of potential habitat.	Low
Bush Stone-curlew <i>Burhinus grallarius</i> E1	Generally occurs in lightly timbered open forest, woodland, heaths and cleared lands with Woodland remnants. The Bush Stone-curlew nests on the ground, often near dead fallen timber within open woodland.	While the nearest record on the NPWS Atlas of NSW is located inland near Bungawalbin National Park, some areas within proposed CA route represents potential habitat. Low to medium occurrence in all sections.	Alteration and removal of potential habitat.	Low to medium
Wompoo Fruit-Dove <i>Ptilinopus magnificus</i> V	Occurs in Rainforest, low elevation moist Eucalypt and Brushbox forests.	Low to medium in southern and central sections. Potential habitat represented in wet sclerophyll that occurs around Evans River crossing, and also within small pockets of Owens Range.	Alteration and removal of small areas of potential habitat. Habitat fragmentation. Increased chance of road strike.	Low to medium.

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Superb Fruit-Dove <i>Ptilinopus superbus</i> V	Occurs in Rainforest, low elevation moist Eucalypt and Brushbox forests.	Low to medium in southern and central sections. Potential habitat represented in wet sclerophyll that occurs around Evans River crossing, and also within small pockets of Owens Range.	Alteration and removal of small areas of potential habitat. Habitat fragmentation. Increased chance of road strike.	Low to medium
Rose-crowned Fruit-Dove <i>Ptilinopus regina</i> V	Occurs in Rainforest, low elevation moist Eucalypt and Brushbox forests.	Low to medium in southern and central sections. Potential habitat represented in wet sclerophyll that occurs around Evans River crossing, and also within small pockets of Owens Range.	Alteration and removal of small areas of potential habitat. Habitat fragmentation. Increased chance of road strike.	Low to medium
Red-tailed Black-Cockatoo <i>Calyptorhynchus banksii</i> V	Occurs in a variety of habitats, however, more common in northern and inland Australia.	Low in all sections. Only two records within the locality, one record 4 km to the east, and the other record 20 km to the west of the proposed CA route. It is considered that limited potential habitat for this species occurs within proposed CA route.	Alteration and removal of potential habitat.	Low

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Glossy Black-Cockatoo <i>Calyptrorhynchus lathamii</i> V	The primary habitat requirements for Glossy Black Cockatoos include a good supply of food in the form of Allocasuarina fruit particularly Allocasuarina torulosa and A. littoralis, and large hollows for nesting (Higgins, 1999; Pepper et al., 2000). Nest hollows range in size, although Garnett et al. (1999) recorded an average nest hollow height of 30 cm, and an average width of 19 cm. Preferred habitat is often on fertile soils in dry open forest and woodland and Glossy Black Cockatoos generally choose to roost and nest in close proximity to preferred feeding sites.	High in southern section. Medium to high in central section. Medium in northern section. Known from records in the Broadwater and Bundjalung National Park. Also recorded in forested areas located within 2 km of The Gap Road. Large amount of potential habitat around Owens Range.	Alteration and removal of known and potential foraging and nesting habitat.	Medium to high impact upon foraging habitat High impact upon potential nesting habitat.
Double-eyed Fig-Parrot <i>Cyclopsitta diophthalma coxeni</i> E1, En,	Confined to subtropical, and dry rainforests particularly those forests with abundant figs. Coxen's Fig parrot nests in excavated cavities in dead or decaying branches and trunks of trees.	Low in all sections. Limited potential habitat within and adjoining proposed CA route.	Alteration, removal and fragmentation of potential habitat. Increased chance of road strike.	Low

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Swift Parrot <i>Lathamus discolor</i> E1, En	The Swift Parrot breeds exclusively in Tasmania and migrates to mainland Australia to feed during the winter months. On the mainland Swift Parrots have been observed in a variety of habitats, being dependant upon on the presence of flowering blossoms. The species is nomadic in response to flowering patterns and other food resources. The Swift Parrot inhabits mainly dry open Eucalypt forests and woodlands, usually Box-Ironbark woodlands and also Yellow Box/ Red Gum woodlands. The species is highly mobile and also often visits urban areas and farmlands with remnant woodland areas.	Low in all sections. The area within and adjoining the proposed CA route may be used opportunistically for foraging depending upon food resource availability. One record within 35 km to the west for the Richmond Valley LGA. Also recorded near the Blackwall Range to the north.	Alteration, removal and fragmentation of potential habitat. Increased chance of road strike.	Low
Ground Parrot (eastern subsp) <i>Pezoporus wallicus wallicus</i> V	Generally confined to wet heaths, sedge lands and associated native grasslands. Habitat suitability influenced heavily by fire and associated vegetation succession (DEH, 2005).	High in southern and northern sections. Numerous records in Broadwater National Park, and also in Bundjalung National Park, with some records within 500 m either side of the proposed CA route. Medium in central section, however; low in riparian area around Evans River crossing.	Alteration, removal and fragmentation of known and potential habitat. Increased chance of road strike. Potential for altered fire regime in fragmented habitats that in turn may result within unsuitable plant succession in burnt areas.	High
Powerful Owl <i>Ninox strenua</i> V	Powerful Owls are known to occur in a variety of forest types along the coast and ranges, with records up to 1500 m asl (Debus and Chafer, 1994; Higgins, 1999). Powerful Owls often roost during the day in the canopy of trees, although large hollows are used during the breeding season (Higgins, 1999). This species is known to have an extensive home range that may be as large as 1000 ha. The Powerful Owl preys most commonly on arboreal mammals.	High in all sections. There are limited records of this species on the NPWS Atlas of NSW Wildlife within or adjoining the proposed CA route. Despite this, the Powerful Owl is considered as likely to occur within all sections of the proposed CA route given the habitats that occur within and adjoining these sections.	Alteration and removal of potential foraging habitat. Removal of potential nesting habitat. Increased chance of road strike.	Medium to high

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Barking Owl <i>Ninox connivens</i> V	The Barking Owls occurs in a variety of forest and woodlands types along the coast and ranges however are most common in savannah woodland. Barking Owls generally roost during the day in the canopy of trees, although hollows are used during the breeding season. The home range of the Barking Owl varies between 30 and 200 hectares depending upon the habitat type. The Barking Owl preys on a variety of mammals, birds and insects (Schodde and Tideman, 1993).	There are limited records of this species on the NPWS Atlas of NSW Wildlife within the locality. Despite this, the Barking Owl is considered as likely to occur within forest and woodland areas of the route. Low in northern section. High in central and southern sections.	Alteration and removal of potential foraging habitat. Removal of potential nesting habitat. Increased chance of road strike.	Medium to high
Sooty Owl <i>Tyto tenebricosa</i> V	Sooty Owls occur primarily in closed forests (rainforests) and tall open forests (wet sclerophyll forest). (Debus, 1998). Essential habitat features include the presence of suitable nesting hollows as provided in old growth forests and a supply of arboreal or scansorial mammals (Debus 1998, NPWS, 2000). Estimated inferred home-ranges for the Sooty Owl are 2 -8 km ² per pair (Debus, 1998).	Low to medium in central and southern sections. Limited potential habitat is represented in areas of wet sclerophyll that occurs at some locations near Evans River crossing, and also within small pockets of Owens Range.	Alteration and removal of potential foraging habitat. Removal of potential nesting habitat. Increased chance of road strike.	Low to medium
Masked Owl <i>Tyto novaehollandiae</i> V	Masked Owls are known to utilise a broad range of habitats, including open forest and woodland with a sparse understorey and adjacent open areas (Hollands, 1991; Debus and Rose, 1994). Essential habitat features include the presence of suitable roosting and nesting hollows and an abundant supply of ground-dwelling or scansorial mammals (Higgins, 1999; Kavanagh, 1996). Masked Owls are known to forage and roost within previously disturbed habitats and on the fringes of urban development (Hollands, 1991; Kavanagh, 1996). Most foraging occurs within open forest or along roads and tracks.	Medium to high in northern and central sections. High in sclerophyll forest communities within the southern section Recorded 4 km to the east in Broadwater National Park.	Alteration and removal of potential foraging habitat. Removal of potential nesting habitat. Increased chance of road strike.	Medium to high

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Grass Owl <i>Tyto capensis</i> V	The Eastern Grass Owl generally inhabits open, often treeless country including swamps, heaths, grassland and, the dense vegetation of floodplains and bore drains (Strahan, 1994). The Eastern Grass Owl nests in hidden platforms of grass among tussocks and sedges. Large areas of known habitat within the Wardell Heath lands and Broadwater National Park.	High in northern section. Numerous records within 500m of the proposed CA route in Broadwater National Park. One of the records within proposed route corridor. Low in central and southern sections. Most records in Bundjalung National Park are located in more appropriate habitat that occurs to the south and east of the proposed CA route.	Alteration and removal of known and potential foraging habitat. Removal of potential nesting habitat. Increased chance of road strike.	Medium to high
Marbled Frogmouth <i>Podargus ocellatus</i> V	Generally confined to subtropical, warm temperate and cool temperate rainforests and wet sclerophyll forests with rainforest understoreys. Generally found within these habitats in gullies and near creeks.	Low to medium in central and southern sections. Some of the areas containing wet sclerophyll forest that occurs at the south of Evans River crossing and also within small pockets of Owens Range may represent potential habitat for this species. No records within locality of CA route on the NPWS Atlas of NSW Wildlife.	Alteration and removal of potential foraging and/or nesting habitat. Increased chance of road strike.	Low
Collared Kingfisher <i>Todiramphus chloris</i> V	The Collared Kingfisher inhabits Mangroves and estuarine riparian habitat, nesting in logs or termitaria in adjoining coastal forests or woodlands.	High at central section in and adjoining riparian vegetation associated with Evans River.	Alteration and removal of potential foraging and/or nesting habitat.	Low to medium

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Albert's Lyrebird <i>Menura alberti</i> V	Generally confined to subtropical, warm temperate and cool temperate rainforests and wet sclerophyll forests with rainforest understoreys. Albert's Lyrebird breeds in autumn to winter constructing large stick dome nests in trees or among rocks.	Low in central and southern sections. Some of the areas containing wet sclerophyll forest that occurs at the south of Evans River crossing and also within small pockets of Owens Range unlikely to represent potential habitat for this species. No records within locality of CA route on the NPWS Atlas of NSW Wildlife.	Alteration, removal and fragmentation of potential foraging and/or nesting habitat. Increased chance of road strike.	Low to medium
Regent Honeyeater <i>Xanthomyza phrygia</i> E1, En	This species occurs in a wide variety of habitat types. The Regent Honeyeater is most commonly found in Box-Ironbark woodlands. Other important habitat includes Swamp Mahogany forests and riverine She-oak (<i>Allocasuarina</i>) woodlands. Remnant stands of timber, roadside reserves, travelling stock routes and street trees also provide important habitat for Regent Honeyeaters at certain times. Threats to this species include clearing of available habitat, lack of replacement regeneration and logging of box-ironbark woodland (Ayers et.al., 1999). A large proportion of their time is spent feeding on nectar from a few 'key' Eucalypts; Mugga Ironbark, White Box, Yellow Box, Yellow Gum and Blakely's Red Gum and, mistletoe sp. (Threatened Species Network, 1999). The species is semi-nomadic and follows foraging opportunities. Food sources include nectar from a variety of Eucalypt and mistletoe sp. and arthropods.	High in southern section. Medium to high in central and northern section where vegetation communities contain suitable areas of Swamp Mahogany. One record within 2 km of the proposed CA route in Broadwater National Park. Despite this, limited records held on the NPWS Atlas of NSW Wildlife within the locality of the proposed CA route.	Alteration and removal of potential foraging habitat.	Low to medium

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Mangrove Honeyeater <i>Lichenostomus fasciocularis</i> V	Generally confined to mangroves and estuarine riparian habitats.	High at central section in and adjoining riparian vegetation associated with Evans River. Despite this, no records held on the NPWS Atlas of NSW Wildlife within the locality of the proposed CA route.	Alteration, removal and fragmentation of potential foraging and nesting habitat.	Low to medium
Grey-crowned Babbler <i>Pomatostomus temporalis</i> V	Occurs in a variety of Dry Sclerophyll forest and woodland types. Live and breeds in co-operative family groups, and constructs dome shaped nests constructed with sticks (Readers digest, 1997; Pizzey, G. and Knight, F., 1997). Forages amongst leaf litter and bark on trees, primarily feeding upon insects (DEC, 2004).	High in southern section. Medium in central section and northern section. Appropriate habitat around Owens Range. Recorded within 2 km to the proposed CA route near The Gap Road.	Alteration and removal of potential foraging and nesting habitat. Increased chance of road strike.	Medium
White-eared Monarch <i>Monarcha leucotis</i> V	Generally occurs in subtropical, warm temperate and cool temperate rainforests and wet sclerophyll forests with rainforest understoreys.	Low to medium in central and southern section. Some of wet sclerophyll forest that occurs at the south of Evans River crossing and also within small pockets of Owens Range may represent potential habitat for this species.	Alteration and removal of potential habitat.	Medium

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Barred Cuckoo-shrike <i>Coracina novaehollandiae</i> V	Occurs in a variety of habitats including Rainforest, Eucalypt forest, swamp woodlands and timber along watercourses (NPWS, 2000). More commonly recorded in low elevations from sea level to 500 m and recorded in subtropical, dry and littoral rainforests. This species feeds on figs and insects on the outer foliage (NPWS, 2005b).	Low in central and southern section. Some areas of wet sclerophyll that occur around Owens Range, and also around Evans River may represent potential habitat. It is considered however, that these forest types are not optimal habitat for this species.	Alteration and removal of potential habitat.	Low
Pied Oystercatcher <i>Haematopus longirostris</i> V	Generally confined to beaches, mudflats and sandflats (NPWS, 2000).	Low to medium in northern and central section. The mudflats and tidal areas associated with the Evans River represent potential habitat. There is limited habitat in the inundated areas within Broadwater National Park. Most records in Bundjalung National Park and Broadwater National Park are located to east of the proposed CA route.	Alteration and removal of potential habitat.	Low
Sooty Oystercatcher <i>Haematopus fuliginosus</i> V	Generally confined to rocky headlands, rocky shelves and beaches and offshore islands. Rarely found on sandy beaches and estuarine tidal flats (NPWS, 2000).	Unlikely in all sections. No suitable habitat occurs within or adjoining the proposed CA route.	NA	Very low
Little Tern <i>Sterna albifrons</i> E1	Confined to coastal waters, bays, shallow inlets, and salt or brackish lakes, Nests in low sand dunes or sandy beaches slightly above the high tide mark and near the mouths of estuaries or adjacent coastal lakes and islands.	Low in central section. Unlikely that the tidal mudflats where the proposed CA route crosses Evans River represents potential habitat.	NA	Very low

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Broad-billed Sandpiper <i>Limicola falcinellus</i> V	Generally found in estuarine mudflats, salt marshes and reefs. Feeds on insects, crustaceans, worms, molluscs and seeds (NPWS, 2005b). Feeds upon a variety of insects, marine worms, crustaceans, molluscs and seeds (Readers Digest, 1997).	Low to medium in central section. Mudflats and salt marshes located around the Evans River crossing may represent suitable habitat for this species.	Alteration and removal of potential habitat.	Low to medium

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
MAMMALS				
Spotted-tailed Quoll <i>Dasyurus maculatus</i> V, En	The Spotted-tailed Quoll is the largest marsupial predator on the Australian mainland and occurs in a variety of habitats including rainforests, open woodlands coastal heathland and inland riparian forests. The species is known to use den sites in hollows logs, caves and rocky ledges.	High in all sections. Known habitat in Broadwater National Park. Recorded within 2 km to the east of the proposed CA route. Likely to utilise the majority of habitats within and adjoining the entire proposed CA route.	Alteration and removal of known and potential habitat. Removal and disturbance to potential breeding habitat. Increased road strike. Isolation of known and potential habitat.	Medium to High
Brush-tailed Phascogale <i>Phascogale tapoatafa</i> V	The Brush-tailed Phascogale is a largely arboreal species that generally prefers Dry Open Sclerophyll Forests and Woodlands with an open ground layer and a moderate density of trees and shrubs in the midstratum (NPWS, 2005b; Soderquist, 1995). The species is dependent on tree hollows for breeding and shelter, generally preferring hollows that are 25-40 mm wide (Ayers et al., 1996).	High in southern and forested areas around the central section. Medium to high in northern section. Recorded in Broadwater National Park and Bundjalung National Park within 1 km east and 1 km west respectively of the proposed CA route.	Alteration and removal of known and potential habitat. Removal and disturbance to potential breeding habitat. Increased road strike. Isolation of known and potential habitat. Isolation of known populations.	Medium to High
Common Planigale <i>Planigale maculata</i> V	Inhabits rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is a surface cover, and usually close to water (NPWS, 2000). Habitat utilisation appears to be dependant upon surface cover (NPWS, 2005b).	High in all sections. Recorded in Broadwater National Park on both sides of the proposed CA route and within 500 m. Also recorded in Bundjalung National Park.	Alteration and removal of known and potential habitat. Increased road strike. Isolation of known and potential habitat. Isolation of known populations.	High

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Koala <i>Phascolarctos cinereus</i> V	Occurs in a variety of forest and woodland types that contain appropriate food tree species.	High in all sections. Numerous records within Broadwater and Bundjalung National Parks, with some of these records within 500 m of the proposed CA route.	Alteration and removal of known and potential habitat. Increased road strike. Isolation of known and potential habitat. Isolation of known populations.	Medium to high.
Squirrel Glider <i>Petaurus norfolcensis</i> V	In Northern NSW Squirrel Gliders tend to occur most commonly in dry open forests with an abundant and varied supply of nectar and arthropods (Sharpe and Goldingay, 1998). Squirrel Gliders have also been recorded roosting in isolated trees in paddocks, so they are capable of traversing partially cleared land (Law et al., 2000).	High in all sections. Known to occur throughout sclerophyll and tall heath associations in Broadwater National Park. Also recorded within Bundjalung National Park.	Alteration and removal of known and potential habitat. Increased road strike. Isolation of known and potential habitat. Isolation of known populations.	Medium to high
Yellow-bellied Glider <i>Petaurus australis</i> V	The Yellow-bellied Glider is the largest of the Australian petaurids and is generally restricted to tall mature wet eucalypt forest (NPWS, 2000; Strahan, 1998). Dens in tree hollows, and feeds on nectar and pollen from a variety of eucalypts. Also feeds upon sap of eucalypts by chewing a V-shaped incision into the bark to collect sap (NPWS 2000).	High in southern section. Despite the paucity of records within the locality, the Wet Sclerophyll Forest areas around Owens Ranges represent potential habitat for this species. Recorded within Bundjalung National Park near The Gap Road.	Alteration and removal of potential habitat. Increased road strike. Isolation of potential habitat.	Medium to high

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Long-nosed Potoroo <i>Potorous tridactylus tridactylus</i> V, Vu	The Long-nosed Potoroo is known to occur in a wide variety of habitats including moist and dry forests, wet heathland and cool temperate rainforests with dense layers of grasses, ferns, vines or shrubs (NPWS, 2000).	High in all sections. Despite the lack of records within the locality, the variety of sclerophyll and heath areas within and adjoining the proposed CA route are considered to represent suitable habitat for the Long-nosed Potoroo.	Alteration and removal of potential habitat. Increased road strike. Isolation of potential habitat.	Medium to high
Eastern Chestnut Mouse <i>Pseudomys gracilicaudatus</i> V	The Eastern Chestnut Mouse is an early seral-stage species which recolonises regenerating areas of vegetation (typically wet heath) following a fire (Monamy and Fox, 2000). This species is known from a variety of habitats ranging from dry sclerophyll forest and swamp forest to heath. Uses a series of runway systems which they regularly maintain, feeding upon plant material and seeds (NPWS, 2000).	Medium to high in northern section. While this species has not been recorded near the proposed CA route, it is considered that the dry and wet heath association of the within Broadwater National Park represents potential habitat.	Alteration and removal of potential habitat. Increased road strike. Isolation of potential habitat.	Medium to high
Hastings River Mouse <i>Pseudomys oralis</i> E1, En	The Hastings River Mouse inhabits in old growth Dry and Wet Sclerophyll forest areas where abundant Herbs forbs and grass species occur in conjunction with shelter sites, such as logs basal hollows or rocky outcrops. Habitats are usually associated with drainage lines, swamps seeps or grassy areas with high soil moisture levels.	Low in southern section only. It is considered that Wet Sclerophyll forest areas associated with Owens Range would represent only limited potential habitat for the Hastings River Mouse.	Alteration and removal of potential habitat. Increased road strike. Isolation of potential habitat.	Low

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Eastern Pygmy-possum <i>Cercartetus nanus</i> V	Occurs in a range of forest types including open forest, rainforest, sclerophyll forest and tree heath. The occurrence of Banksia and Leptospermum is documented as an important habitat feature. Often nests in tree hollows and stumps, and also under bark of eucalypts or in the forks of tea trees (NPWS, 2005b)	High in northern section. Medium to high in central section. Medium in southern section. Despite the lack of records for the locality, it is considered that the heath lands of Broadwater National Park represent potential habitat. In addition, the sclerophyll forest association around Evans River and also Owens Range represent appropriate habitat for the Eastern Pygmy-possum.	Alteration and removal of potential habitat. Increased road strike. Isolation of potential habitat.	Medium to high.
Common Blossom-bat <i>Syconycteris australis</i> V	In northern NSW the species forages on a variety of Banksia species however Banksia integrifolia is particularly favoured. The Common Blossom-bat is also known to forage on other nectar rich plants such as Swamp Mahogany, and Melaleuca spp. are also used (Law, 1996; Churchill, 1998). Common Blossom-bats most commonly roost during the day in coastal rainforest and forage in adjacent heathland (Law, 1993). Roost sites are generally in areas of dense vegetation in the upper canopy of rainforest however recent studies have identified roosts in the dried leaves of Macaranga (Richards and Campbell, in prep).	High in northern section. Medium to high in central section. Known to forage through the heaths and associated habitats with Broadwater National Park. Recorded within 1.5 km of the proposed CA route. May utilise the Wet Sclerophyll forest around Evans River for roosting.	Alteration and removal of known and potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of known and potential foraging habitat.	High

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Black Flying-fox <i>Pteropus alecto</i> V	Found in a wide variety of habitats from tall heaths and mangroves to rainforests, migrating between food resources.	High in all sections. Likely to forage amongst a variety of habitats within and adjoining the proposed CA route. Recorded within Broadwater and Bundjalung National Park.	Alteration and removal of known and potential foraging habitat. Fragmentation of known and potential foraging habitat.	Low
Grey-headed Flying-fox <i>Pteropus poliocephalus</i> V, Vu	The Grey-headed Flying-fox is known to feed on a variety of native fruits and blossoms from a wide variety of habitats including rainforests, sclerophyll forests, woodland, heaths and disturbed environments including suburban gardens. The Grey-headed Flying-fox, roost communally in colonies in rainforest, mangroves and sclerophyll forests, but are also known to occur in urban parks and gardens (G Richards pers. comm.).	High in all sections. Likely to forage amongst a variety of habitats within and adjoining the proposed CA route. Numerous records within locality, and within 1 km of the proposed CA route.	Alteration and removal of known and potential foraging habitat. Fragmentation of known and potential foraging habitat.	Low
Eastern Tube-nosed Bat <i>Nyctimene robinsoni</i> V	Generally confined to subtropical, warm temperate and cool temperate rainforests and wet sclerophyll forests with rainforest understoreys. Generally found within these habitats in gullies and near creeks.	Medium to high in central and southern section. Despite the lack of records within the locality, the Wet Sclerophyll forest around Evans River and Owens Range represent potential habitat.	Alteration and removal of potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of potential foraging habitat.	Medium to high

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Yellow-bellied Sheathtail-bat <i>Saccolaimus flaviventris</i> V	The Yellow-bellied Sheathtail-bat forages over almost all habitats within its range including forests, woodlands, Acacia scrubland, mallee and desert. This species roosts in tree hollows and tends to be solitary for most of the year, forming small groups of 2 to 6 in later winter and spring. On occasions the Yellow-bellied Sheathtail-bat has been found hanging from the outside walls of buildings in broad daylight (Churchill, 1998). The Yellow-bellied Sheathtail-bat generally forages above the tree canopy, flying high and fast and covers many kilometres during a single night foraging. Their prey is varied, however about 90% of their diet comprises beetles, but also includes long-horned grasshoppers, shield bugs and a few flying ants.	High in all sections. The majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species. These areas would also contain potential roosting habitat. Known to occur within Broadwater National Park, recorded within 2 km of the proposed CA route.	Alteration and removal of known and potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of known and potential foraging habitat.	High
Beccari's Freetail-bat <i>Mormopterus beccarii</i> V	Little is known about the biology of this species. Despite this, the species has been recorded from a variety of habitats including rainforest, river flood plains, tall open forests, Savannah Woodlands, arid shrublands and grasslands (Strahan, 1998; Churchill, 1998). It is believed that the Beccari's Freetail-bat is primarily a tree roosting species however, colonies of up to 50 individuals have been found under roofs in urban areas in Queensland (Strahan, 1998).	High in all sections. Despite the lack of records within the locality, the majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species. These areas would also contain potential roosting habitat.	Alteration and removal of potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of potential foraging habitat.	Medium to high

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Eastern Freetail-bat <i>Mormopterus norfolkensis</i> V	Recorded from a variety of habitats including Woodland, Dry and Wet sclerophyll forests and has been recorded foraging along a river within Rainforest (Strahan, 1998; Churchill, 1998). It is believed that the Eastern Freetail-bat is primarily a tree roosting species however; it has been recorded within the roof of a hut (Strahan, 1998).	High in all sections. Despite the lack of records within the locality, the majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species. These areas would also contain potential roosting habitat.	Alteration and removal of potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of potential foraging habitat.	Medium to high
Golden-tipped Bat <i>Kerivoula papuensis</i> V	Generally confined to Rainforest and wet sclerophyll forest however has been recorded within open forest habitats (NPWS, 2000). Feeds upon a variety of insects, however, a major food source appears to be orb weaving spiders. Roosts in disused bird nests and hollow buttresses of rainforest trees. (NPWS, 2005b).	Medium to high in central and southern section. Despite the lack of records within the locality, the Wet Sclerophyll forest around Evans River and Owens Range represent potential habitat.	Alteration and removal of potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of potential foraging habitat.	Medium to high
Little Bentwing-bat <i>Miniopterus australis</i> V	The Little Bentwing-bat is an insectivorous species that occurs in a variety of habitats, including rainforest, paperbark swamps, heaths, Eucalypt forests and woodlands in north-eastern Australia. It forages below the tree canopy. The Little Bentwing-bat is considered as a cave obligate species which roosts by day in caves, tunnels, and mines. It forms maternity colonies in summer in roost sites which have extremely high humidity, and are often shared with the Common Bentwing-bat.	High in all sections. The majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species. Numerous records within locality. Known to occur within Broadwater National Park and Bundjalung National Park, with some records within 500 m of the proposed CA route.	Alteration and removal of known and potential foraging habitat. Increased road strike. Fragmentation of known and potential foraging habitat.	High

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Common Bentwing-bat <i>Miniopterus schreibersii oceanensis</i> V	Occurs in variety of timbered habitats, including rainforest, paperbark swamps, heaths, woodlands and Sclerophyll forests. The Common Bentwing-bat is considered as a cave obligate species, only known to roost in caves, tunnels and mines. Known or potential habitat throughout the study area, however the study area contains no roosting habitat.	High in all sections. Despite the lack of records within the locality, the majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species.	Alteration and removal of potential foraging habitat. Increased road strike. Fragmentation of potential foraging habitat.	Medium to high
Eastern Long-eared Bat <i>Nyctophilus bifax</i> V	Generally forages in coastal heaths, woodlands and forests, generally utilises Rainforest and Wet sclerophyll for roosting however it is expected that a hollows are used in a variety of habitats. Known habitat throughout the study area.	High in all sections. The majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species. These areas would also contain potential roosting habitat. Known to occur within Broadwater National Park and Bundjalung National Park. Recorded within 2.5 km of the proposed CA route.	Alteration and removal of known potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of known and potential foraging habitat.	High
Hoary Wattled Bat <i>Chalinolobus nigrogriseus</i> V	The Hoary Wattled Bat occurs in a variety of habitats including dry open forest, woodland, vine thickets, heath, and grasslands (Churchill, 1998). Roost sites have been identified as tree hollows, rock crevices and the roofs of buildings (Churchill, 1998). Potential foraging habitat throughout the study area, potential roosting habitat occurs in sclerophyll forest communities.	High in all sections. The majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species. These areas would also contain potential roosting habitat. Known to occur within Broadwater National Park and Bundjalung National Park. Recorded within 1 km of the proposed CA route.	Alteration and removal of known potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of known and potential foraging habitat.	High

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Large-eared Pied Bat <i>Chalinolobus dwyeri</i> V	Generally found in a variety of drier habitats, including dry sclerophyll forests and woodland. Although most existing records are from drier habitats, this species has been recorded at the edges of rainforest and moist eucalypt forest, and also from subalpine woodland above 1500 m. Given the limited records of this species in general, it is thought that this species is likely to occur in a greater range of habitats than has been recorded (Strahan, 1998). Primarily recorded roosting in caves, and rock crevices, however, also recorded in hollow bearing trees.	High in all sections. The majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species. These areas would also contain potential roosting habitat. Known to occur within Broadwater National Park and Bundjalung National Park. Recorded within 500 m of the proposed CA route.	Alteration and removal of known potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of known and potential foraging habitat.	High
Southern Myotis <i>Myotis macropus</i> V	The Southern Myotis is considered as a specialist species due to its foraging behaviour. This species forages low above open water where it hunts for aquatic and flying insects and small fish, using their extremely large feet to rake the water. This species is known to roost in caves, tunnels, hollows, buildings, amongst dense foliage and has been recorded using nest boxes. These roost sites are generally found close to areas of open water.	High in northern and central sections Low to medium in southern section. The water bodies associated with the Evans River, and also the swampy areas within Broadwater National Park represent potential foraging habitat for this species. In addition, the vegetation communities within proximity to the areas of potential foraging habitats are considered to contain potential roosting habitat. Known to occur within Broadwater National Park and Bundjalung National Park. Recorded within 2 km of the proposed CA route.	Alteration and removal of known potential foraging habitat. In addition alteration of hydrology may impact upon suitable water bodies that represent potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of known and potential foraging habitat.	High

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Eastern Falsistrelle <i>Falsistrellus tasmaniensis</i> V	The Eastern Falsistrelle inhabits sclerophyll forests and woodlands, however, this species generally prefers tall forests where it forages above the canopy. In addition, this species is known to forage over open water. This species has a wing morphology which indicates that it is highly mobile with a comparatively large foraging range. The Eastern Falsistrelle is known to roost in tree hollows though has been recorded roosting in Jenolan caves and in old wooden houses (Churchill, 1998; Strahan, 1998).	High in all sections. Despite the lack of records within the locality, the majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species. In addition, this species may forage over the water bodies associated with the Evans River, and also the swampy areas within Broadwater National Park. The vegetation communities within and adjoining the proposed CA route would contain potential roosting habitat.	Alteration and removal of known potential foraging habitat. In addition alteration of hydrology may impact upon suitable water bodies that represent potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of known and potential foraging habitat.	High
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i> V	The Greater Broad-nosed Bat is known to occur in a wide variety of habitat types including grazing land, Heathland, Melaleuca Swamps, Woodlands and Wet and Dry Sclerophyll Forests. Roost sites of the Greater Broad-nosed Bat have been located in hollow tree trunks and branches, as well as the roofs of old buildings. It generally prefers roosts with entrance diameters which are slightly larger than the size of the animals' body. These roosts have been located in mature remnant trees in grazing land, Melaleucas in Swamp forests and in dry Sclerophyll forest (B. Campbell pers obs, Churchill, 1998).	High in all sections. The majority of the vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species. These areas would also contain potential roosting habitat. Known to occur within Broadwater National Park and Bundjalung National Park. Recorded within 500 m of the proposed CA route.	Alteration and removal of known potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of known and potential foraging habitat.	High

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Eastern Cave Bat <i>Vespadelus troughtoni</i> V	Primarily a cave dwelling bat, that occurs in drier forest and tropical woodlands (Strahan, 1998).	High in all sections. Despite the lack of records within the locality, the drier vegetation communities within and adjoining the proposed CA route represent potential foraging habitat for this species.	Alteration and removal potential foraging habitat. Alteration and removal of potential roosting habitat. Increased road strike. Fragmentation of potential foraging habitat.	High

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
AMPHIBIANS				
Wallum Froglet <i>Crinia tinnula</i> V	The habitat of the Wallum Froglet is generally confined to the acid swamps of the 'Wallum' country, but is also known to occur in disturbed or regenerating habitats where abiotic parameters are appropriate (Cogger, 2000; Tyler, 1994; Lewis, 1996; G. Czechura, pers. comm; B. Campbell, pers obs.). The essential habitat requirements for this species are primarily determined by the water quality of these habitats, as it requires strongly acidic water (pH 3.4 – 5.4) conditions to spawn.	High in northern section. Acidic swamps in Broadwater National Park represent potential habitat and there are large populations of the species known from Broadwater NP. Also heard calling from within the proposed CA route in Broadwater National Park during field investigations.	Alteration and removal of known and potential foraging and breeding habitat. Fragmentation and isolation of known and potential foraging and breeding habitat. Alteration of hydrology may impact upon known and potential foraging and breeding habitat	High
Olongburra Frog <i>Litoria olongburensis</i> V, Vu	Restricted to low nutrient wetlands with highly acidic, tannin waters occurring on Pleistocene coastal sand deposits. Often found in Swamp forests, woodlands and sedgeland dominated by Melaleuca quinquenervia with Lepironia articulata as an understorey. May also occur around fringes of swamps, along creeks, and emergent vegetation (NPWS 2005b).	High in northern section. Acidic swamps in Broadwater National Park represent potential habitat. Known to occur throughout the swamp assemblages of Broadwater National Park. Recorded within 250 m of the proposed CA route corridor.	Alteration and removal of known and potential foraging and breeding habitat. Fragmentation and isolation of known and potential foraging and breeding habitat. Alteration of hydrology may impact upon known and potential foraging and breeding habitat	High

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Green-thighed Frog <i>Litoria brevipalmata</i> V	Occurs in a variety of habitats from dry to wet sclerophyll forest, rainforest, and shrubland with a heath understorey. Generally found in tempoaray pools, permanat ponds, and flooded araes (NPWS, 2005b)	High in southern section and some areas of the central section. Medium to high in northern section. Despite the lack of records within the locality, potential habitat occurs around in Owens Range, and forest areas around Evans River. In addition, some areas within Broadwater National Park may represent potential habitat.	Alteration and removal of potential foraging and breeding habitat. Fragmentation and isolation of potential foraging and breeding habitat. Alteration of hydrology may impact upon potential foraging and breeding habitat	Medium to high

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
REPTILES				
Three-toed Snake-tooth Skink <i>Coeranoscincus reticulatus</i> V, Vu	Occurs in Rainforest and occasionally in Wet and Dry Sclerophyll forest with abundant leaf litter and ground debris (NPWS, 2000). Usually found in these habitats amongst deep litter, decaying logs and fallen epiphytes (NPWS, 2005b)	Low southern section. Unlikely that the wet sclerophyll forest areas within Owens Range would contain suitable areas of deep leaf litter.	Alteration and removal of potential habitat. Isolation of potential habitat.	Low
White-crowned Snake <i>Cacophis harriettae</i> V	Occurs in a variety of habitat types including dry sclerophyll forest and heath.	High in southern and central section. Medium to high in northern section. Despite the lack of records within the locality, the vegetation communities within and adjoining the proposed CA route may contain potential habitat.	Alteration and removal of potential habitat. Isolation of potential habitat.	Low
Pale-headed Snake <i>Hoplocephalus bitorquatus</i> V	Mainly occurs in dry sclerophyll forests and woodlands, and occasionally in drier rainforests and margins of wet sclerophyll forest (NPWS, 2000).	High in southern section. Low to medium central section. Despite the lack of records within the locality, the dry sclerophyll forest communities within Owens range represents potential habitat. May also occur in drier sclerophyll forest areas around Evans River.	Alteration and removal of potential habitat. Isolation of potential habitat.	Low to medium

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
Stephen's Banded Snake <i>Hoplocephalus stephensii</i> V	Found in a range of habitats from wet to dry sclerophyll forests. More commonly occurs within wet to moist sclerophyll forests with rocky outcrops, cliffs and ridges. Primarily dens in trees hollows and hollow logs, but may also use rock crevices (NPWS 2005b)	High in southern section. Medium central section. Low in northern section. The sclerophyll forest communities within Owens range, and also around Evans River represent potential habitat. Limited potential habitat in Broadwater National Park. Nearest record within 10 km to the south in Tabbimoble Swamp Nature Reserve.	Alteration and removal of potential habitat. Isolation of potential habitat.	Medium
FISH				
Oxleyan Pygmy Perch <i>Nannoperca oxleyana</i> E4	Surveys of the Oxleyan Pygmy Perch in northern NSW coast have identified that this species is typically found in still acidic waters associated with Melaleuca swamps. The proposed CA route passes through a large portion of the areas mapped as known habitat within Broadwater National Park. The proposed CA route also passes through some other areas mapped as known habitat occurring in the locality (eg. immediately north of proposed CA route – Evans River crossing).	High in northern section and some areas of the central section. Many inundated areas within Broadwater National Park are mapped as known Oxleyan Pygmy Perch habitat (DPI, 2004), and the proposed CA route passes through some of these known habitat areas. In addition, known habitat mapped to the north of the Evans River crossing. DPI has also mapped other inundated areas within Broadwater National Park as potential habitat for this species.	Alteration and removal of known and potential habitat. In addition alteration of hydrology may impact upon known and potential habitat adjoining the proposed CA route. Isolation and fragmentation of known and potential habitat.	High

Species	Habitat Requirements	Likelihood of occurrence in proposed CA route	Potential impacts of proposed CA route	Constraints rating
INVERTEBRATES				
Mitchell's Rainforest Snail <i>Thersites mitchellae</i> E1, CE	Mitchell's Rainforest Snail is a large land snail that is known to occur in lowland subtropical rainforest and swamp sclerophyll forest with a rainforest understorey. This species distribution appears to be restricted to between the Richmond and Tweed Rivers of the NSW north coast (NSW NPWS, 2001).	Low in southern section. Limited habitat occurs within wet sclerophyll forests occurring around Owens Range. In addition, this species has not been record south of Richmond River	Alteration and removal potential habitat. Isolation and fragmentation of potential habitat.	Low

E2 - Listed as an 'Endangered Population' under Part 2 of Schedule 1 of the *Threatened Species Conservation Act 1995*.

E1 – Listed as 'Endangered' under Part 1 of Schedule 1 of the *Threatened Species Conservation Act 1995*.

V - Listed as 'Vulnerable' under Schedule 2 of the *Threatened Species Conservation Act 1995*.

E4 - Listed as 'Endangered' under Part 1 of Schedule 4 of the *Fisheries Management Act 1994*.

Vu – Listed as 'Vulnerable' under the *Environment Protection and Biodiversity Conservation Act 1999*.

En – Listed as 'Endangered' under the *Environment Protection and Biodiversity Conservation Act 1999*.

CE – Listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999*.

Appendix B

Value Management Workshop report



**Roads and Traffic Authority
New South Wales**

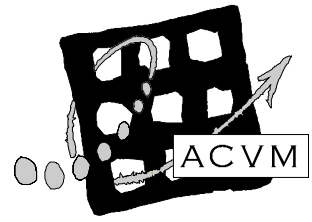
PACIFIC HIGHWAY UPGRADE

WOODBURN TO BALLINA

VALUE MANAGEMENT WORKSHOP

Workshop Report

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Report

Background

The Pacific Highway is the main road transport corridor serving the north coast region of NSW and is a major highway link between Sydney and Brisbane. An agreement between the NSW and Commonwealth Governments to upgrade the Pacific Highway has led to an upgrade program to eliminate accident blackspots, provide dual carriageway conditions where possible, improve traffic flows and reduce travel times over a ten year period which ends in 2006.

The section of the highway (subject of this project) between Woodburn and Ballina is approximately 32km long and provides access to the townships of Woodburn, Broadwater and Wardell finishing at the southern end of the proposed Ballina Bypass project. The highway in this section is largely a single carriageway with one lane in each direction and limited overtaking opportunities. The highway is generally speed posted at 100km/h between townships and 60km/h within the townships.

It has intersections with various local roads serving coastal and rural residential communities.

The population growth on the Northern Rivers region in general is increasing which is likely to lead to further safety concerns on the road network.

Moreover, the through traffic volumes are expected to increase as the Pacific Highway Upgrade Program continues and the overall highway improves. These increases (in both local and through traffic volumes) is likely to lead to more traffic conflicts and increased congestion with the risk of increased accidents as well as reduced local amenity particularly caused by increased noise (a major issue in the community). The highway will continue to be used by the current mix of traffic (ie. heavy and light vehicles, etc)

Investigations to upgrade this section of the highway commenced in September 2004 with the Roads and Traffic Authority (RTA) commissioning Hyder Consulting Pty Ltd (the Hyder Study Team) to undertake route option investigation, concept development and an environmental impact assessment within the Study Area (see **Figure 1**). The preferred option is to meet the future transport needs for the highway whilst balancing social, environmental, heritage, functional, economic and cost factors.

For the purposes of identifying and assessing corridor options, the 32 km long Study Area has been divided into 3 Sections (see **Figure 1**):

- **Section 1:** 2.5km south of Woodburn to the middle of the existing highway through the Broadwater National Park between Woodburn and Broadwater
- **Section 2:** From Section 1 to just north of Coolgardie Road on the existing highway north of Wardell
- **Section 3:** From Section 2 to the southern end of the existing approved Ballina Bypass just north of Pimlico Road

Initially a long list of corridor options were developed by combining three different approaches referred to as traditional, community and quantum approaches. These options were assessed against performance criteria, measures and other interpretations. A review of strengths and weaknesses of the corridor options was also undertaken by the Study Team and through stakeholder consultation processes.

From this analysis, a short list of options was developed (see **Figure 1** and **Appendix 3** for description) for further detailed assessment and for public display and comment.

Now that the shortlist of corridor options has been developed and displayed for comment, a Value Management Workshop (VMW) was seen as the tool to bring together a wide range of stakeholder interests and expertise to review the investigations undertaken to date and on the balance of issues and assessment of the options against agreed assessment criteria, determine a preferred direction for further investigation to progress the project development.

The assessments of the value management workshop are seen as one input into the process for determining the preferred route for the project.

The Australian Centre for Value Management (ACVM) was commissioned to facilitate and report on the workshop which was attended by a range of stakeholders on **21st and 22nd July 2005**. A list of participants who attended the workshop can be found in **Appendix 1**.

Workshop Objectives

The objective of the workshop, as presented to the participants, was to:

- *Clarify how the shortlist of corridor options were determined*
- *Review the shortlist of options using the specialist assessments undertaken*
- *Canvass the issues and concerns of stakeholders*
- *Examine the corridor options developed and recommend a preferred direction, if appropriate to do so, to assist in progressing the project to the next stage of development*
- *Develop an action plan to progress the Study*

This report has been compiled by ACVM and seeks to provide an objective overview of the project aspects discussed and the outcomes formulated by the end of the workshop.

Workshop Activities

The workshop process builds on the perspectives as well as the detailed and specialist knowledge which resides with the workshop participants then structures the review and corridor option assessment from a functional base (ie. what must the project achieve to be successful and how well do the options perform against these).

During the workshop, background material was presented (**Appendices 2, 4, 5 and 6**). What was important about the project from various stakeholder perspectives was identified. The project objectives and the framework within which the project is being planned were reviewed.

Assessment criteria were developed under five key perspectives (Environment, Heritage, Functional, Social and Noise, and Business and Economics) based on what participants considered important for later assessment of the shortlisted corridor options (**Appendix 2**).

The shortlisted options (to meet the project objectives and address the problems identified) were reviewed by the group (**Appendix 3**) and a number of key issues and concerns were identified that still required to be addressed as the project proceeds.

The group then assessed the corridor options in each Section using the assessment criteria developed (**Appendix 3**).

The result of the assessment indicated that there was unanimous support for **Option 1C in Section 1** and **Option 3B in Section 3** as the preferred options to move forward for more detailed investigation and development to progress the project subject to satisfactory resolution of the issues raised during the workshop.

However, in **Section 2** of the Study Area, it was agreed that:

- *All the options examined have issues and risks*
- **Options 2A and 2B** should not be further pursued
- **Option 2C** has possibilities subject to resolving the heritage issues, quarry issues, environmental issues, etc. However, **Options 2D, 2E and 2F** have also been assessed as possibilities subject to further investigation to resolve issues mentioned during the workshop

The workshop discussions led the group to conclusions and actions as outlined below.

Workshop Outcomes

By the end of the workshop, the participants had:

- **Confirmed** the project objectives which reflect what the project must do to be successful in achieving its purpose. The project objectives are to:
 - Improve the efficiency of state, regional and local travel, safety and accessibility
 - Provide a flowing road alignment responsive to and integrated with the landscape, optimising views, elegant design and planting opportunities
 - Engage with the community and be informed of their views and experience
 - Identify and enhance potential beneficial environmental effects, and mitigate potential adverse environmental effects
 - Minimise adverse socio-economic effects on the local community and maximise socio-economic benefits arising from the project
 - Achieve high quality design and constructability
 - Achieve value for money
 - Apply a sustainable framework to all stages of the project
- **Reviewed** the givens and constraints that the Study Team were working within so there could be a common understanding of the framework in which the planning was taking place. These were agreed as:
 - The Woodburn to Ballina Project is part of the overall Pacific Highway Upgrade Program

- Townships are to be avoided (ie. bypass town centres)
- The maximum increase of flood level will be 50mm afflux as a result of the project and we need to be cognisant of duration, flows, velocity, etc
- Designing to 110km/hr design speed and to current RTA engineering design standards
- Targeting a 1:100 year flood immunity with a minimum of 1:20 year flood immunity for the road
- Appropriate recognition and protection of ecologically sensitive areas, prime farm land and other resources
- Appropriate recognition and protection of heritage and cultural sites (indigenous and non-indigenous)
- The Minister's announcement of the preferred route and concept design is expected by mid 2006
- Adherence to principles of ESD (as per the Route Option Development Report)
- Looking to achieve value for money
- **Identified** assessment criteria under five key perspectives (Environment, Heritage, Functional, Social and Noise, and Business and Economics) based on what participants considered important for later assessment of the shortlisted corridor options. The assessment criteria to assess the corridor options were agreed as:

Environmental

- *Impact on Key Habitats and Corridors*
- *Impact on Threatened Species and EECs*
- *Hydrological Impacts on Ecosystems*
- *Potential Water Quality Impacts*

Heritage

- *Threatened Significant Indigenous Heritage Sites*
- *Threatened Significant Non-Indigenous Heritage Sites*
- *Existence of Special Title, Ownership and Claims*

Functional

- *Travel Efficiency*
- *Safety*
- *Access Points/Links*
- *Aesthetics from the Highway*

Social and Noise

- *Relative Noise Increases*
- *Number of Noise Receivers*
- *Potential Flood Impacts*
- *Limits to Town Development*
- *Impacts on Rural Residential Development*
- *Aesthetics from the Community View*
- *Number of Residences lost in Route Footprint*

Business and Economic

- *Impact on Cane Production*
- *Loss of Regionally Significant Agricultural Land*
- *Road Proximity to Support Towns*
- *Other Business Impacts (eg. quarries, etc)*
- **Reviewed** the shortlisted corridor options tabled for the project, obtained an understanding of their relative merits and weaknesses and identified issues and concerns that still need to be addressed as planning proceeds (see **Appendix 3**).
- **Assessed** the shortlisted corridor options in each Section against the assessment criteria within each of the key perspectives and ranked the performance of each option. The options were also ranked in terms of the relative project cost estimates (see **Appendix 3**)
- **Agreed** that as a result of undertaking the assessment, that on balance:
 - In **Section 1, Option 1C** is recommended as the preferred option to move forward for more detailed investigation and development to progress the project because it performs better on all criteria other than from an environmental perspective. This recommendation was made subject to investigating the feasibility of avoiding or minimising impacts of removing vegetation, EECs and threatened species in the alignment
 - In **Section 3, Option 3B** is recommended as the preferred option to move forward for more detailed investigation and development to progress the project because it performs better on all criteria and is best value for money. This recommendation was made subject to confirming the road footprint for Option 3B and the impact on sugar cane land (if any)
 - In **Section 2** of the Study Area, there was agreement that:
 - All the options examined have issues and risks
 - **Options 2A & 2B** do not have many positives environmentally, functionally, business and economically and should not be further pursued
 - **Options 2D & 2E** are high risk options (traverse through indigenous Jali land, land claims, heritage issues, etc)
 - **Option 2C** is feasible subject to mitigation of environmental and heritage issues including ESD issues. However it is believed by some participants that it is not possible to achieve ESD on Option 2C due to immitigable impacts

- **Option 2F** is feasible subject to being prepared to pay over 60% more than Option 2C and noting its ranking as the lowest performing option in section 2 from the functional, business and economic perspectives (it is believed by some participants that it is not feasible to fund Option 2F at such additional cost burden)
- In summary, Option 2C has possibilities subject to resolving the heritage issues, quarry issues, environmental issues, etc. However, Options 2D, 2E and 2F have also been assessed as possibilities subject to further investigation to resolve issues
- **Developed** an outline of the process and direction (Action Plan) for the project to move forward from here (see next page).

Where to From Here?

At the conclusion of the workshop, an Action Plan was produced which outlined the direction and process to be undertaken by the Study Team and others to move the project forward from here.

No.	Task	By Whom	By When
1.	Deal with the issues and concerns tabled in light of the specialist presentations and information shared during the workshop	Shane Higgins/ Hyder Study Team	End July 2005
2.	Understand and resolve the quarry impacts and issues with regard to the preferred corridor options in Section 2	Shane Higgins/ Hyder Study Team	Concept Design Stage
3.	Establish an Aboriginal heritage focus group and finalise inputs for option consideration	Shane Higgins/ Mary-Lou Buck	End August 2005
4.	Secure a copy of the RTA Greenhouse Report for the Study Team and the CLG	David Corry	End July 2005
5.	Revisit/review other options should immitigable impacts arise on the shortlisted preferred options	Shane Higgins/ Hyder Study Team	Prior to Preferred Option Report
6.	Investigate source materials and the cost for the road construction	Shane Higgins/ Hyder Study Team	Concept Design Stage
7.	Clarify how the RTA has addressed greenhouse gas emission implications of the options	Shane Higgins/ Hyder Study Team	Prior to Preferred Option Report
8.	Determine how the alternative option ("flood free route" option) will be assessed relative to the shortlisted options	Shane Higgins/ Hyder Study Team	Prior to Preferred Option Report

Diagram indicating the Shortlisted Corridor Options

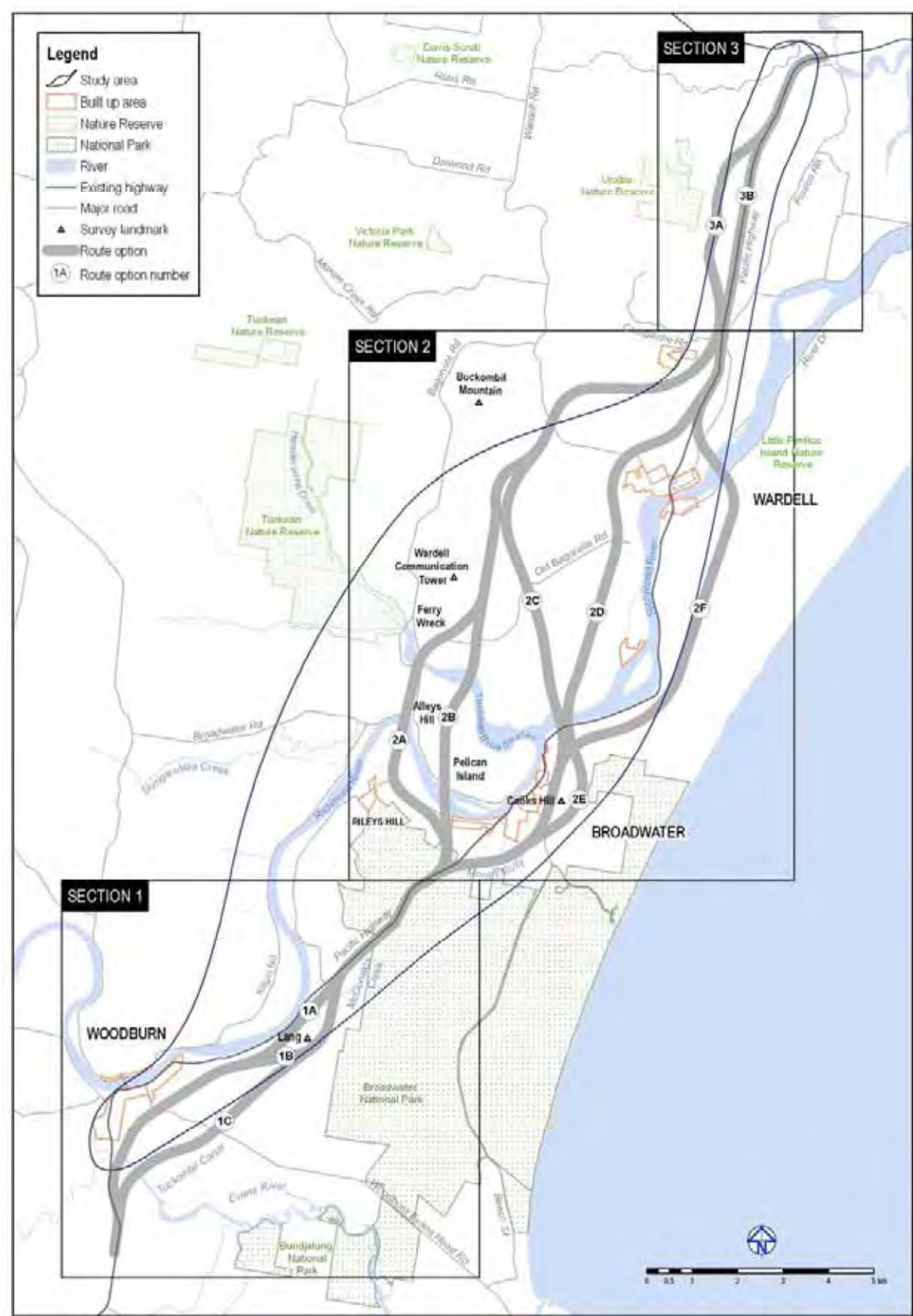


Figure 1: Corridor Options (diagram supplied by Hyder Consulting)

Appendix 1. List of Participants

PACIFIC HIGHWAY UPGRADE: WOODBURN TO BALLINA

VALUE MANAGEMENT WORKSHOP

PARTICIPANTS LIST

Project Stakeholders

Paul Busmanis	Engineering Manager, Ballina Shire Council
Ian Gaskell	Environmental Scientist, Ballina Shire Council
Kim Forsyth	Project Co-ordinator, Department of Environment and Conservation
Scott Hunter	Department of Environment and Conservation
Greg Davey	Conservation Manager, Department of Primary Industries (Fisheries)
Rik Whitehead	Agricultural Environmental Officer, Department of Primary Industries
Jeff Brownlow	Mineral Resources (Armidale), Department of Primary Industries
David Thompson	Environmental Planning Officer, Department of Infrastructure, Planning and Natural Resources
Angela Owers	Secretary, Friends of the Koala
Natalie McCarthy	Natural Resource Manager, Strategic Planning, Lismore City Council
Charlie Mitchell	Lismore City Council
Hugh McMaster	Executive Officer, NSW Road Transport Association
Michael Wood	Project Co-ordinator, Richmond River County Council
Ray Medhurst	Manager Strategic Planning, Richmond Valley Council
Brian Eggins	Senior Strategic Planning Officer , Richmond Valley Council
John Hession	Strategic Planning Officer, Richmond Valley Council
Terry Gobbe	Distributions Asset Manager, Rous Water
Emma Walke	Community Liaison Group representative
Bert Plenkovich	Community Liaison Group representative
Mark Graham	Community Liaison Group representative
Jack Matthes	Community Liaison Group representative
Uncle Lewis Cook (Day 1 only)	Senior Custodian of the Njangabal/Aragwal Aboriginal Community
Artie Ferguson	Aboriginal Community
Lois Cook (Day 2 only)	Aboriginal Community

Roads and Traffic Authority

Bob Higgins	General Manager, Pacific Highway Office
Shane Higgins	Project Development Manager
David Corry	Senior Projects Manager, Road Network Infrastructure
Scott Lawrence	Environmental Advisor
Toby Heys	Project Officer
Mary-Lou Buck	Aboriginal Cultural and Heritage Consultant

PACIFIC HIGHWAY UPGRADE: WOODBURN TO BALLINA VALUE MANAGEMENT WORKSHOP

PARTICIPANTS LIST (cont)

Hyder Consulting Study Team

Harry Batt	Project Manager
Andrew Nathan	Deputy Project Manager and Engineering
Carolyn Stone	Community Consultation
Annette Ross	Environmental Team Manager

Rob Peterson	Hydrology and Flooding Specialist
Matt Sugden	Noise Assessment Specialist
Mike Butler	Socio Economics Specialist
Mary-Anne McGirr	Urban and Landscape Design Specialist

Tanya Coates	Environmental Team Leader
Allen Macourt	Project Director
Graham Richardson	Project Control
Daniela Payne	Community Consultation

Peter Volk	Geotechnical Specialist
Brett Campbell	Ecology Specialist
Llewellyn Cain	GIS Systems Specialist

Workshop Facilitation Team

Ross Prestipino	Facilitator, ACVM
Alan Butler	Co-facilitator, ACVM

Appendix 2. Project Information and Analysis

Project Information and Analysis

The information presented in this Appendix is a consolidation of the general outputs and perceptions by the workshop group as they shared information about the Pacific Highway Upgrade: Woodburn to Ballina which allowed them to later make comparisons of corridor options based on the analysis of what the project was required to achieve.

Traditional Welcome

At the commencement of the workshop, a traditional welcome was made by Uncle Lewis Cook, Senior Custodian of the Njangabal/Aragwal People of the Bundjalung Nation. Key points made in his welcome were:

- Good morning ladies and gentlemen, my name is Lewis Cook. I am the senior custodian of the Njangabal/Aragwal People. I would firstly like to acknowledge the spirit of our ancestors who lived and protected our land with the knowledge of our lore and customs
- We, the Bundjalung Nation, take pride in our unique heritage. Today is significant to all of us because the proposed Pacific Highway Upgrade has brought us together with the wider community
- The Pacific Highway Upgrade proposal is an ambitious project and should be treated with respect and understanding. The CLG committee is to be congratulated for their fine effort working together with the consulting team to protect sites of significance as well as the flora and fauna of our homelands
- The traditional Aboriginal pathways linked our clans and the Bundjalung nation for centuries through cultural practices, ceremonies, festivals and family gatherings. You now call them roads
- Caring and sharing for our country and extending goodwill to the community is important to any committed group of people working together to achieve the best outcomes. The Bundjalung People want to protect our unique heritage and welcome those who want to be involved in this process
- Before European invasion, there was at least 70 Aboriginal languages and dialects spoken in NSW. Language is a direct linkage to land and country. It holds traditional songs and stories. It is about the deep and complex meaning of spirituality and reflects our unique cultural concepts and the way we look at the world. Although sites have been lost over time as a result of European settlement and natural environmental factors, our traditional homeland is still rich in existing Aboriginal sites which are of great cultural importance to our people
- In closing I would like to say thank you on behalf of our people for inviting me here today to welcome all of you

The Strategic Context of the Project

In order to allow the participants to obtain an understanding of the project's context, Bob Higgins, General Manager Pacific Highway Office, RTA and Shane Higgins, Project Development Manager, RTA outlined the strategic context of the project (the "Big Picture") within the context of the Pacific Highway Upgrade Program.

Key points raised in their presentation included:

- The purpose of the Pacific Highway is:
 - As a major transport asset of National significance
 - To provide safe and efficient transportation of people and goods to destinations between Sydney and Brisbane
 - To service coastal townships and populations along the route
 - To support National, Regional and Local economic development
- In terms of strategic considerations in meeting this purpose:
 - There is a need to secure a corridor for the future upgrade of the highway
 - Identification of a preferred route for the Woodburn to Ballina section of highway
 - Opportunities to stage construction
 - Planning for the project is being funded by the State Government as part of its \$1.6 billion contribution to the 10 year upgrading program (\$2.2 billion total)

- What is the future (beyond the 10 year program)?
 - The State Government is committed to continue the upgrade of the Pacific Highway
 - Federal Government released AusLink White Paper which maintains \$60 million/year to the end of current 10 year program (2006) and increases contributions to \$160 million/year over the following 3 years
- Key drivers for the Program and the Project are:
 - Increasing pressure to accelerate the completion of dual carriageway due to:
 - Road safety (crashes including fatalities, separation of local and through traffic)
 - Increased travel demand from rapid population growth on the North Coast and anticipated increases in traffic volumes
 - Potential local community impacts such as:
 - Land use and future development
 - Local economy and business
 - Amenity – noise, visual, air quality, flooding and water quality
 - Potential environmental impacts (ie. flora and fauna, heritage)
 - Economic considerations (ie. constructability, cost and value for money)
- The Project has to strike a balance between transport needs, social needs and ecological needs while providing value for money
- Key constraints within the Study Area include:
 - Townships (ie. Woodburn, Broadwater/Rileys Hill, Wardell, Cabbage Tree Island/Lumleys Lane Communities)
 - Rural residential development
 - Major rivers and associated floodplains (Richmond River, Evans River and the Richmond Valley Floodplain)
 - Agricultural land use (ie. sugar industry)
 - Major topographical features (Blackwall Range, Cooks Hill, Langs Hill and Alleys Hill)
 - Environmental issues (including SEPP 14 Wetlands, National Park, Wardell Heath/high value vegetation and high value heritage areas)
- Development of the corridor options between Woodburn and Ballina included:
 - Project announcement in October 2004 with 3 Community Information Sessions (CISs) held in November 2004 at Wardell, Broadwater and Woodburn
 - A Planning Focus meeting and a Corridor Mapping Workshop were held with government agencies, local Councils and stakeholders in November 2004 and February 2005 respectively
 - In May 2005, corridor options were released for community information and comment
- For the purposes of identifying and assessing corridor options, the 32 km long Study Area has been divided into 3 Sections (see **Figure 1**):
 - **Section 1:** 2.5km south of Woodburn to the middle of the existing highway through the Broadwater National Park between Woodburn and Broadwater
 - **Section 2:** From Section 1 to just north of Coolgardie Road on the existing highway north of Wardell
 - **Section 3:** From Section 2 to the southern end of the existing approved Ballina Bypass just north of Pimlico Road
- The Pacific Highway Program objectives are:
 - **Functional:**
 - Significantly reduce road accidents and injuries
 - Reduce travel times and freight transport costs
 - **Social:**
 - Develop a route that involves the community and considers their interests
 - Provide a route that supports economic development
 - **Environmental:**
 - Manage the upgrading of the route in accordance with Ecologically Sustainable Development (ESD) principles
 - **Economic:**
 - Provide the best value for money

- Flowing from this, the Objectives for the Woodburn to Ballina Project are to:
 - Improve efficiency of state, regional and local travel, safety and accessibility
 - Provide a flowing road alignment responsive to and integrated with the landscape; optimising views, elegant design and planting opportunities
 - Engage with the community and be informed by their views and experience
 - Identify and enhance potential beneficial environmental effects, and mitigate potential adverse environmental effects
 - Minimise adverse socio-economic effects on the local community and maximise socio-economic benefits arising from the project
 - Achieve high quality design and constructability
 - Value for money
 - Apply a sustainability framework to all stages of the project
- The next steps in the process after the development of the shortlisted corridor options and their display to the community is the selection of a preferred route using the submissions made by the community, the technical assessments and the outputs of the value management workshop we are currently undertaking. Once the preferred corridor option is selected more detailed investigation will be undertaken to develop a concept design which then moves to the environmental assessment process before the project can be approved

Study Overview Presentation

An overview of the work undertaken to date and the steps ahead was presented by Harry Batt and Graham Richardson, Hyder Consulting Study Team. Key points made in their presentation which supplements the background information distributed to participants prior to the workshop included the following points below.

- A number of specialist investigations have been carried out across the Study Area and will continue in more detail as the project progresses and the preferred corridor is chosen. The investigation level to date has identified constraints to develop corridor options
- The constraints identified areas of topographic and geological features, areas that are sensitive from an ecological and/or heritage perspective, areas that have been identified as residential, industrial and commercial development sites, areas of high agricultural potential and areas of flood sensitivity
- The development of the corridor options takes these constraints into account in identifying potentially feasible corridors that meet the project objectives and avoids these areas where possible
- Initially a long list of corridor options were developed by combining three different approaches referred to as traditional, community and 'Quantm' approaches. These options were assessed against performance criteria, measures and interpretations. A review of strengths and weaknesses of the corridor options was also undertaken by the Study Team and through stakeholder consultation processes
- From this analysis, a short list of options was developed (see **Diagram 1**) for further detailed assessment and for public display and comment. Detailed specialist assessment of the corridor options will be presented later in the workshop
- The Value Management Workshop (VMW) which will be used to assess the corridor options will be used together with the specialist assessments and public comments to determine the preferred corridor option and lead us to undertake more detailed analysis in the next stage of the project

Community Liaison Group Perspectives

Four brief presentations were made by members of the Community Liaison Group (CLG) who represented the various community stakeholder perspectives within the Study Area. This gave the workshop participants a level of understanding of the issues important to various sections of the community at this early stage of the workshop. Key points made are highlighted below.

Emma Walke

- Emma stated she was a member of the local Aboriginal community who lived within the Study Area. She provided an opinion on the various options within each Section based on responses of those with whom she had discussed the options on public display.
- Emma's comments included:
 - Section 1:* People have not felt that any route option met with their approval
 - Section 2:* Corridor Options 2A, 2B, 2C and 2D should be disregarded since they created damage to important and fragile heathlands and traverse sections of "special" lands important to local Aboriginal communities – sacred, housing, titled lands, ceremonial lands, etc
 - Section 3:* There was a strong preference for Option 3B which generally followed the existing highway alignment
- Emma also underlined the importance to retain and protect the scarce remaining Aboriginal heritage areas and culturally significant sites because so much had already been lost and cannot be retrieved.

Jack Matthes

- Jack concentrated on his long history and experience with flooding in the Study Area. He acknowledged that Bert Plenkovich, a fellow CLG member who was delivering the next presentation, would focus on flooding in more detail. He would support Bert's comments.
- Jack made the following comments on corridor options in each Section:
 - Section 1:* There is flooding along all the corridor options except for the northern 3 kilometres
 - Section 2:* Corridor options 2A, 2B, 2C, 2D and 2E all flood in the southern area. Options 2A, 2B and 2C are all flood-free in the northern area. Option 2D appears to be affected by flood water in the north but this is felt to be an error on the mapping
 - Section 3:* These options do not have flood problems

Bert Plenkovich

- Bert spoke about two primary issues in this catchment being flooding generally and the Sugar Cane Industry.

Flooding:

- The catchment is larger than the project study area being 6,892km². It has only two drainage relief points – the Richmond River at Ballina and the Tuckombil Canal
- The system has a number of limiters to free flow which see flood waters back up, rise, hold and drain at a slower rate. These include "the hairpin bend" about 10km north of Woodburn and the weir on Tuckombil Canal. They create a bottleneck to flows. The new road could add to this problem and widen the effected areas and/or increase the flooding heights in the area
- Over 3,500 people are impacted by flooding and need support in flood times. Land inundation impacts are large and expensive – rotting vegetation, lost agistment, homes and possessions damaged and lost, etc.
 - Section 1:* Any barriers to the flow of flood waters on the east side of the river will have an impact
 - Section 2:* Options 2A and 2B impact on the bottleneck and at least 10 families of koalas. The management of the run of the river is a big issue throughout all options in this Section 2
 - Section 3:* Not as big a concern in terms of flooding

Sugar Cane Industry:

- The industry operates as a co-operative across the State. It generates over \$200M per annum
- The industry feels it cannot lose any more useable land after 120ha was lost to the highway upgrade in the Tweed Valley. There are approx. 35,000ha of sugar cane lands in NSW and of this the Richmond Valley supplies approx.16,000ha
- Cane lands must be frost free and are prime agricultural lands
- There appears to be two competing government objectives being to: (i) protect scarce prime agricultural lands and (ii) create new bigger, safer, faster roads

- The worst corridor options from the perspective of the Sugar Cane Industry are Options 1A, 1B and 2F. It is estimated by the local sugar cane industry that when the new access roads, revised drainage layouts and the unsustainable severed sections of lands are excluded, approximately 1,000ha or an annual loss in production of 70,000 tonnes of sugar cane could result from an unfavourable corridor option choice. (*Note: these area figures were questioned and will need review and verification*)
- It should be remembered that this community has never had a flood free route.

As part of his presentation, Bert also presented an alternative option (called the “Flood Free” route option) to the shortlisted corridor options tabled for consideration in the workshop. His presentation material can be found in **Appendix 4**. Some initial investigation work was undertaken by Hyder Consulting and their preliminary findings on this alternative option (which they had called the CLG route) are also presented in **Appendix 4**. In terms of process, only the shortlisted options were to be assessed in the workshop and comparison of the preferred corridor option with this alternative option would take place outside the workshop.

Mark Graham

- Mark noted the special and in many ways unique areas which the Study Area covers from an ecological, threatened species and heritage perspective. He indicated that his research has identified 7 ecologically significant areas and over 100 threatened species, many nationally recorded on the endangered schedules which would be impacted or crossed by the shortlisted corridor options.
- Mark was overtly concerned with his beliefs that:
 - Many of these areas or threatened species posed “unmitigable” obstacles for certain corridor options which should be understood before the options could be assessed further
 - Inadequate consideration has been given to the significance of the wetlands and heath lands in the Study Area
 - No consideration has been given to the mapping of endangered ecological areas, for which there is an applicable Act of Parliament
 - The specialist ecological and environmental consultants have: not demonstrated scientific rigor; not incorporated data on additional critical aspects (eg. eight additional threatened species identified, etc) which have been provided to them by CLG members and Ballina Council; not surveyed over the necessary full seasonal periods; and that they have not been effectively comprehensive nor transparent in their output materials and findings
- Mark’s comments on the corridor options specifically were concentrated in Section 2:
 - Options 2A and 2B impact on the Tuckean Broadwater (the No. 1 significant acid sulfate hotspot in NSW) which would certainly create massive water quality problems downstream and jeopardise important fishing resources
 - Options 2A, 2B, 2C and 2D all fragment wildlife corridors. The options also traverse culturally significant sites to the local Aboriginal community

What’s Important about the Pacific Highway Upgrade: Woodburn to Ballina

The group identified from their various perspectives (individually, then within focus groups and finally collectively) what was important about the highway upgrade project. The group recorded what was important (shown below) and then reflected on the collated list (in five focus groups). Although acknowledging that all items are important, the group indicated which items were considered more critical by marking them with an asterisk (*) as shown below. (More than one asterisk indicates an allocation by more than one focus group. Also some items were considered linked, as indicated, and only one of those items if considered more critical was asterisked).

No.	What’s Important	Rating
1.	Maintaining the Northern Rivers “differentiators” (ie. heritage, culture, beauty and environmental diversity)	*
2.	Reaching a balanced solution	
3.	Protecting and respecting indigenous culture, heritage, values and sites	****
4.	Appropriately identifying and addressing noise impacts	*
5.	Determining a route which meets the Pacific Highway Program objectives	

No.	What's Important (cont)	Rating
6.	Protecting and avoiding impact on wildlife corridors and key habitats (<i>linked to item 14</i>)	
7.	Forming an Aboriginal based focus group which is consulted and provided with information for the wider aboriginal community	
8.	Avoiding and/or minimising impacts on DEC estates	*
9.	Maintaining and enhancing flood plain management (holistic)	***
10.	Improving safety by providing best road standards for through and local traffic	**
11.	Demonstrating justification of the preferred corridor in terms of ecological, economic and social factors and that the process is transparent	
12.	Maintaining expansion potential for towns and minimising separation of communities	
13.	Minimising impact on agricultural land	***
14.	Avoiding threatened species, sensitive flood plain and EEC wetlands	***
15.	Minimising the level of compromise in environmental areas	
16.	Avoiding impacts and protecting water quality	
17.	Managing the impacts of increased traffic on the local road system	
18.	Creating a positive impact by reducing driving times, providing certainty of route for the community, etc	
19.	Not having a poor visual impact	
20.	Achieving an outcome that is best for most people	
21.	Providing safe driving conditions and reducing operating cost	
22.	Improving the safety of National Park estates (eg. for fire and wildlife management)	
23.	Meeting engineering standards for the road (<i>linked to item 10</i>)	
24.	Identifying and managing of air quality	
25.	Bypassing towns and minimising social and economic impacts	*
26.	Avoiding irreversible impacts (social, environmental and heritage impacts)	**
27.	Ensuring access to local communities is not compromised	*
28.	Reaching technical conclusions that are scientifically justified	*
29.	Minimising economic impact on the number of properties involved (including agricultural properties) (<i>linked to item 13</i>)	
30.	Repairing and restoring the urban/environmental quality of towns/villages	
31.	Protecting important identified resources (eg. quarries at Cooks Hill and Bagotville)	*
32.	Limiting fragmentation impacts by using or being close to the existing highway alignment (ie. Broadwater to Wardell)	
33.	Improving the noise environment	*
34.	Implementing suitable mitigation measures	
35.	Being financially viable	*
36.	Having no discernable adverse impacts to the sugar industry	
37.	Avoiding impacts on undeveloped native vegetation precincts and rural residential areas	
38.	Ensuring minimal loss of native vegetation	

Upon reflection, the workshop group concurred that there was overlap in the list. However, the list reflected the items considered important that the project needs to address as planning proceeds. This "What's Important" list (as well as other information such as the project objectives) would later be used in the workshop to develop clusters, and considerations within those clusters to assess the various corridor options in each Section of the Study Area.

Project Objectives

The group reviewed the project objectives (ie. what must the project achieve to be successful) as stated in the Route Options Development Report to ensure there was a common understanding as to what they were and clarification sought where required.

The Pacific Highway Upgrade: Woodburn to Ballina Project Objectives were agreed as to:

- Improve the efficiency of state, regional and local travel, safety and accessibility
- Provide a flowing road alignment responsive to and integrated with the landscape, optimising views, elegant design and planting opportunities
- Engage with the community and be informed of their views and experience
- Identify and enhance potential beneficial environmental effects, and mitigate potential adverse environmental effects
- Minimise adverse socio-economic effects on the local community and maximise socio-economic benefits arising from the project
- Achieve high quality design and constructability
- Value for money
- Apply a sustainable framework to all stages of the project

Givens and Constraints

The group discussed the givens and constraints that the Study Team were working within so there could be a common understanding of the framework in which the planning was taking place. These were added to where appropriate. The givens and constraints in which the project was being planned were agreed as:

- The Woodburn to Ballina Project is part of the overall Pacific Highway Upgrade Program
- Townships are to be avoided (ie. bypass town centres)
- The maximum increase of flood level will be 50mm afflux as a result of the project and we need to be cognisant of duration, flows, velocity, etc
- Designing to 110km/hr design speed and to current RTA engineering design standards
- Targeting a 1:100 year flood immunity with a minimum of 1:20 year flood immunity for the road
- Appropriate recognition and protection of ecologically sensitive areas, prime farm land and other resources
- Appropriate recognition and protection of heritage and cultural sites (indigenous and non indigenous)
- The Minister's announcement of the preferred route and concept design is expected by mid 2006
- Adherence to principles of ESD (as per the Route Option Development Report)
- Looking to achieve value for money

Developing the Assessment Criteria

As a result of the information shared in the workshop to date (in particular, the "What's Important" statements and the project objectives), a focus group consolidated a set of clusters and considerations within each cluster in order to assess the various corridor options in each Section of the Study Area.

The approach adopted was to have a focus group cluster the "What's Important" statements under five key perspectives being Environment, Heritage, Functional, Social and Noise, and Business and Economic.

Each "What's Important" Statement was categorised as falling under one of the clusters nominated (some statements were deemed multi faceted and were categorised under more than one cluster but with a different focus in each cluster) or as either duplicates, givens (*ie. use of RTA design and engineering standards, financially viable, etc*), outcomes (*ie. transparent and demonstrated justification, a balanced solution, meets Pacific Highway Program objectives, etc*), process focussed (*ie. establishing an aboriginal focus group, etc*) or not being able to assist in differentiating between corridor options.

Consolidated considerations within each cluster were then agreed based on the meaningfulness to differentiate between the corridor options.

Finally these were presented to the whole group for comment, amendment (as required) and finally endorsement to evaluate the various corridor options in each Section of the Study Area.

The assessment criteria identified under each of the five clusters accepted by the whole group to assess the corridor options were:

1. Environmental

- A) Impact on Key Habitats and Corridors
- B) Impact on Threatened Species and EECs
- C) Hydrological Impacts on Ecosystems
- D) Potential Water Quality Impacts

2. Heritage

- A) Threatened Significant Indigenous Heritage Sites
- B) Threatened Significant Non-Indigenous Heritage Sites
- C) Existence of Special Title, Ownership and Claims

3. Functional

- A) Travel Efficiency
- B) Safety
- C) Access Points/Links
- D) Aesthetics from the Highway

4. Social and Noise

- A) Relative Noise Increases
- B) Number of Noise Receivers
- C) Potential Flood Impacts
- D) Limits to Town Development
- E) Impacts on Rural Residential Development
- F) Aesthetics from the Community View
- G) Number of Residences lost in Route Footprint

5. Business and Economic

- A) Impact on Cane Production
- B) Loss of Regionally Significant Agricultural Land
- C) Road Proximity to Support Towns
- D) Other Business Impacts (eg. quarries, etc)

Having built a foundation and common understanding of the what's important to various stakeholders, the objectives (what the project is to achieve), and the considerations in clusters for assessment of the corridor options, the group was now in a position to broadly review the corridor options shortlisted for the project, outline their issues and concerns that still need to be addressed and assess the corridor options with the information available.

Appendix 3. Corridor Option Review and Recommendation

Corridor Option Review and Recommendation

Corridor Option Presentations

The Study Team led by Harry Batt, Project Manager, Hyder Consulting presented key investigations to the group of the shortlisted corridor options being considered. The shortlisted options are best described in the Route Options Development Report and appear in **Figure 1**. In short they consist of:

Section 1 – Southern Section

- **Option 1A** – Departs the existing highway approx. 3km south of Woodburn, generally running parallel and east of the existing highway. It crosses Tuckombil Canal and travels northeast (east of Woodburn). It then runs generally parallel to and east of the Richmond River between the existing highway and Lang Hill until it reaches McDonalds Creek where it then follows the existing highway again through the Broadwater National Park
- **Option 1B** – The same as Option 1A except it runs to the east of Lang Hill and then joins the existing highway north of McDonalds Creek
- **Option 1C** – Departs from the existing highway approx. 3 km south of Woodburn, crosses Tuckombil Canal and travels northeast (east of Woodburn). The route travels northeast around the eastern side of Lang Hill and then joins the existing highway just north of McDonalds Creek where it then follows the existing highway through the Broadwater National Park

Section 2 – Central Section

- **Option 2A** – Departs the existing highway at the northern end of the Broadwater National Park and heads northwest (generally parallel to the Richmond River) towards Rileys Hill. The route then curves to the north and bridges the Richmond River following an existing clearing west of Alleys Hill to the southern bank of the Tuckean Broadwater. It then bridges the Tuckean Broadwater to the northern bank west of the Ferry Wreck and then runs northeast and parallel to the Bagotville-Wardell Road. The route turns to the north near the Wardell communication tower. It then passes to the east of the toe of the Blackwall Range. Near the base of Buckombil Mountain, the route crosses Thurgates Lane and heads northeast avoiding the timbered land in the vicinity of Bingal Creek. The route heads east through the Wardell Heath towards the existing highway, then turns to the north west near Coolgardie Road
- **Option 2B** – Departs the existing highway at the northern end of the Broadwater National Park and heads north away from the highway and bridges the Richmond River west of Pelican Island. From the Tuckean Broadwater, the route generally heads north and joins Option 2A just east of the Wardell communication tower
- **Option 2C** – Departs the existing highway at the northern end of the Broadwater National Park and heads east running parallel to the Richmond River. At Broadwater, the route is east of the residential area and on the western side of Cooks Hill. After passing Cooks Hill, the route heads north and crosses the Richmond River west of Goat Island. The route then heads northwest and runs along the western edges of the Crown Reserve. It then follows the same line as Option 2A from Thurgates Lane
- **Option 2D** – Departs the existing highway at the northern end of the Broadwater National Park and heads east running parallel to the Richmond River. At Broadwater, the route is east of the residential area and on the western side of Cooks Hill. After passing Cooks Hill, the route heads north and crosses the Richmond River west of Goat Island. The route then heads northwest and runs along the eastern edges of the Crown Reserve. It continues north through Wardell Heath and circles Wardell to the west. It then follows a disused airstrip until it joins the existing highway until the Coolgardie Road intersection
- **Option 2E** – The same as Option 1D except at the northern end of the Broadwater National Park, the route turns east and skirts to the east of Cooks Hill. The route then turns northwest and joins Option 2D on the southern banks of the Richmond River
- **Option 2F** – Departs the existing highway at the northern end of the Broadwater National Park and heads east running parallel to the Richmond River. At Broadwater, the route is east of the residential area and on the western side of Cooks Hill. After passing Cooks Hill at Pine Tree Road, the route heads northeast parallel and east of the Richmond River. In the vicinity of Goat Island, the route then heads more northward towards Wardell. At Carney Lane the route turns northwest to cross the Richmond River south of Little Pimlico Island. The route turns northward and joins the existing highway near the northern end of the disused airstrip. From the northern edge of the disused airstrip the route follows the existing highway to the Coolgardie Road intersection

Section 3 – Northern Section

- **Option 3A** – Departs the existing highway north of Coolgardie Road and hugs the Blackwall Range escarpment and abutting sugar cane land. The route approaches then abuts the existing highway in the vicinity of Uralba and utilises the existing highway corridor until the Bruxner Highway intersection
- **Option 3B** – The route utilises the existing highway corridor from north of Coolgardie Road to the Bruxner Highway intersection

It should be noted that no further options were considered in the workshop. However, it was acknowledged that there was no “perfect” option and that whichever preferred options moved forward for further analysis in the next stage of development, there would be a level of fine tuning and improvement undertaken to ensure adverse impacts to those options were mitigated. Also it was acknowledged that other/alternative options put forward (ie. “Flood Free” Option) would need to be considered by the Study Team comparatively with the preferred option from the workshop.

Below is a list of the presentations of investigations of the corridor options in specialist areas made by the Study Team which summarised and supplemented information in the Route Options Development Report.

Key Presentations of the Corridor Options in Specialist Areas

- *Visual/Urban Design* – Mary-Anne McGirr
- *Engineering, Flooding and Geotechnical Investigations* – Andrew Nathan, Rob Peterson, Peter Volk
- *Environment (Ecology, Water Quality)* – Annette Ross
- *Heritage (Aboriginal, Non-Aboriginal)* – Annette Ross
- *Noise, Social and Economic Impacts* – Matt Sugden, Carolyn Stone, Mike Butler

The presentations can be found in **Appendix 5** except for the Social Impact presentation by Carolyn Stone. Some key points from her presentation are outlined below. Also it was acknowledged that there were some errors in environmental data presented by Annette Ross. This information has been amended in the material appearing in **Appendix 5**.

Social Impacts – Carolyn Stone

- There have been many specialist consultants working on the project and a number of areas overlap into the “Social Impacts” area. Consequently the scope of this presentation was adjusted to reflect dimensions other than these specialities.
- Main points of focus were:
 - Social character of the towns
 - Opportunity and accessibility to sporting and community support facilities
 - Amenity for the community (noise and visual aesthetics come together)
- The conclusions drawn indicated that there did not appear to be much differentiation between corridor options based on this social impact scope. However a number of issues common to all options would need to be addressed regardless of the option chosen as the preferred

Key Issues and Concerns to be Addressed

Having listened to the various specialist assessments of the corridor options, the group highlighted key issues and concerns that still required to be addressed as the project planning proceeded. The task was undertaken in five focus groups, each with a different topic. Their findings were presented to the whole group for comment, amendment, additions and finally concurrence that these issues be considered as the project is progressed.

The focus group findings together with amendments and additions as agreed by the whole group appear below.

Focus group 1: Environment

- Fragmentation of key habitats/corridors
- Scientific rigour underpinning findings

- Inclusion of all Threatened Species records
- Precise vegetation mapping (expanded outside corridors – old growth areas)
- Assessing quality of vegetation communities (habitats, structure)
- Clarification of potential impact on DEC reserves (ie. areas, locations, mitigation, compensation, etc)
- Identify species, habitats and EECs which are difficult to mitigate
- Clarification of impacts on aquatic habitats (ie. fisheries – commercial and recreational, threatened species, etc)
- Identification of funding projects and environmental initiatives (ie. CMA, Wetland Care Australia, Lismore Council, etc)
- Is Threatened Aquatic Species information available?
- Identify both major and minor creek crossings (Class 1, 2 & 3) for each corridor option
- Identify potential for impact on water quality and ensure protection on receiving environment
- Determine the feasibility of mitigation measures on water quality
- Assess the economics of loss of native vegetation/habitats
- Identification of local corridor and road kills (ie. information from Friends of the Koala)
- Correct identification of EECs
- Clarify detail and time period for the rezoning of Environmental Protection Land
- Identification of ecosystem services (ie. clean air, clean water, carbon dioxide sinks, etc)

Focus group 2: Heritage (Indigenous, Non-Indigenous)

Indigenous

- Clarification regarding Aboriginal Land Rights Act – appropriation
- Clarify Aboriginal lands under the Native Title Act or the Aboriginal Land Rights Act
- Further investigation required regarding potential sites around the chosen route
- Contact with knowledge holders for information
- Contact all Aboriginal stakeholder groups
- Establish an Aboriginal focus group
- Determine the social/emotional impacts on the community of the corridor options
- There is a risk of finding sensitive areas during the construction phase (eg. burial sites, Cooks Hill, Wardell cemetery)
- There is no mitigation for sacred sites

Non-Indigenous

- Once the preferred option has been chosen, determine the significance of cultural heritage on the route and avoid where possible or mitigate
- Check the legitimacy of the Meerschaum Vale brickworks
- Investigate the “Oakvale” homestead qualities/significance
- Clarify heritage items over 50 years old that might not be on a register but are significant
- Establish the status of the heritage value of items on the old Pacific Highway (that may be bypassed) especially bridge structures, drains, etc

Focus group 3: Engineering, Flooding and Geotechnical Investigations

- Acid sulfate soils issues – potentially understated sulphide bearing mineral deposits in basement rocks (could impact on water quality)
- Hydro-geology assessment required due to past mining disturbance – ground water management required
- Drainage/flood impact and its duration (check the current Flood Management regime)
- Assess any new drainage impacts (ie. acid sulphate soils or potential acid sulphate soils)
- Long term impact on the use of the local quarries (DA may be required)
- Impact on local roads during construction (ie. traffic management issues) (DA may be required)
- Water requirements during construction. Where will it be sourced (DA may be required)
- Source of road making materials (DA may be required, also a cost issue)
- Confirming bridge height requirements

- Noise impacts and changes to local traffic patterns
- Concern over the low number of geotechnical bore sites on Option 2F in reaching findings
- Air quality impacts and inversion layers need to be considered
- Sandplain aquifers need to be considered in planning

Focus group 4: Visual/Urban Design

- Views to and from the new highway need to be considered
- Noise mitigation measures can have negative visual impacts (mounds, noise walls, etc)
- If too close to urban areas then urban expansion can be restricted
- More difficult to mitigate visual impacts if the road goes through the middle of a landscape (easier if along boundary of say a vegetation boundary)
- The closer the road is to the river, the greater the visual impact (embankments) from the river (tourism, fishing, etc)
- Aesthetics of bridge design needs to be considered
- A balance between a variety of visual experiences for road users as against a monotonous landscape for the driver
- Gateway signage/welcome to the local aboriginal nation is important
- RTA can create character along the road
- Consideration of the existing visual impact is required
- Consistency of approach with other sections of the Highway Upgrade Program is required
- Further identification of rest points to view local features
- Consider the provision of heavy vehicle rest areas/ service centres/ using the towns as service towns

Focus group 5: Noise, Social and Economic Impacts

- The use of base data/existing impacts. Recognise that there are existing impacts
- Detailed consideration of flooding impacts – linked to economic impacts
- Even weighting for urban and rural amenity needs to occur
- Tourism and general impact upon businesses. There are threats and opportunities (SWOT analysis required)
- Detailed consideration of social and economic impacts need to be given at the stage of preferred option choice, specifically to rural farming businesses/and other land owners
- Specific acoustic mitigation measures (feasibility of certain measures). Could be an urban design issue
- Landform issues (particularly in relation to the amphitheatre effect) for corridor option noise assessment need to be considered. In particular western options of Section 2 impacted
- Concern over the level of detail with regard to noise sampling sites. In particular western options of Section 2
- The impacts to nature based tourism and the value of the Tuckean Broadwater, Wardell wetlands and heath lands
- Concern with the detail of ecosystem services (eg. clean water; clean air and carbon sequestration). Data is available from “Fish Unlimited Programme” (see Wetland Care Australia for further information)
- Fisheries and habitat considerations
- Logistics of cane haulage routes
- Social emotion of road location
- Due regard to the upcoming Parliamentary Enquiry on the Pacific Highway to the north and the learnings for this project

In summary, there were a number of key questions and reservations expressed which need to be resolved as planning proceeds. These included:

Questions:

- What ecological framework was used to strike out broader options to arrive at the short listed options?

- Can it be demonstrated how the data on threatened species and key ecological areas (provided by Ballina City Council and Mark Graham, CLG member) has been considered in the work of the Study Team in reaching the short listed options?
- If DEC considers the current environmental assessment on fisheries preliminary and not detailed, can we proceed with a preferred option without further data?
- Can the implications of the “Williams Case” be made clear to the Study Team in terms of “seeking to destroy” NPWS lands, Aboriginal titled lands, pending land claims and the provision of RTA’s draft guideline for Aboriginal liaison?
- Can the reference to the existence of the Meerschaum Vale brickworks site be reviewed and removed from the documentation, if this is proven to be incorrect?
- Are noise mitigation measures feasible for light structures and where maintenance of the outdoor quality of life is a core desire?
- If “unmitigable” impacts become evident then will other options be revisited and reviewed?
- Is visual amenity from the community to be considered as by the current or future communities?
- What action is to be taken to do comparisons and assess benefits for the alternative corridor option (ie. “Flood Free” route)?

Reservations Expressed

- Completeness of data sufficient to be confident in the viability of the corridor options
- Level of scientific rigour to data presented by ecological sub-consultants
- Aboriginal habitation, heritage, cultural and ownership implications on the corridor options needs further investigation
- It is uncertain if some corridor options present an “unmitigable” impact on the environment or other feature to enable confidence in a preferred corridor, particularly in Section 2
- Uncertainty exists on the implications on the quarries and their businesses, their life, extraction methods, type of resource, etc
- Uncertainty of impacts to Eco-tourism businesses of the corridor options

The participants concurred that despite the questions and reservations expressed, there was sufficient collective knowledge at the workshop to proceed with the assessment of the route options. The challenge for the Study Team will be to further investigate and resolve these issues as the project planning proceeds.

Feedback Summary from the Corridor Options Display

Annette Ross, Environmental Team Leader, Hyder Consulting presented to the group a summary of findings from the written submissions and feedback forms received during the Corridor Options Display. Her presentation can be found in **Appendix 6**. However key points raised included:

- Issues raised (details in Appendix 6) could be categorised in the areas of:
 - Environment
 - Property
 - Traffic noise
 - Flooding and drainage
 - Lifestyle of local residents
 - Agricultural land
 - Air quality
 - Impacts on local business
- From the feedback forms,
 - 380 feedback forms were received. Respondents were requested to provide feedback on the importance of identified issues in Section 1, Section 2 and Section 3. Many respondents did not indicate a preference or provide feedback on the importance of particular issues
 - Respondents who indicated preferences favoured:
 - In Section 1 – Option 1C, followed by Options 1A & 1B on the basis of low level of impact on high value habitat areas, meets construction criteria, least impact on residential areas and high value agricultural land
 - In Section 2 – Options 2F & 2E and then Options 2B, 2D, 2A, 2C for environmental reasons such as habitat value as well as traffic noise and no resumption of private residences
 - In Section 3 – Option 3B because it makes use of the existing highway corridor, no encroachment into rural areas and less wildlife is affected

Assessment of Corridor Options

Having reviewed the shortlisted corridor options and discussed their advantages and disadvantages as well as issues to be addressed as planning proceeds in relation to the various specialist studies outlined in the presentations above (including information outlined in the Route Options Development Report), and supplemented with the knowledge and perspectives of the various workshop participants, the group was now in a position to assess the corridor options against the consideration and prompts under the five key perspectives developed earlier in the workshop.

The group (in five focus groups) assessed the corridor options in each Section using the considerations and prompts for each of the key perspectives being Environment, Heritage, Functional, Social and Noise, and Business and Economics. For instance, one focus group assessed the corridor options against the environmental considerations, whilst a second focus group assessed the corridor options against the heritage considerations, and so on.

The options were judged on a qualitative basis of how well each option met each consideration in each perspective on a scale of Excellent **(E)**, Very Good **(VG)**, Good **(G)**, Fair **(F)** or Poor **(P)**.

Once the qualitative assessment was completed, the focus group reflected on the assessment and established “on balance” of the considerations made, a ranking for each corridor option in each Section within their allocated perspective or cluster.

During the process, each focus group recorded their observations and conclusions as a result of their deliberations and findings.

The findings of each focus group was presented to the whole group for discussion, amendment (if required) and finally endorsement as to an agreed assessment and ranking of corridor options within each perspective and Section to assist the group move forward.

Their findings as presented (together with amendments) and as agreed by the whole group are listed below. Their key observations in reaching their findings is also recorded.

Assessment of Corridor Options within the Environmental Perspective

Section 1		Environmental Perspective									
		Considerations Prompts	Impact on key habitats & corridors	Threatened species & EECs	Hydrological impacts on ecosystems	Potential water quality impacts					
OPTIONS											
1A			E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
1B			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
1C			E	E	E	E	E	E	E	E	RANK 3
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	

Section 2

Environmental Perspective											
Considerations Prompts		Impact on key habitats & corridors	Threatened species & EECs	Hydrological impacts on ecosystems	Potential water quality impacts						
OPTIONS											
2A			E	E	E	E	E	E	E	E	RANK 4
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2B			E	E	E	E	E	E	E	E	RANK 4
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2C			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2D			E	E	E	E	E	E	E	E	RANK 3
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2E			E	E	E	E	E	E	E	E	RANK 3
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2F			E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	

Section 3		Environmental Perspective									
		Considerations Prompts	Impact on key habitats & corridors	Threatened species & EECs	Hydrological impacts on ecosystems	Potential water quality impacts					
OPTIONS											
3A			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
3B			E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	

Key Observations

The group noted that as some updated ecological data had only been presented at the workshop, and that the Ecology report was still being finalised, it had to accept the updated information at face value when undertaking the assessments. The group raised concern that this may have resulted in some incorrect ranking of options (specifically in relation to section 2), although the collective knowledge of the group also assisted in the ranking of the options.

Section 1

- For the consideration of "Impact of key habitats and corridors":
 - The focus group made the assumption that all likely/known threatened flora species and vegetation communities have been identified within the Study Area
 - The focus group made the assumption that the threatened species have been appropriately linked to the habitat type
 - The corridors identified do not necessarily include the smaller corridors
 - The EEC table in the Report is an overestimate except for freshwater wetland EECs
 - The amount of hectares of vegetation identified and impacted is questioned. Relative total vegetation of each corridor has been used as a reference point
- For the consideration of "Threatened Species and EECs", the real differentiating factor is measured by the section between Woodburn and the start of the National Park
- For the consideration of "Hydrology impacts on ecosystems":
 - The focus group made the assumption that the inundation times are short enough that it does not impact upon the environment (Will there be changes to current trends?)
 - De-oxygenation of water is a major factor
- For "Potential water quality impacts", findings indicate that Option 1A and 1B are equal and that Option 1C is less preferred

Section 2

- For the consideration of "Impact of key habitats and corridors", The focus group made the assumption that fauna usage is the same across all corridors that are crossed. The group could not differentiate between Options 2A, 2B, 2C, 2D or 2E initially as to which was relatively worse, although Option 2F was unanimously assumed the best option.
- For the consideration of "Threatened Species and EECs":
 - Need to check the amount of vegetation removed in Options 2E & 2D in the area where the two corridors differentiate

- Option 2E is assumed to link to Option 2D only (not to Option 2C or other options), thereby Option 2E was not possible to separate from Option 2D
- Options 2A, 2B & 2C were acknowledged as being worse than the other options. The decision of these relative to each other was more difficult to make. They were decided as being equally as bad as each other because of the impact on a very important salt marsh (which is a very rare EEC in Option 2B) – even though the total area of EECs was less than in Option 2A & 2C
- The assessment could be done at a finer level if the assessment of threatened species and EECs were separated
- The two other species (with difficulty in mitigation) are the Wallum Sedge Frog and the Wallum Froglet – which are identified for being potentially being resident in Option 2D
- Freshwater wetland EECs are also not mapped in Option 2D (this needs to be investigated, as this information is only an opinion)
- The occurrence of Blossom Bats; Squirrel Gliders and known Koala habitats in the Lumleys Lane area of Option 2C, has to be considered in terms of possible mitigation measures
- For the consideration of “Hydrology impacts on ecosystems”:
 - Inundation was not considered as big a problem as the interruption of Coffee Rock, aquifers and water table interruptions is not large although the exact impacts needs to be quantified
 - There were difficulties in differentiating between Options 2A, 2B & 2C
 - Defining hydrological impact is very difficult to ascertain at this stage due to lack of data for Option 2A, 2B & 2C
- For “Potential water quality impacts”, all corridor options have a major effect at the tail route stage of water flow impacts

Section 3

- For the consideration of “Impact of key habitats and corridors”, the fragmentation issue already exists in Option 3B (existing road) therefore it is the better option
- For the consideration of “Threatened Species and EECs”, existing impacts are already there in Option 3B therefore it is the better option
- For “Potential water quality impacts”, there are many creek and drain line crossings in Option 3A. For Option 3B, flood mitigation is already in place therefore Option 3B is rated good

Assessment of Corridor Options within the Heritage Perspective

Section 1

Heritage Perspective											
Considerations Prompts											
	Threatened significant indigenous heritage sites	Threatened significant non-indigenous heritage sites	Existence of special title, ownership, claims								
OPTIONS											
1A			E	E	E	E	E	E	E	E	RANK 3
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
1B			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
1C			E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	

Section 2

Heritage Perspective											
Considerations Prompts		Threatened significant indigenous heritage sites	Threatened significant non-indigenous heritage sites	Existence of special title, ownership, claims							
OPTIONS											
2A			E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2B			E	E	E	E	E	E	E	E	RANK 3
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2C			E	E	E	E	E	E	E	E	RANK 4
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2D			E	E	E	E	E	E	E	E	RANK 5
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2E			E	E	E	E	E	E	E	E	RANK 6
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
2F			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	

Section 3

Section 3		Heritage Perspective										
		Considerations Prompts	Threatened significant indigenous heritage sites	Threatened significant non-indigenous heritage sites	Existence of special title, ownership, claims							
OPTIONS												
3A			E	E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
3B			E	E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	

Key Observations

Section 1

- For the consideration of "Threatened significant indigenous heritage sites":
 - Option 1C has less impact on the massacre site at Woodburn
 - Options 1A or 1B would require 150m buffer to the massacre site
 - No differentiator on this consideration for traversing in front or behind Lang Hill
- For the consideration of "Threatened significant non-indigenous heritage sites":
 - Some non-indigenous heritage items occur in Woodburn
 - Option 1C is further away, therefore better (but not a key differentiator)
 - Option 1B preserves more of the existing Pacific Highway than Option 1A
- For the consideration of "Existence of special title, ownership or claims":
 - Evans Creek has Aboriginal significance, hence Option 1C slightly better than Options 1A & 1B
 - Need to review areas of Crown Land under Native Title Claim. Potential impact on Option 1C

Section 2

- For the consideration of "Threatened significant indigenous heritage sites":
 - Scarred trees near Wardell Road - Impact on Options 2A, 2B, 2C
 - For Option 2A, no issues until Wardell Road (good past Rileys Hill/Tuckean Broadwater)
 - For Option 2B near Bagotville Post Office, there is potential indigenous heritage impacts
 - Sacred site at the crossing of the Richmond River near Options 2C, 2D, 2E
 - Scar trees on Option 2C, north of the Richmond River
 - Potential burials/camp/artefacts south-west of Wardell (Impact by Option 2D) – camp site may extend further south
 - Bora ring to the west of Option 2D near Cabbage Tree Island
 - Scarred trees are some of the last remnants of Aboriginal heritage in the area
 - Options 2A to 2D all affect areas with remaining tangible evidence of Aboriginal heritage
 - Wardell cemetery and Bingal Creek areas are highly significant (Impact by Option 2D)
 - For Option 2E, there is significant impact past Cooks Hill (this could be improved by moving the corridor east)
 - For Option 2E, there is potential "men's business" at Cooks Hill
 - For Option 2F, there is potential "women's business" north and east of Cooks Hill

- There are potential burials between Broadwater and Cooks Hill to Boundary Creek (Impact by Options 2C, 2E, 2F)
- For Option 2F, traditional access from Cabbage Tree Island to Boundary Creek and the ocean would need to be maintained. There is a traditional camp at Boundary Creek (Impact by 2F)
- More investigation and ground survey will be required on Option 2F if it is the preferred option
- For the consideration of "Threatened significant non-indigenous heritage sites":
 - Review the status of "Oakvale" Homestead (Impact by Options 2A, 2B, 2C)
 - Review the status (and possibly the existence) of Meerschaum Vale Brickworks (Impact by Options 2A, 2B, 2C)
 - Option 2A – Fair but impacts on Stonehenge? (*questionable*)
 - Option 2B – Fair but impacts on Bagotville Post Office and Stonehenge
 - Option 2C – Poor (additional impact on Byrne property)
 - Option 2D – Poor (impacts on Byrne property as well as Wardell cemetery and Bingal Creek)
 - Option 2E – Poor (impacts on Wardell cemetery and Bingal Creek)
 - Option 2F – Fair
- For the consideration of "Existence of special title, ownership or claims":
 - Options 2A & 2B – Good (no known impacts)
 - Option 2C – Fair (impacts on edges of Local Aboriginal Land Council – LALC land)
 - Options 2D & 2E – Poor (major impact on LALC land)
 - Option 2F – Good (no known impacts)

Section 3

- For the consideration of "Threatened significant indigenous heritage sites", there is potential for some artefacts in the foothills of Blackwall Range
- For the consideration of "Threatened significant non-indigenous heritage sites", there are no significant issues
- For the consideration of "Existence of special title, ownership or claims", there are no significant issues

Assessment of Corridor Options within the Functional Perspective

		Functional Perspective										
		Considerations Prompts	Travel efficiency	Safety	Access points/links	Aesthetics from highway						
OPTIONS												
1A			E	E	(E)	(E)	E	E	E	E	E	RANK 3
			(VG)	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	(F)	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
1B			E	E	(E)	(E)	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			(G)	(G)	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
1C			(E)	(E)	E	E	E	E	E	E	E	RANK 1
			VG	VG	(VG)	(VG)	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	

Section 2

Functional Perspective												
Considerations Prompts		Travel efficiency	Safety	Access points/links - local	Access points/links - highway	Aesthetics from highway						
OPTIONS												
2A			E	E	E	E	E	E	E	E	E	RANK 5
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2B			VG	VG	VG	VG	VG	VG	VG	VG	VG	RANK 4
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2C			E	E	E	E	E	E	E	E	E	RANK 3
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2D			E	E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2E			E	E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2F			E	E	E	E	E	E	E	E	E	RANK 6
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	

Section 3		Functional Perspective									
		Considerations Prompts	Travel efficiency	Safety	Access points/links	Aesthetics from highway					
OPTIONS											
3A			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
3B			E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	

Key Observations

Section 1

- For the consideration of “Travel efficiency”, all routes have similar lengths, with Option 1C slightly shorter. Therefore, similar travel efficiency (Option 1C best, followed by Option 1A, then Option 1B)
- For the consideration of “Safety”, Option 1C has the shortest length of safety barriers, Option 1A the greatest length. Therefore, Option 1C best, followed by Option 1B, then Option 1A (worst)
- For the consideration of “Access points and links”, Options 1A and 1B are closer to Woodburn and, therefore, with similar access issues, with Option 1C further away. Therefore, Options 1A and 1B are the same, then Option 1C (worst)
- For the consideration of “Aesthetics from the highway”, Option 1A has views of the river, Option 1B has views of the river and the hillside. Option 1C considered not as good regarding aesthetics. Therefore, Options 1A and 1B are the same, then Option 1C (worst)
- On balance, Option 1C has the shortest length and has the shortest length of safety barriers, with aesthetics essentially similar between the routes. Therefore Option 1C best, followed by Option 1B, then Option 1A**

Section 2

- For the consideration of “Travel efficiency”, Options 2C, 2A, 2F, 2B, 2E, 2D in order of decreasing length. Therefore Option 2D most efficient for travel
- For the consideration of “Safety”:
 - Options 2C, then Options 2A/ 2D/ 2E (similar), followed by Options 2B, 2F in order of increasing length of safety barriers
 - Option 2F has greatest length of viaduct and safety barriers
- For the consideration of “Access points and links”, the item was split into 2 parts (locally and to the highway):
 - For access locally:
 - Option 2E (best), followed by Options 2C, 2A, 2D, 2B and then Option 2F (worst) in increasing travel lengths
 - Option 2F is worst because of additional length of trips required to access highway
 - Option 2E has least length of trips to access highway locally
 - For access onto the proposed upgraded highway – Options 2C/ 2D/ 2E are similar, followed by Option 2F with Options 2A and 2B (worst)

- For the consideration of “Aesthetics from the highway”:
 - Option 2F provides good views of cane fields and Blackwall Ranges but not much variety
 - Options 2A & 2B provide views of the river and the Tuckean Broadwater. Therefore the options were grouped as follows – Options 2A, 2B, 2F – good aesthetics, Options 2D, 2C, 2E – poor aesthetics
- ***Difficult to rank, considering the variety of landscapes along the route options. However the overall ranking was agreed as Option 2E (best), followed by Options 2D, 2C, 2B, 2A and finally Option 2F (worst)***

Section 3

- For the consideration of “Travel efficiency”, Option 3A is slightly longer than Option 3B. Therefore, Option 3B is more efficient for travel
- For the consideration of “Safety”, Option 3A is slightly longer, no special safety provisions. Therefore, Option 3B is marginally better for safety
- For the consideration of “Access points and links”:
 - Interchanges are not a major consideration at corridor selection stage. However, Option 3A will require additional service roads compared with Option 3B. Therefore Option 3B is rated better
- For the consideration of “Aesthetics from the highway”, both options are difficult to differentiate on aesthetics. Therefore, Options 3A & 3B are rated the same
- ***Overall rating has Option 3B as best***

Potential Improvements for ongoing consideration identified by the Focus Group

- Cane haulage access needs further consideration
- Contact needs to be made with designers of the conveyor system to the sugar mill
- Rileys Hill Road will not support local traffic under the options being considered in Section 1. Functional improvements could be made by having the service roads parallel to the highway through the National Park which would require some minor additional National Park land resumption
- Option 2D can be improved by moving the corridor slightly west and up onto the sand ridge (minor additional impact on heath land). However there may be potential Aboriginal land impacts
- More detailed work is required to confirm viability of local/nearby quarry resources

Assessment of Corridor Options within the Social and Noise Perspective

Section 1		Social Perspective									
		Considerations Prompts	Relative noise increase	Number of noise receivers	Potential flood impacts	Limits to town development	Impacts on r/residential development	Aesthetics from community view	Number of residences lost in route footprint		
OPTIONS											
1A			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			(G)	G	G	G	G	G	G	G	
			F	(F)	(F)	F	F	(F)	F	F	
			P	P	P	P	P	P	P	P	
1B			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			(G)	G	G	G	G	G	G	G	
			F	(F)	(F)	F	F	(F)	F	F	
			P	P	P	P	P	P	P	P	
1C			E	E	E	E	E	E	E	E	RANK 1
			(VG)	(VG)	VG	VG	VG	VG	VG	VG	
			G	G	(G)	G	G	(G)	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	

Section 2

Social Perspective												
Considerations Prompts			Relative noise increase	Number of noise receivers	Potential flood impacts	Limits to town development	Impacts on r/residential development	Aesthetics from community view	Number of residences lost in route footprint			
OPTIONS												
2A			E	E	E	E	E	E	E	E	E	RANK 3
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2B			E	E	E	E	E	E	E	E	E	RANK 3
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2C			E	E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2D			E	E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2E			E	E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2F			E	E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	

Section 3		Social Perspective									
		Considerations Prompts	Relative noise increase	Number of noise receivers	Potential flood impacts	Limits to town development	Impacts on r/residential development	Aesthetics from community view	Number of residences lost in route footprint		
OPTIONS											
3A			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
3B			E	E	E	E	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	

Key Observations

Section 1

- In considering relative noise increases and number of receivers, Options 1A & 1B have approximately 55 receivers whereas Option 1C has approximately 5 receivers
- For the consideration of “Potential flood impacts”, Options 1A & 1B are fair and Option 1C is slightly better
- For the consideration of “Limits to town development”, it is not an issue in the Section (re: Woodburn’s future) so it was not rated – not a differentiator between options
- For the consideration of “Impacts on rural residential development”, Lang Hill is the only location of cluster development in the area and is approximately the same for each option so it was not rated – not a differentiator between options
- For the consideration of “Aesthetics from the community view”, Option 1B is slightly better than Option 1A. Option 1C is the furthest from Woodburn so the greater number of people would say Option 1C was the best of the options
- For the consideration of “Number of residences lost in route footprint”, the number of residences affected is approximately the same so it was not rated – not a differentiator between options

Section 2

- In considering relative noise changes and number of receivers, the focus group assumed that they all achieve a better result than the existing situation (due to bypass of towns). The ratings have been determined by the noise impact on previously unaffected areas
- For the consideration of “Impacts on rural residential development”, impacts were viewed as worst for Option 2A
- For the consideration of “Aesthetics from the community view”, there was major discord within the focus group regarding the ratings of Options 2C and 2F. There appeared different impressions regarding community view on aesthetics being either a change from the beauty already existing to a highway view or if we have a highway, can we design it to fit into the landscape with visual appeal. Accordingly Options 2C and 2F could not be rated by the focus group
- For the consideration of “Number of residences lost in route footprint”, there was disagreement with the number of houses lost as against structures. The data provided at the workshop indicated the number of “structures” not houses. Accordingly the options could not be rated by the focus group
- **Section 2 was the most contentious and sensitive of the sections to rank for the social and noise focus group**

Section 3

- In considering relative noise increases and number of receivers:
 - Option 3A diverges further from the highway, therefore greatest change in noise (negative impact)
 - It was flagged that in the consideration of impacts, the mitigability or unmitigability of the impact must be taken into account. The degree of difficulty in mitigating the impact varies for the options from poor to fair only
 - Option 3A has an amphitheatre effect with regards to reflective noise impact which needs to be considered
 - For Option 3B, the noise change may force RTA to mitigate better than the current situation, hence Option 3B rating is upgraded from fair to good
 - A 300m buffer zone needs to be considered for land form purposes (ie. visibility)
 - Number of noise receivers not differentiated by the focus group
- For the consideration of "Potential flood impacts", flood levels afflux no greater than 50mm. Some confusion as to whether the options are in flood plain. Not rated by the focus group
- For the consideration of "Limits to town development", it was considered not an issue in the Section so it was not rated – not a differentiator between options
- For the consideration of "Impacts on rural residential development", the focus group discussed how one would feel about having a road where there wasn't one before. Hence rated Option 3B better than Option 3A
- For the consideration of "Aesthetics from the community view", there was concern about a "scar" on the landscape if Option 3A is in the foothills, specifically when looking back from elevated positions in Ballina. However the urban designer believes that this can be addressed. Option 3A was rated better than Option 3B
- For the consideration of "Number of residences lost in route footprint", Option 3B rated better than Option 3A due to its proximity to the current highway footprint

Assessment of Corridor Options within the Business and Economic Perspective

Section 1	Business and Economic Perspective										
	Considerations Prompts		Impact on cane production	Loss of regionally significant agricultural land	Road proximity to support towns	Other business impacts (e.g. quarries)					
	OPTIONS										
1A			E	E	E	E	E	E	E	E	RANK 3
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
1B			E	E	E	E	E	E	E	E	RANK 2
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	
1C			E	E	E	F	E	E	E	E	RANK 1
			VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	

Section 2

Business and Economic Perspective												
Considerations Prompts		Impact on cane production	Loss of regionally significant agricultural land	Road proximity to support towns	Other business impacts (cane haulage to mills)	Quarry impacts						
OPTIONS												
2A			E	E	(E)	E	E	E	E	E	E	RANK 5
			VG	(VG)	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	(G)	(G)	G	G	G	G	
			(F)	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2B			E	E	E	E	E	E	E	E	E	RANK 4
			VG	VG	(VG)	VG	VG	VG	VG	VG	VG	
			G	G	G	(G)	(G)	G	G	G	G	
			(F)	(F)	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2C			E	E	E	E	E	E	E	E	E	RANK 3
			VG	(VG)	VG	VG	VG	VG	VG	VG	VG	
			G	G	(G)	(G)	G	G	G	G	G	
			(F)	F	F	F	F	F	F	F	F	
			P	P	P	P	(P)	P	P	P	P	
2D			E	E	E	E	(E)	E	E	E	E	RANK 2
			(VG)	VG	VG	(VG)	VG	VG	VG	VG	VG	
			G	(G)	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	(P)	P	P	P	P	P	P	
2E			E	E	E	(E)	(E)	E	E	E	E	RANK 1
			(VG)	VG	VG	VG	VG	VG	VG	VG	VG	
			G	(G)	(G)	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
2F			E	E	E	E	(E)	E	E	E	E	RANK 6
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			(P)	(P)	(P)	(P)	P	P	P	P	P	

Section 3		Business and Economic Perspective										RANK
		Considerations Prompts	Impact on cane production	Loss of regionally significant agricultural land	Road proximity to support towns	Other business impacts (e.g. quarries)						
OPTIONS												
3A			E	E	E	E	E	E	E	E	E	2
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	
3B			E	E	E	E	E	E	E	E	E	1
			VG	VG	VG	VG	VG	VG	VG	VG	VG	
			G	G	G	G	G	G	G	G	G	
			F	F	F	F	F	F	F	F	F	
			P	P	P	P	P	P	P	P	P	

Key Observations

Jeff Brownlow (DPI) made the following observations:

- It was noted that quarries did not feature in technical presentations.
- The graphics of acid sulphate soil potential indicated only area distribution and lacked data on depths, thicknesses plus pyrite contents and lacked a quantitative analyses of engineering/ cost significance.

Section 1

- For the consideration of "Impact on cane production", the cane industry does not like any of the options (ie. Options 1A, 1B, 1C) due to the perceived flooding impacts and would like to have the alternative option (called the "Flood Free" route option) considered. However of the options shortlisted, Option 1C is significantly better than Options 1A & 1B as it skirts the area
- For the consideration of "Loss of regionally significant agricultural land", Option 1C has slightly less impact
- For the consideration of "Road proximity to support towns":
 - There is a need to consider the proximity of interchanges
 - Townships need the ability and room to develop
 - There are issues with Options 1A & 1B being closer to the river with potential impact on river industry
 - Off ramp near the junction of Rileys Hill Road and the existing highway will allow travel along river
- For the consideration of "Other business impacts", the focus in this section is township businesses (no quarries exist in Section 1). The long term impacts are greater than short term impacts so there is a preference for the option being further away from the town (ie. marginally Option 1C is better than Option 1B which is better than Option 1A)

Section 2

- For the consideration of "Impact on cane production", the most impact would be Option 2F (poor), the least impact would be Options 2D & 2E (very good). There would be family issues around Cooks Hill (social) which would be impacted by Option 2D. Options 2A & 2B would have the same impact (includes haulage impacts). Options 2A, 2B and 2C would only be fair
- For the consideration of "Loss of regionally significant agricultural land", the greatest impact would be Option 2F (prime agricultural land). Option 2E would impact on subdivisions (Maloney's

property). Options 2A & 2C would have the least impact followed by Options 2E & 2D, then Option 2B with Option 2F the worst impact

- For the consideration of “Road proximity to support towns”, at Broadwater there is a need to be mindful of local through traffic (ie. maintain access). Options rate from Option 2A, then Options 2B, 2C, 2E, 2D and finally Option 2F. At Wardell, Option 2F impacts on the caravan park. Options 2A & 2B do not sever the coast from the beach area and are further away from both Broadwater and Wardell
- For the consideration of “Other business impacts”, this point was divided into cane haulage to mill and quarry impacts. For cane haulage to mill, mapping indicated that Option 2F had greatest impact, followed by Options 2A, 2B & 2C which had a medium impact and Options 2D & 2E with the lowest impact. For quarry impacts, Options 2C & 2E have existing quarries on the routes which service existing districts. Options 2D and 2F are excellent with Options 2A & 2B having minor quarries in between
- ***The overall ranking of options has been undertaken under the assumption that the issues associated with the quarries on the corridor options can be managed or resolved (particularly for Options 2C & 2E)***

Section 3

- For the consideration of “Impact on cane production”, the existing infrastructure is aligned with Option 3B. With Option 3A, there would be a need to change farming set up (ie. pads, etc). There could be proposed expansion for cane production in Option 3A
- For the consideration of “Loss of regionally significant agricultural land”, Option 3A has significant loss
- The consideration of “Road proximity to support towns” and “Other business impacts” are not applicable for this section
- ***Overall Option 3B is far superior than Option 3A from a Business and Economic perspective***

Summary of Preliminary Project Cost Estimates

As project cost estimates were still to be determined, preliminary information was presented to the workshop to give an understanding of the relative nature of the unit costs of the various corridor options in each section for comparative purposes.

The preliminary project cost estimates included:

- Project development costs
- Investigation and design costs
- Property acquisition costs
- Public utility adjustments costs
- Construction costs
- Handover costs

The preliminary project cost estimates appear below as presented to the group and are relative as at year 2005. For the purposes of comparison in each Section, Option A was assigned 100 cost units and each other option in that Section relatively compared as a percentage against Option A. The comparisons appear below.

Section 1

Corridor Options	Cost (%) relative to Option A for this Section
Option 1A	100
Option 1B	88
Option 1C	86

Section 2

Corridor Options	Cost (%) relative to Option A for this Section
Option 2A	100
Option 2B	109
Option 2C	93
Option 2D	88
Option 2E	84
Option 2F	160

Section 3

Corridor Options	Cost (%) relative to Option A for this Section
Option 3A	100
Option 3B	98

Summary of Corridor Option Assessment Rankings

A summary of the rankings of the corridor options against the various perspectives together with the cost estimates presented earlier appears below

Section 1 – Ranking of Corridor Options

Perspectives						
Option	Environmental	Heritage	Functional	Social & Noise	Business & Economic	Cost (units)
1A	1	3	3	2	3	100
1B	2	2	2	2	2	88
1C	3	1	1	1	1	86

Section 2 – Ranking of Corridor Options

Perspectives						
Option	Environmental*	Heritage	Functional	Social & Noise	Business & Economic*	Cost (units)
2A	4	1	5	3	5	100
2B	4	3	4	3	4	109
2C	2 (3)	4	3	1	3	93
2D	3 (2)	5	2	2	2	88
2E	3 (2)	6	1	2	1	84
2F	1	2	6	1	6	160

* It should be noted that upon reflection during this stage of the workshop, the focus group who assessed the Environmental perspective revisited their findings and believed they had incorrectly interpreted impact on a particular aspect in the area north west of Wardell being the recently documented State Significant Remnant Vegetation Zone and the amount of salt marsh impacted. This caused them to re-rank Option 2C lower (as indicated in brackets in the above table) with respect to Options 2D & 2E as Option 2C traverses through this area (as does Options 2A & 2B. Options 2A & 2B remain at a lower ranking as they also create further problems in the southern area of the Section.

Also it should be noted that the ranking of corridor options from a Business and Economic perspective is based on the assumption that the quarry issues identified can be resolved or managed.

Section 3 – Ranking of Corridor Options

Perspectives						
Option	Environmental	Heritage	Functional	Social & Noise	Business & Economic	Cost (units)
3A	2	2	2	2	2	100
3B	1	1	1	1	1	98

Recommending a Preferred Direction

As a result of the work undertaken above, the group (in focus groups) was asked “Which corridor option should be recommended as the preferred option to move forward for refinement and more detailed investigation to progress the project as well as the reasons why”. However, the preference is “subject to” the issues identified being addressed. Also a fallback option was to be nominated should the preferred corridor option later turn out not to be feasible.

One focus group examined Section 1 of the Study Area, another focus group examined Section 3 and three focus groups reviewed Section 2. Their findings were then discussed, amended (if required) and finally agreed as to the direction forward.

The focus group conclusions are recorded below.

Focus group examining Section 1

We prefer Option 1C as the preferred corridor to progress the project.

Because:

- It performs better on all criteria other than from an environmental perspective

Subject to:

- Investigating the feasibility of avoiding or minimising impacts of removing vegetation, EECs and threatened species in the alignment

Fallback position:

- Option 1B because it is the next best option on all criteria identified

Focus group examining Section 3

We prefer Option 3B as the preferred corridor to progress the project.

Because:

- It performs better on all criteria and is best value for money

Subject to:

- Confirming the road footprint for Option 3B and the impact on sugar cane land (if any)

Fallback position:

- Not nominated

Focus groups examining Section 2

Focus group 1

We prefer Option 2C as the preferred corridor to progress the project.

Because:

- It performs well from a social, noise and environmental perspective
- It performs reasonably from a functional, business and economic perspective
- It is reasonably cost effective

Subject to:

- Improving the alignment around Cooks Hill

- Clarifying and managing the quarry issues (Broadwater and Bagotville)
- Managing the heritage issues

Fallback position:

- Option 2D because of its high relative ranking functionally, socially and economically and low relative cost. However this is subject to improving the alignment around Cooks Hill and managing/avoiding the heritage issues

Focus group 2

We prefer Option 2E as the preferred corridor to progress the project.

Because:

- It performs best from a functional, business and economic perspective
- It performs reasonably (mid range) from an environmental, social and noise perspective
- It is reasonably cost effective

Subject to:

- Satisfactorily resolving the heritage issues

Fallback position:

- Option 2C because its overall mid range position in rank and its high relative ranking socially and economically

Focus group 3

Could not agree on a preferred option but drew the following conclusions:

- Options 2D & 2E are high risk options (traverse through Jali land, land claims, heritage issues, etc)
- Options 2A & 2B do not have many positives environmentally, functionally, business and economically
- Option 2C is feasible subject to mitigation of environmental and heritage issues including ESD issues. However it is believed by some participants that it is not possible to achieve ESD on Option 2C due to unmitigable impacts
- Option 2F is feasible subject to being prepared to pay over 60% more than Option 2C as well as having a poor performance outcome functionally, business wise and economically (it is believed by some participants that it is not feasible to fund Option 2F at such additional cost burden)

Conclusions Drawn from the Workshop

As a result of the discussions over the two days of the workshop, the group agreed to the following conclusions:

- From the short listed corridor options reviewed in the workshop, there was unanimous support for Option 1C in Section 1 and Option 3B in Section 3 moving forward for more detailed investigation, development and refinement to progress the project
- In Section 2 of the Study Area, there was agreement that:
 - All the options examined have issues and risks
 - Options 2A and 2B should not be further pursued
 - Option 2C has possibilities subject to resolving the heritage issues, quarry issues, environmental issues, etc. However, Options 2D, 2E and 2F have also been mentioned as possibilities subject to further investigation to resolve issues mentioned during the workshop

Where to From Here?

At the conclusion of the workshop, an Action Plan was produced which outlined the direction and process to be undertaken by the Study Team and others to move the project forward from here.

No.	Task	By Whom	By When
1.	Deal with the issues and concerns tabled in light of the specialist presentations and information shared during the workshop	Shane Higgins/ Hyder Study Team	End July 2005
2.	Understand and resolve the quarry impacts and issues with regard to the preferred corridor options in Section 2	Shane Higgins/ Hyder Study Team	Concept Design Stage
3.	Establish an Aboriginal heritage focus group and finalise inputs for option consideration	Shane Higgins/ Mary-Lou Buck	End August 2005
4.	Secure a copy of the RTA Greenhouse Report for the Study Team and the CLG	David Corry	End July 2005
5.	Revisit/review other options should immitigable impacts arise on the shortlisted preferred options	Shane Higgins/ Hyder Study Team	Prior to Preferred Option Report
6.	Investigate source materials and the cost for the road construction	Shane Higgins/ Hyder Study Team	Concept Design Stage
7.	Clarify how the RTA has addressed greenhouse gas emission implications of the options	Shane Higgins/ Hyder Study Team	Prior to Preferred Option Report
8.	Determine how the alternative option ("flood free route" option) will be assessed relative to the shortlisted options	Shane Higgins/ Hyder Study Team	Prior to Preferred Option Report

Appendix 4. Presentation by Bert Plenkovich, CLG representative and Hyder Consulting on an Alternative Corridor Option

Flooding & the Sugar Industry on the Richmond River Floodplain

Presentation to the Value Management
Workshop

20th & 21st July 2005

BM Plenkovich

- The catchment area is 6,892 sq klms comprising of 3 major areas being:
 - Wilson River approx 1,587 sq klms
 - Richmond River to Casino/Kyogle 2,716 sq klms
 - Bungawalbyn Catchment 2,589 sq klms
- Only 2 drainage points exist to drain the Richmond River of floodwater
 - One is the Richmond River itself to Ballina
 - The other is the Tuckombil Canal and Evans River

- Current natural bottlenecks to the release of floodwater are:
 - “Hairpin” bend in the Richmond River at Dungarubba some 3 klms upstream from the township of Broadwater



- Pelican Island
- Sharp bend in the Richmond River at Broadwater
- The recent flood has also shown that the current configuration of the Tuckombil Canal has considerably delayed the release of floodwaters in low lying areas



- Any further obstructions to the flow of floodwaters will cause:
 - Delay in the release of floodwaters
 - Increased duration of flooding
 - On lower floodplain Lismore City and Richmond Valley Council indicate 3,500 people isolated unable to access work & community services and would create social & economic problem

- increased inundation of low lying areas
 - Household losses, crop losses, agistment of cattle, etc
- Possible effect on areas previously considered as having minimal concern from floods



- Possible Route Option Obstructions

- Routes 1A, 1B & 1C

- The river area parallel to these routes overflows across the existing Pacific Highway in major flood events
 - Is a release value for flooding with water flowing back to the Evans River



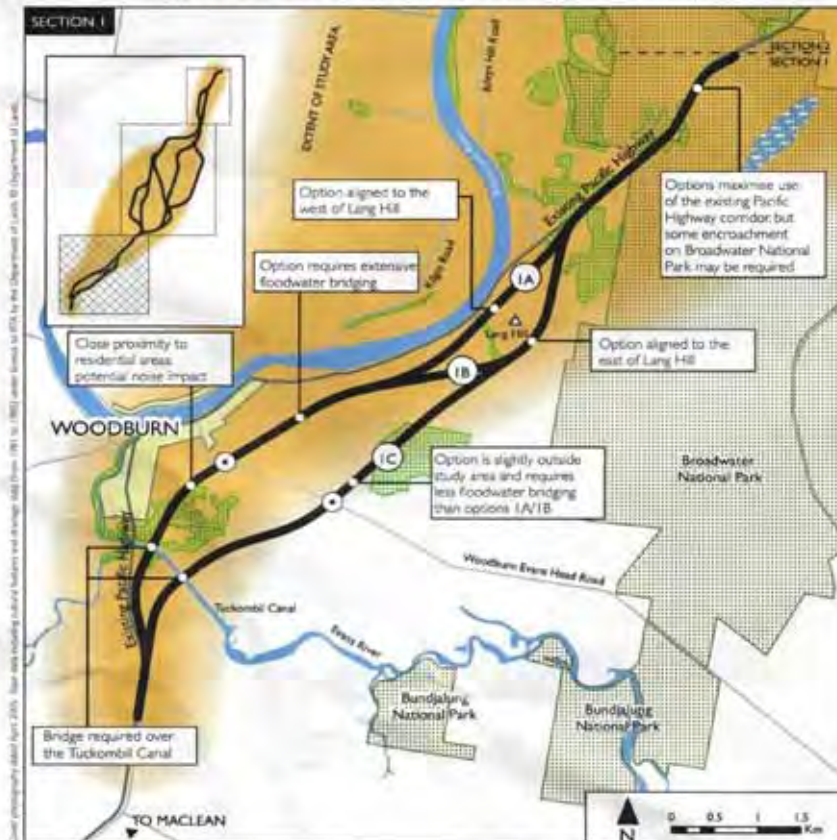
- Any further obstructions in this area with levee or culvert type constructions will create barriers to the escape of floodwaters
- Would cause increased flooding in the lower catchment
- These problems can be avoided by adoption of the “Flood Free” Route option

The NSW Roads and Traffic Authority is in the process of identifying a highway upgrade route from the south of Woodburn to the approved Ballina Bypass.

This community update describes the route options that have been shortlisted for community consideration and the key issues associated with each of the options. **The route options are on display from 23 May to 17 June 2005.**

For this study area the route options can be linked together in many different ways. There are decisions to be made about a preferred route in the southern, the central and the northern parts of the study area.

The RTA invites you to consider each of the three sections and provide your comment on the feedback form included here or available by contacting the project information line.



Option	IA	IB	IC
Route length (km)	11.4	11.8	11.2
Percentage of option within the 1 in 100 year flood plain	78%	76%	76%
Approximate number of private properties within 250m corridor	90	90	45

- Possible Route Option Obstructions
 - Routes 2A & 2B (at Richmond River crossing)
 - Normal width of the river at 2A bottleneck is 250 metres and during major floods the river width increase to about 600 metres
 - Any structure at 2A or 2B would greatly restrict flow causing further increased inundation and duration in areas above these points
 - Large sugarcane farming area and community of Riley's Hill would be significantly disadvantaged by either of these routes



- Both route options cross the highly valued areas of habitat of the Tuckean Broadwater wetlands



- There are also concerns for flood effects for the Northern section of these proposed routes at Meerschaumvale/Lumley's Lane area and southern area of the Blackwall Range

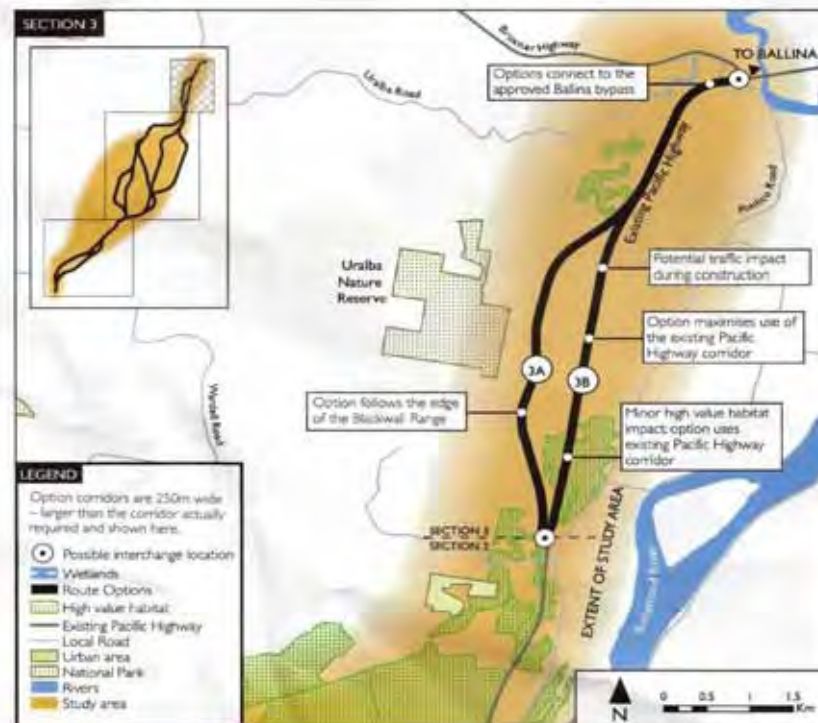


TYPICAL CROSS SECTION



*Options for local access include using the existing highway upgrading local roads, or new local access roads.

This cross section shows a typical arrangement of a highway upgrade, with a 12 metre wide median and 32 metres from shoulder to shoulder. The final arrangement may vary as conditions, for example topography, change.



Option	3A	3B
Route length (km)	6.7	6.4
Percentage of option within the 1 in 100 year flood plain	0%	33%
Approximate number of private properties within 250m corridor	35	40

- Sugar Industry Comment

- The Pacific Highway upgrade will pass through the 3 cane growing areas with the potential to impact significantly on cane land and the economy of the region
- The industry has been operating in NSW since 1882 and currently generates over \$200 million to the region each year and employs over 2,000 people
- Given the current state of the industry we cannot afford to lose cane land and hence throughput to the Co-operatively owned mills

- Sugar Industry
Comment (cont...)
 - Individual growers located on particular routes would see their farms become unviable through either total loss of productive area or fragmentation
 - In certain localities the loss of cane land will directly effect the continued viability of harvesting groups



- Losses to the sugar industry are significant for routes 1A & 1B, 2A & 2B, part 2C, 2F and 3A as shown in the table

ROUTE OPTION	TONNES OF CANE LOST	HECTARES OF CANE LAND LOST	% of BROADWATER MILL AREA PRODUCTION LOST
1A	26,200	476	2.62
1B	26,200	476	2.62
1C	4,500	73	0.45
2A	10,500	141	1.05
2B	11,000	148	1.10
2C*	7,500	128	0.75
2D*	4,500	49	0.45
2E	650	7	0.07
2F*	37,500	406	3.76
3A	5,500	64	0.55
3B	Unknown	Unknown	Unknown

- Worse case scenario is lose of 70,000 tonnes of sugarcane and approx 1,000 hectares of irreplaceable prime agricultural land



- Sugar Industry Comment (cont...)
 - Industry's Preferred Option
 - Creates a basically flood free route
 - Minimises impact on the townships of Wardell and Jali communities , Broadwater and Riley's Hill communities and town of Woodburn



- Creates a first ever flood free access to Evans Head
- Minimal Impact on Prime Agricultural Land although it is realised that there is significant loss to one property north of Broadwater
- Would appear to also be the most cost effective to build



- Closing Comment

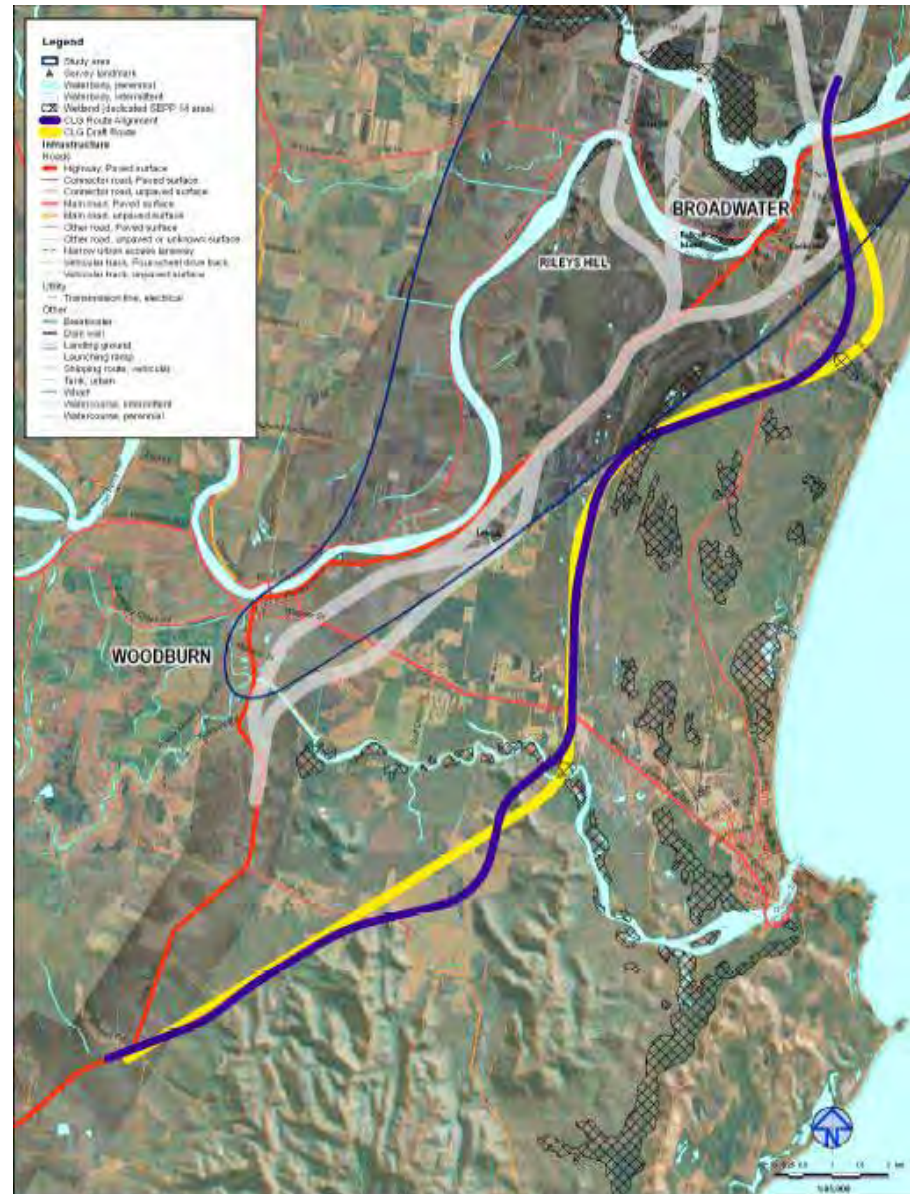
Unfortunately there seems to be 2 sets of standards with on the one hand the State Government having in place a policy to preserve agricultural land while appearing to distance themselves from this goal in terms of highway construction

**CLG Route –
Preliminary
Investigation by Hyder
Study Team**

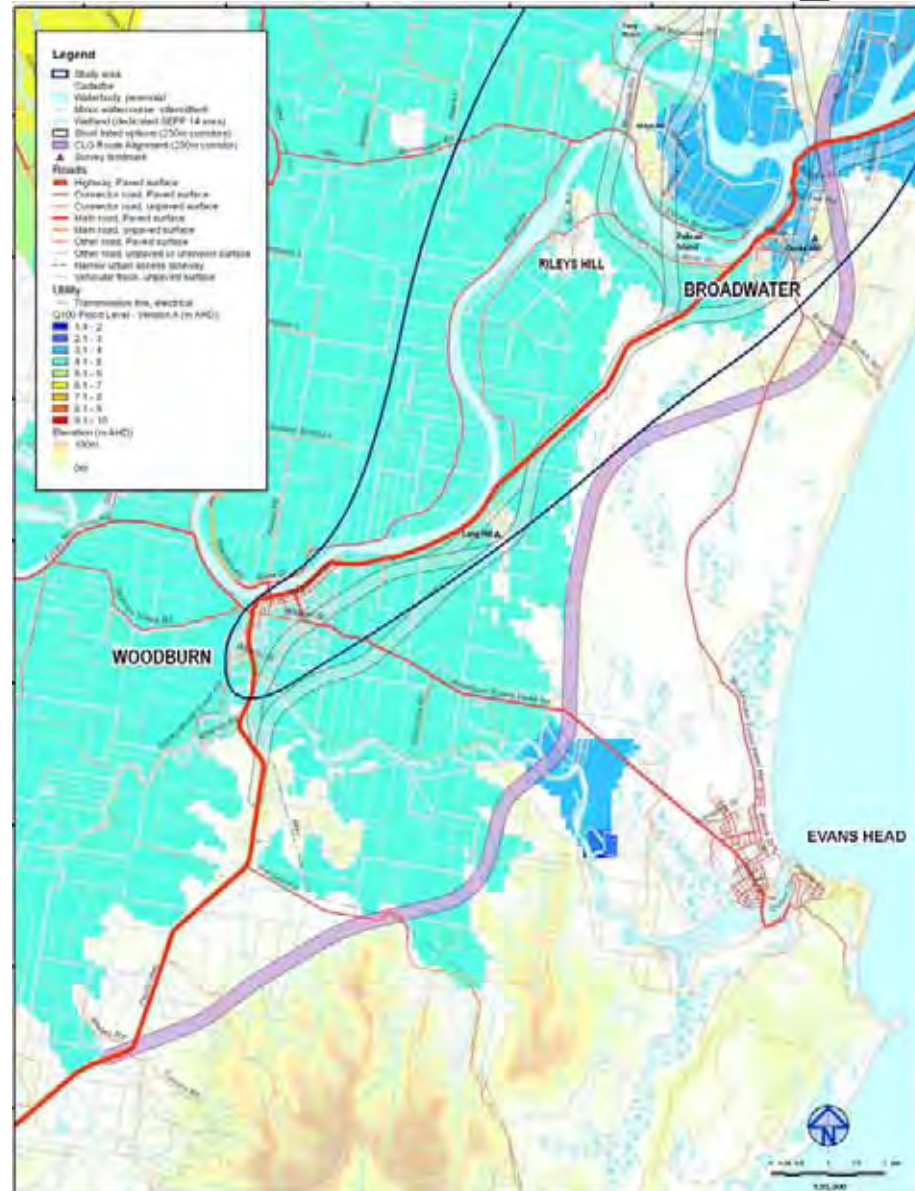
Route considered in Route Options Development Report



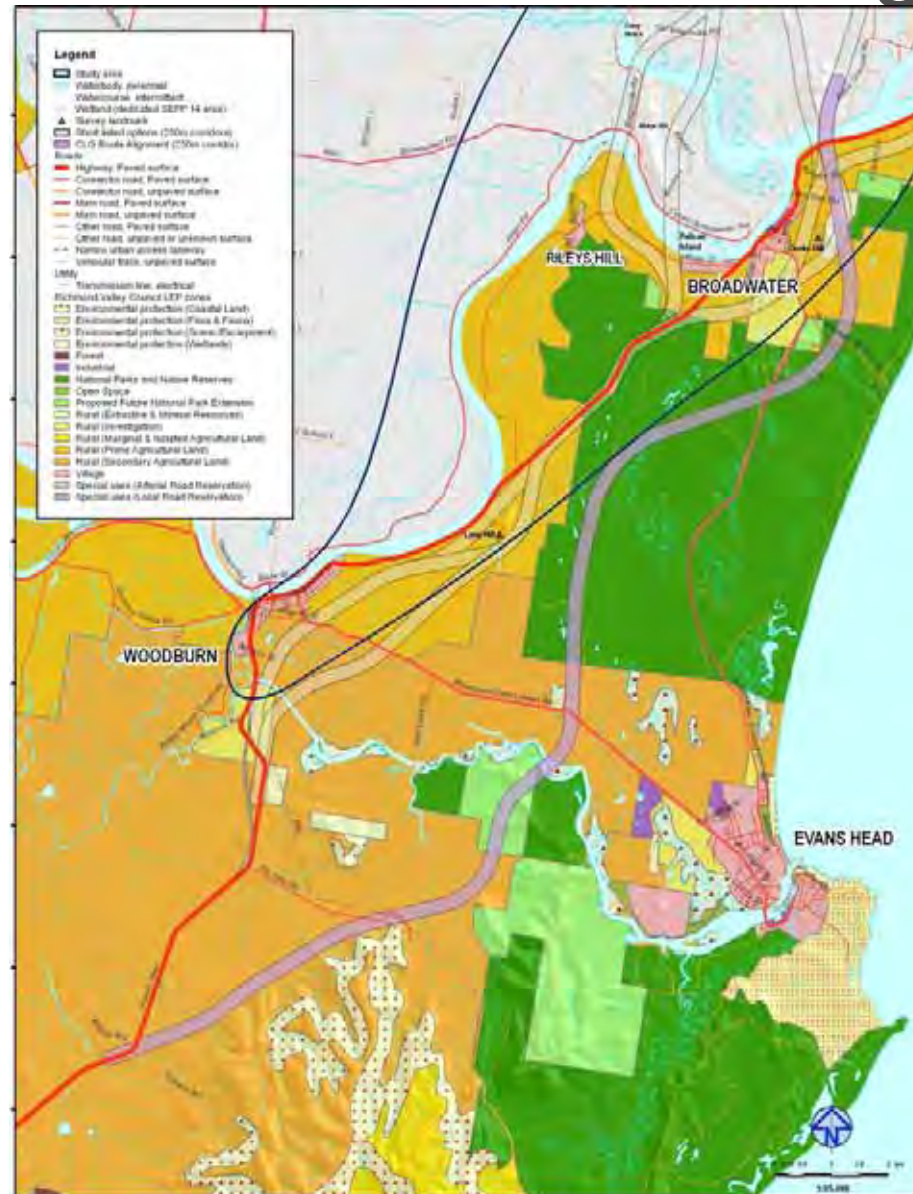
CLG Route



CLG Route - Flooding



CLG Route – LEP Zoning



CLG Route – Potential Indigenous Heritage



CLG Route

	ENGINEERING	
OPTION	ADVANTAGES	DISADVANTAGES
1C+2E (+ 6.5km upgrade to south)	Reuse of Existing Hwy	Highest Acid Sulphate Soil risk (46Ha additional) Longest length of Bridges/viaducts (780m additional) Highest earthworks volumes (14% additional volume) Longest length over deep soft soils
CLG Route	Lowest Acid Sulphate Soil risk Shortest length of Bridges / Viaducts. Lowest earthworks volumes Shortest length over deep soft soils Potential for flood protected access for Evans Head	Construction of additional 6.5km of new Hwy

CLG Route

	LANDUSE	
OPTION	ADVANTAGES	DISADVANTAGES
1C+2E (+ 6.5km upgrade to south)		Higher impact on Cane Farming
CLG Route	Minimum impact on cane farming	

CLG Route

	ENVIRONMENTAL	
OPTION	ADVANTAGES	DISADVANTAGES
1C+2E (+ 6.5km upgrade to south)	Least impact on National Park Least impact on Threatened Species Least impact on Endangered Ecological Communities	
CLG Route		Significant potential Impact on National Park Significant potential impact on Threatened Species Significant potential impact on Endangered Ecological Communities Highest risk of impact on fisheries in the Evans River DEC and Fisheries have provided strong advice supporting the ecological impacts likely to arise

CLG Route

	ABORIGINAL HERITAGE	
OPTION	ADVANTAGES	DISADVANTAGES
1C+2E (+ 6.5km upgrade to south)	Smallest areas of potential cultural sites affected	
CLG Route		Broad areas of high cultural significance traversed (Evans River, East of Cooks Hill)

Appendix 5. Study Team Presentations

Corridor Option Review

Harry Batt

Short list of options



Visual/Urban Design

Mary-Anne McGirr

Visual/Urban Design

Section 1: Option 1A

Advantages / Strengths / Opportunities

- Lower embankment heights than Option 1C – generally 4 metre plus
- Interesting and varied view experience includes:
 - Views to Woodburn
 - Views to Richmond River
 - Canefields
 - Views to Langs Hill
 - Broadwater National Park

Visual/Urban Design

Section 1: Option 1A

Disadvantages/ Weaknesses

- Increases visual and physical severance of the Richmond River
- Proximity to Woodburn- potential noise and visual issues at Woodburn
- Exaggerates height of the river embankment from the river due to additional road embankments
- Does not correspond to landscape patterns – cuts through the middle of cane fields
- High visual impact as route is close to Woodburn and the Richmond River

Visual/Urban Design

Section 1: Option 1B

Advantages/ Strengths/ Opportunities

- Same as 1A except route passes east of Langs Hill
- Lower embankment heights than Option 1C – generally 4 metre plus
- Interesting and varied view experience includes:
 - Views to Woodburn
 - Views to Richmond River,
 - Canefields,
 - Views to Langs Hill
 - Broadwater National Park

Visual/Urban Design

Section 1: Option 1B

Disadvantages/ Weaknesses

- Exaggerates height of the river embankment from the river due to additional road embankments
- Increases visual and physical severance of the Richmond River although less than Option 1A
- Proximity to Woodburn- potential noise and visual issues
- Does not correspond to landscape patterns – cuts through the middle of cane fields
- Medium- high visual impact as route is close to Woodburn and the Richmond River – different from 1A as this route is east of Langs Hill

Visual/Urban Design

Section 1: Option 1C

Advantages/ Strengths/ Opportunities

- Follows junctions of landscape types
- Route is through the middle of pasturelands rather than cane fields
- Captures significant amounts of existing vegetation – woodland along edge of National Park
- Option is not located along the Richmond River edge therefore no severance issues
- Distant from Woodburn therefore less impact on amenity of the town
- Route traverses less sensitive landscape – mostly pasturelands

Visual/Urban Design

Section 1: Option 1C

Disadvantages/ Weaknesses

- Large embankment heights – significant amounts 6 metres plus
- Less varied and rich visual experience as there are no/ limited views to Woodburn or the Richmond River
- Visual impact is medium-high as although the magnitude of proposal is high, the spatial precinct sensitivity is low and there is less impact on Woodburn and the Richmond River

Visual/Urban Design

Section 2: Option 2A

Advantages/ Strengths/ Opportunities

- Generally follows the junctions of landscape types – edge of BN Park, edge of Blackwall Range
- Exceptional landscape and River crossings experience includes:
- Views to Rileys Hill
- Views to Richmond River,
- Canefields,
- Views to Alleys Hill
- Broadwater National Park edge
- Tuckean Broadwater
- Foothills of the Blackwall Mountain Range

Visual/Urban Design

Section 2: Option 2A

Disadvantages/ Weaknesses

- Varied embankment heights 2-6 metres
- Two river crossings with significant embankments on the Richmond River bridge approaches due to height clearance requirements
- Passes through single landscape types at River, Tuckean Broadwater
- Passes through middle of cane fields around Tuckean Broadwater and pasturelands in the foothills of the Blackwall Range
- Route is close to Rileys Hill community – potential visual and amenity issues

Visual/Urban Design

Section 2: Option 2A

Disadvantages/ Weaknesses (cont.)

- Close to Meridian Heights settlement in plan (although vertically distant)
- Route traverses existing fringe rural countryside
- Medium- high visual impact as the route passes through visually sensitive landscapes with embankments of significant height

Visual/Urban Design

Section 2: Option 2B

Advantages/ Strengths/ Opportunities

- Generally follows the junctions of landscape types – edge of BN Park, edge of Blackwall Range
- Reasonably distant from all towns and settlements
- Exceptional landscape and River crossings experience includes:
 - Views to Richmond River,
 - Canefields,
 - Views to Alleys Hill
 - Views to Sugar Mill
 - Tuckean Broadwater
 - Foothills of the Blackwall Mountain Range

Visual/Urban Design

Section 2: Option 2B

Disadvantages/ Weaknesses

- Varied embankment heights 2-6 metres
- Two river crossings with significant embankments on approaches to both bridges due to height clearance requirements
- Potential impacts on residences along Rileys Hill Road
- Medium visual impact – the route passes through visually sensitive landscape with embankments of medium height and avoids any major rural settlements
- Route traverses existing fringe rural countryside

Visual/Urban Design

Section 2: Option 2B

Disadvantages/ Weaknesses (cont.)

- Passes through middle of single landscape types at Richmond River, Tuckean Broadwater
- Passes through middle of cane fields around Tuckean Broadwater and pasturelands in the foothills of the Blackwall Range
- Close to Meridian Heights settlement in plan (although vertically distant)

Visual/Urban Design

Section 2: Option 2C

Advantages/ Strengths/ Opportunities

- Embankment heights generally less than 4 metres
- Long sections of the route closely follow junctions of landscape types – edge of BN Park, edge of Blackwall Range, edge of heathlands
- Substantial lengths of corridor adjacent or through existing vegetation
- Distant from Wardell township

Visual/Urban Design

Section 2: Option 2C

Advantages/ Strengths/ Opportunities (cont.)

- Potentially rich and varied experience includes:
 - Vista to Buckombil Mountain,
 - Views to Broadwater,
 - Views to Sugar Mill,
 - edge of heathland/ woodland
 - Foothills of the Blackwall Mountain Range
 - Views to Cooks Hill
 - Views to Laws Hill
- Opportunity to improve this route by taking the alignment to the east of Cooks Hill, avoiding Broadwater – potentially better visual and acoustic amenity for town

Visual/Urban Design

Section 2: Option 2C

Disadvantages/ Weaknesses

- Proximity to Broadwater – potential noise and visual issues (less of an issue if re-aligned east of Cooks Hill)
- Route traverses existing fringe rural countryside in the foothills of the Blackwall Range
- Passes through single landscape type – middle of cane fields around Cooks Hill/ Broadwater and pasturelands in the foothills of the Blackwall Range
- Close to Meridian Heights settlement in plan (although vertically distant)
- Medium visual impact – the route passes generally through medium sensitivity landscapes with embankments of medium height

Visual/Urban Design

Section 2: Option 2D

Advantages/ Strengths/ Opportunities

- Embankment heights generally less than 4 metres and in long continuous stretches
- Long sections of the route closely follow junctions of landscape types – edge of Broadwater National Park, edge of heathlands
- Substantial lengths of corridor adjacent or through existing vegetation
- One bridge crossing only

Visual/Urban Design

Section 2: Option 2D

Advantages/ Strengths/ Opportunities (cont.)

- Potentially varied experience includes:
 - Views to Broadwater and possibly Wardell,
 - Views to Sugar Mill,
 - Views to Wardell Bridge
 - edge of heathland/ woodland
 - Views to Cooks Hill
 - Views to Laws Hill

Visual/Urban Design

Section 2: Option 2D

Disadvantages/ Weaknesses

- Proximity to Broadwater and Wardell – potential noise and visual issues
- Medium visual impact – the route passes generally through medium sensitivity landscapes with embankments of medium height
- No visual experience of foothills of the Blackwall Mountain Range
- Clearance/severance of heathland west of Wardell

Visual/Urban Design

Section 2: Option 2D

Advantages/ Strengths/ Opportunities

- Similar to Option 2D – except route passes east of Cooks Hill
- Embankment heights generally less than 4 metres and in long continuous stretches – embankments are lower east of Cooks Hill than those west of Cooks Hill
- Long sections of the route closely follow junctions of landscape types – edge of Broadwater National Park, edge of heathlands
- Substantial lengths of corridor adjacent or through existing vegetation

Visual/Urban Design

Section 2: Option 2E

Advantages/ Strengths/ Opportunities (cont.)

- Separated from Broadwater township by Cooks Hill
- One bridge crossing only
- Potentially varied experience includes:
 - Views to Broadwater and possibly Wardell,
 - Views to Sugar Mill,
 - Views to Wardell Bridge
 - edge of heathland/ woodland
 - Views to Cooks Hill
 - Views to Laws Hill

Visual/Urban Design

Section 2: Option 2E

Disadvantages/ Weaknesses

- Proximity to Wardell – potential noise and visual issues
- Medium visual impact – the route passes generally through medium sensitivity landscapes with embankments of medium height
- No visual experience of Blackwall Mountain Range
- Clearance/severance of heathland west of Wardell

Visual/Urban Design

Section 2: Option 2F

Advantages/ Strengths/ Opportunities

- Does not impact ecologically sensitive heathland
- One bridge crossing only
- Reasonably varied experience includes:
 - Views to Broadwater and Wardell,
 - Views to Sugar Mill,
 - Views to Wardell Bridge
 - Views to Cooks Hill
 - Views to Laws Hill

Visual/Urban Design

Section 2: Option 2F

Disadvantages/ Weaknesses

- Major embankment heights throughout ranging from 4-8 metres
- Bridge crossing is longest in length – over 1 km and very high clearance requirements mean 6-8 metre approach embankments
- Little relationship to junctions of landscape types – the route cuts through the middle of cane fields particularly east of the Richmond River
- Little visual access to existing vegetation/ woodland – mostly views to cane fields

Visual/Urban Design

Section 2: Option 2F

Disadvantages/ Weaknesses (cont.)

- Route is close to both Wardell and Broadwater
- Increases visual and physical severance of the Richmond River north east of Broadwater
- High visual impact due to high magnitude of proposal
- Visual experience is okay but there are long stretches of cane fields and only distant views of the Blackwall Range

Visual/Urban Design

Section 3: Option 3A

Advantages/ Strengths/ Opportunities

- Follows junction of landscape types – foothills of Blackwall Mountain Range and cane field floodplain
- Captures stands of existing vegetation – edge of Blackwall Mountain Range
- Utilises existing highway as a potential service road
- Potentially rich and varied experience:
 - skirts edge of the Blackwall Mountain Range, is elevated and looks over the sugarcane valley floodplain
- Low visual impact as landscape less sensitive

Visual/Urban Design

Section 3: Option 3A

Disadvantages/ Weaknesses

- Embankment heights vary up to 6 metres
- Potential impact on rural residences located along the foothills of the Blackwall Mountain Range
- Route traverses existing fringe rural countryside in the foothills of the Blackwall Mountain Range

Visual/Urban Design

Section 3: Option 3B

Advantages/ Strengths/ Opportunities

- Embankment heights generally limited to 2 metres
- Utilises existing road corridor
- Low visual impact as utilises existing corridor and is less sensitive landscape – highly disturbed by agricultural and road activities

Visual/Urban Design

Section 3: Option 3B

Disadvantages/ Weaknesses

- Little relationship to junctions of landscape types – the route cuts through the middle of the cane fields
- Potential impact on rural residences along edge of existing highway particularly as there will be an increase in corridor footprint
- As the existing landscape character is through cane fields, more open views would more appropriate and therefore would mean less opportunity for screen planting of the highway
- Potentially less varied visual experience as the route is in the floodplain and through cane fields

Engineering (Flooding, Geotechnical)

Andrew Nathan

Robert Peterson

Peter Volk

Engineering

Andrew Nathan

Engineering

SECTION 1		
OPTION	ADVANTAGES	DISADVANTAGES
1A	▪ Lowest earthworks volumes	▪ Highest Acid Sulphate Soil risk (44% more PASS area) ▪ Equal longest length of bridges and viaducts (500m additional) ▪ Longest length over deep soft soils (200m additional) ▪ Highest impact on local traffic (4km of additional local roads to be constructed)
1B	▪ Lowest impact on local traffic	▪ Longest Option (5% longer) ▪ Equal longest length of bridges and viaducts (500m additional)
1C	▪ Lowest Acid Sulphate Soil risk ▪ Shortest option ▪ Shortest length of bridges and viaducts ▪ Shortest length over deep soft soils	▪ Highest earthworks volumes (10% additional volume)

Engineering

SECTION 2		
OPTION	ADVANTAGES	DISADVANTAGES
2A	▪ Lowest Acid Sulphate Soil risk	▪ Highest earthworks volumes (30% additional volume)
2B	▪ Shortest length over deep soft soils	
2C	▪ Shortest length of bridges and viaducts	▪ Longest Option (12% longer)
2D	▪ Shortest option	
2E(+2D)	▪ Lowest earthworks volumes ▪ Lowest impact on local traffic	
2F		▪ Highest Acid Sulphate Soil risk (200% more PASS area) ▪ Longest length over deep soft soils (7,300m additional) ▪ Longest length of bridges and viaducts (4,300m additional) ▪ Highest impact on local traffic (13km of additional local roads to be constructed)

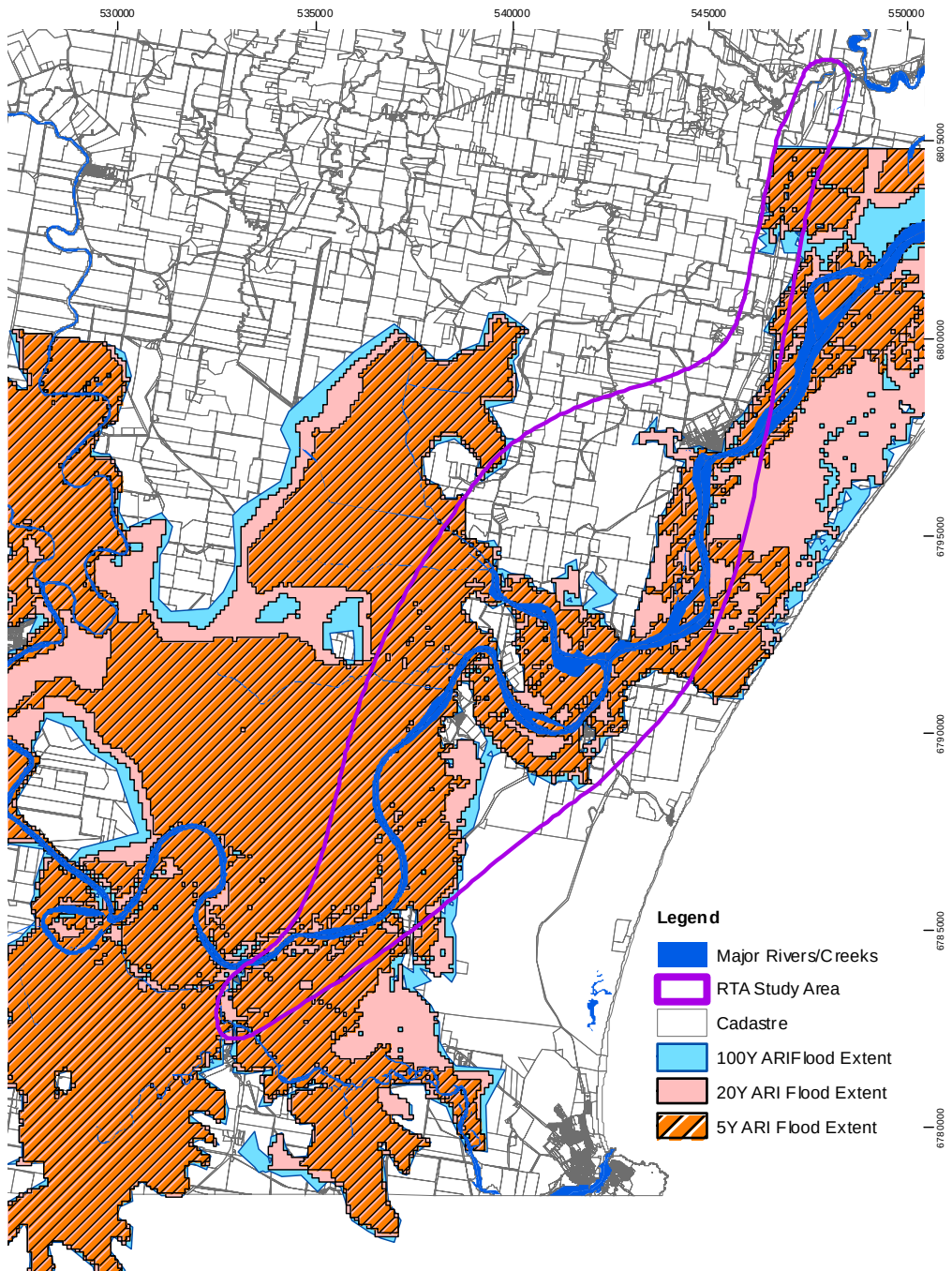
Engineering

SECTION 3		
OPTION	ADVANTAGES	DISADVANTAGES
3A	▪ Lowest earthworks volumes ▪ Equally Low Acid Sulphate Soil risk ▪ No major bridges/viaducts ▪ Shortest length over deep soft soils	▪ Highest impact on local traffic (8km of additional local roads to be constructed) ▪ Longest Option (6% longer)
3B	▪ Lowest impact on local traffic ▪ Equally Low Acid Sulphate Soil risk ▪ Shortest option ▪ No major bridges/viaducts	▪ Highest earthworks volumes (55% additional volume) ▪ Longest length over deep soft soils (1600m additional)

Flooding

Robert Peterson

Flood Extents



Flood Management Objectives

Afflux:

- Limit the rise in water level upstream of a hydraulic structure (levee, culvert, bridge, etc.)
- Restricted to 50mm max in the 100 year ARI event.

Duration:

- Limit effects on flood inundation times across the flood plain
- Generally managed when limiting effects on flood levels

Direction:

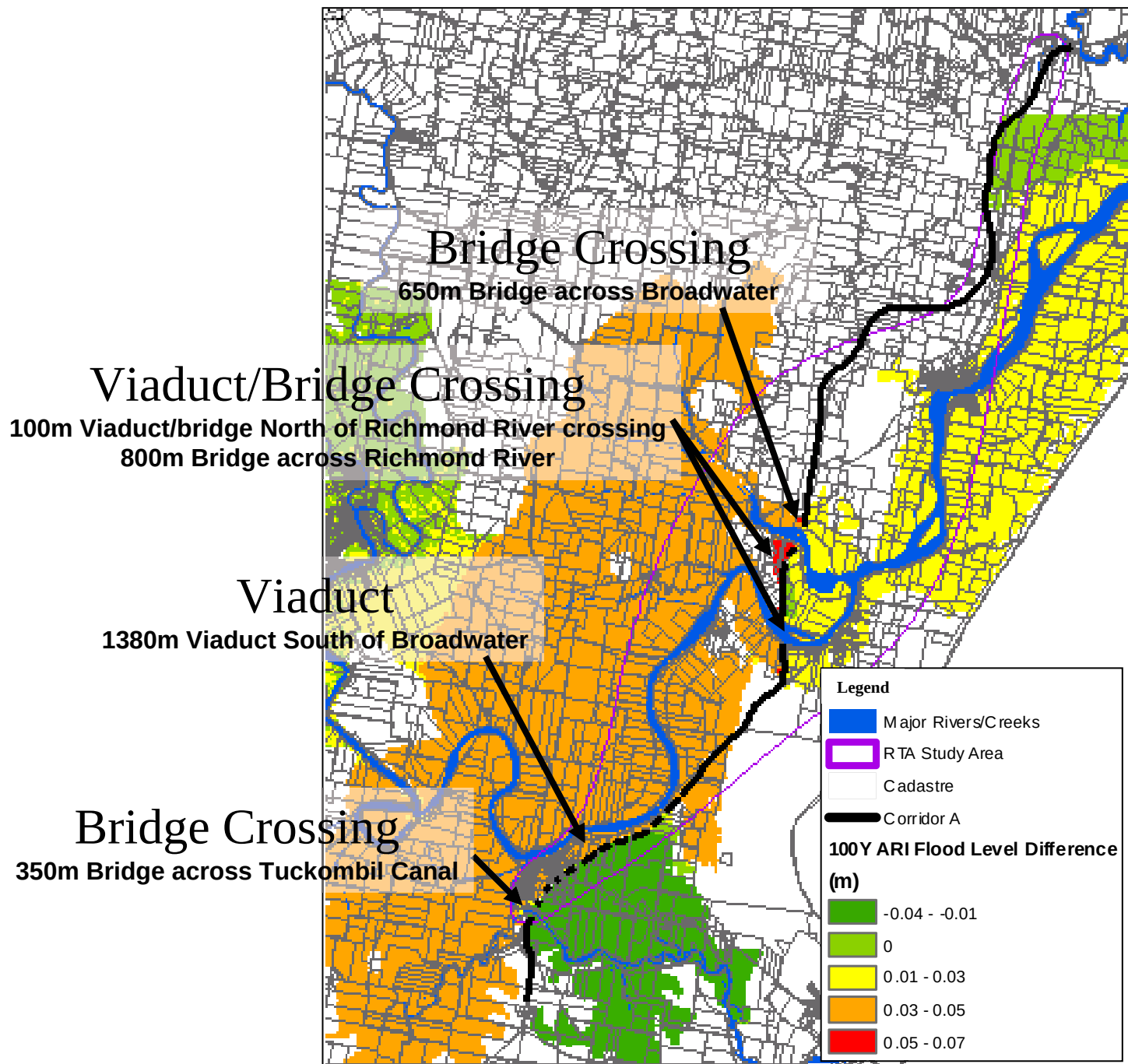
- Limit major changes in direction of flow across the flood plain, particular in areas East of Woodburn/Evans River

Flood Hazard:

- No change in flood hazard classification in developed areas

Corridor A (1A-2B-3A)

1 in 100 year ARI Stormwater Management Works



Advantages & Disadvantages

Section 1

Option	Comments
1A	•Most flood mitigation required •Longest length of bridge / viaduct •Close to the river •High impact on local flows
1B	•Flood mitigation required (less impact than 1A) •Longest length of bridge / viaduct •Close to the river •High impact on local flows
1C	•Least flood Mitigation required •Shortest length of bridge / viaduct •Away from river •Medium impact on local flows

Advantages & Disadvantages

Section 2

Option	Comments
2A	•Flood mitigation required •2 bridges over river •High impact on local flows
2B	•Flood mitigation required •2 bridges over river •Medium impact on local flows
2C	•Least flood Mitigation required •Shortest length of bridge / viaduct •Low impact on local flows
2D	•Flood Mitigation required •Shortest length of bridge / viaduct •Low impact on local flows
2E	•Flood Mitigation required •Shortest length of bridge / viaduct •Low impact on local flows
2F	•Most flood Mitigation required •Longest length of bridge / viaduct •Close to river •Low impact on local flows due to amount of viaduct

Advantages & Disadvantages

Section 3

Option	Comments
3A	•Minimal flood mitigation required •High impact on local flows
3B	•Flood mitigation required •Low impact on local flows

Geotechnical

Peter Volk

Geotechnical Investigations

- Assessment of available data
- Boreholes, testpits and cone penetrometer tests
- Limited laboratory testing of soils

Principal Geotechnical Constraints

- Depth of soft soils / cost implications for foundation treatments
- Depth of rock (implications for piling depths for bridges)
- Material Sources (road cuts and quarries)

Geotechnical – Section 1

Route Option	Advantages	Disadvantages
1A	• Potential for sourcing of materials from cutting in Lang Hill.	• 2km of soft clay (5-15m)
1B	• Potential for sourcing of materials from cutting.	• 1.9km of soft clay (5-15m)
1C	• Potential for sourcing of materials from cutting.	• 1.9m of soft clay (5-15m)

Geotechnical – Section 2

Route Option	Advantages	Disadvantages
2A	• Bridge over Richmond R. near Rileys Hill - shallow piling depths of 0-13m. • Bridge over Tuckean Broadwater with shallow piling depths of 1-8.5m.	• 0.55km of soft clay (5 –15m)
2B	• Road materials sourced from two large cuts between Nodes EJ.	• 0.25km of soft clay (5-15m) • Bridges over Richmond River and Tuckean Broadwater with piling depths of 22-29m.
2C	• One bridge crossing of Richmond River with piling depths of 25-35m. • Road materials sourced from long cut between Nodes GK.	• 0.6km of soft clay (15-25m)
2D	• One bridge crossing of Richmond River with piling depths of 25-35m.	• 0.75km of soft clay (15-25m)
2E	• One bridge crossing of Richmond River with piling depths of 25-35m. • Potential for sourcing materials from road cuts.	• 0.8km of soft clay (15-25m)
2F	• One bridge crossing of Richmond River with piling depths of at least 30m.	• 7.6km of soft clay (15-25m).

Geotechnical – Section 3

Route Option	Advantages	Disadvantages
3A	• Minor cuts may supply some fill materials.	• 3.4km of soft clay (5-10m)
3B	• Deletion of stabilising berm from one side of road, hence less foundation treatment and material	• 5km of soft clay (5-10m) • Total & differential settlement of existing road due to new embankment

Environment (Ecology, Water Quality)

Annette Ross

Environment – Planning and Zoning

- The implications of planned amendments to the *Environmental Planning & Assessment Act 1979* for the Woodburn to Ballina project are currently being reviewed by the RTA.

Environment – Planning and Zoning

Option	Advantages	Disadvantages
Section 1:		
Option 1A	Roads not prohibited.	Could affect Broadwater National Park.
Option 1B	Roads not prohibited.	Could affect Broadwater National Park.
Option 1C	Roads not prohibited.	Could affect Broadwater National Park.
Section 2:		
Option 2A	Roads are not prohibited in most of this option.	•Affects SEPP14 coastal wetland •Zoning prohibits roads in this SEPP14 area.
Option 2B	Roads are not prohibited in this option.	Affects SEPP14 coastal wetland

Environment – Planning and Zoning

Option	Advantages	Disadvantages
Option 2C	Roads are not prohibited in this option.	
Option 2D	Roads are not prohibited in this option.	
Option 2E	Roads are prohibited in parts of this option.	Roads prohibited through the 1e Rural (extractive & mineral resources) zoning.
Option 2F	Roads are not prohibited in this option.	
Section 3:		
Options 3A and 3B	No option has advantages over the other	

Environment - Ecology

A number of the route options could pose the potential for significant species, endangered populations and Endangered Ecological Communities.

Option	Advantages	Disadvantages
Section 1:		
Option 1A	Primarily traverses cleared land. Lower impact on Endangered Ecological Communities (EECs) (25.55ha) in comparison to 1B and 1C.	Could create a barrier to fauna movement and some loss of habitat for threatened flora and fauna species.
Option 1B	Primarily traverses cleared land.	Impacts on 38.54ha of EEC. Could create a barrier to fauna movement and some loss of habitat for threatened flora and fauna species.
Option 1C	Primarily traverses cleared land.	As above but traverses a greater area of EEC than Option 1A and 1B (84.67ha).

Environment - Ecology

Option	Advantages	Disadvantages
Section 2:		
Option 2A		Large EEC impact (128.86ha). Large impact on threatened species.
Option 2B		Large impact on EECs (109.95ha). Large impact on threatened species.
Option 2C	Traverses primarily cleared land north of Broadwater National Park until it crosses Richmond River.	Highest impact on EECs (146.19ha). Large impact on threatened species.
Option 2D	Traverses the edge of Wardell Heath parallel to Back Channel Road.	Impact on EECs (106.36ha). Impact on threatened species. Potential impact on hydrological regime.
Option 2E		Impact on EECs (99.48ha). Impact on threatened species. Potential impact on hydrological regime.
Option 2F	Generally poses the lowest potential for ecological impact in Section 2.	Impacts on EECs (41.61ha)

Environment - Ecology

Option	Advantages	Disadvantages
Section 3:		
Option 3A		Highest EEC impacts in Section 3 (42.83ha)
Option 3B	Generally poses the lowest potential for ecological impact in Section 3.	Impacts on EECs (22.07ha).

Environment - Water Quality

- Historical water quality data shows that the main issues of concern within the study area are a very low pH and dissolved oxygen levels, with turbidity levels also being elevated at a number of sites.
- Water testing commenced in June 2005 in accordance with the Hyder's Water Quality Monitoring Plan.
- Fourteen surface water quality monitoring sites were selected upstream and downstream of the seven locations where the route options cross significant watercourses. A further two sites were sampled upstream of the study area to characterise upstream water quality.
- No advantages or disadvantages between options can be determined from the water quality monitoring at this stage. However it is considered that the number of water crossings would increase the potential to cause water quality impacts.

Heritage (Aboriginal, Non-Aboriginal)

Annette Ross

Heritage - Aboriginal

Option	Advantages	Disadvantages
Section 1:		
Option 1A	All options disturbed by land clearing, grazing and farming	Reported massacre site at Woodburn
Option 1B	As above	Reported massacre site at Woodburn
Option 1C	As above	Reported massacre site at Woodburn
Section 2:		
Option 2A	Extensively disturbed by vegetation clearing, farming and grazing. Archaeological resource is unlikely to be substantial.	3 possible scarred trees affected by Options 2A and 2B on a valley flat.
Option 2B	Extensively disturbed by vegetation clearing, farming and grazing. Archaeological resource is unlikely to be substantial.	As above Potential for subsurface evidence of Aboriginal occupation on the sand rise between Tuckean Broadwater and Old Bagotville Road.

Heritage - Aboriginal

Option	Advantages	Disadvantages
Option 2C	Extensively disturbed by vegetation clearing, farming, quarrying and grazing.	Mythological/sacred site situated on the Richmond River bed. Group of four scarred trees north of Back Channel Road, Bagotville.
Option 2D		Traverses culturally sensitive coastal barrier landscapes. Reported Aboriginal burials in the sand plain near Wardell. Historic/contemporary Aboriginal campsite south of Bingal Creek.
Option 2E		2 culturally significant sites with a high level of Aboriginal heritage sensitivity.
Option 2F	No permanent Aboriginal constraints identified.	

Heritage - Aboriginal

Option	Advantages	Disadvantages
Section 3:		
Option 3A	Not considered to have any substantial archaeological potential.	
Option 3B	Not considered to have any substantial archaeological potential.	

Heritage – Non-Aboriginal

Option	Advantages	Disadvantages
Section 1:		
Option 1A	No items as having either local or State heritage significance.	Archaeological potential - Langs Brick Quarry at Langs Hill. Tuckombil Canal Other items: Drainage canals Early stock route
Option 1B	No items as having either local or State heritage significance.	Archaeological potential - Langs Brick Quarry at Langs Hill Tuckombil Canal Other items: Drainage canals Early stock route
Option 1C	No items as having either local or State heritage significance.	Archaeological potential - Langs Brick Quarry at Langs Hill Tuckombil Canal

Heritage – Non-Aboriginal

Option	Advantages	Disadvantages
Section 2:		
Option 2A	No items listed on either a LEP or State Heritage Register.	Number of items tentatively identified as having local heritage significance.
Option 2B	No items identified as having either local or State heritage significance.	Option passes close to a listed item on the WCBHS, the former Bagotville Post Office.
Option 2C		Possible cemetery site north of the property 'Heathvale'.
		There are a number of heritage sites of local and of Commonwealth significance (Broadwater Catholic Church) near the option. The potential for unknown heritage sites of heritage significance is likely to be high, particularly in the vicinity of the Byrne property.
Option 2D	No items of local or State heritage significance.	Possible cemetery site north of the property 'Heathvale' and the option is close to the Wardell Cemetery. The potential for unknown heritage sites of heritage significance is likely to be high, particularly in the vicinity of the Byrne property. The former Meerschaum Vale brickworks has been included in the WCBHS and has been assessed of being of local significance.

Heritage – Non-Aboriginal

Option	Advantages	Disadvantages
Option 2E	No items of local or State heritage significance.	Possible cemetery site north of the property 'Heathvale'. Modified or artificial drainage channels, mill site, moveable items associated with sand mining operations near Cooks Hill, Wardell Recreation Grounds, Wardell Cemetery, and extant tramways associated with sugar cane haulage.
Option 2F	No items of local or State heritage significance.	Possible cemetery site north of the property 'Heathvale'. Modified or artificial drainage lines, a mill site constructed by the Bagot brothers, moveable items associated with sand mining in the quarry near Cooks Hill, and tramlines associated with sugar cane haulage.
Section 3:		
Option 3A	No items of local or State heritage significance.	
Option 3B	No items of local or State heritage significance.	

Noise, Social and Economic Impacts

Matt Sugden

Carolyn Stone

Mike Butler

Noise Impacts

Matt Sugden

Noise Assessment – General Considerations

Traffic noise impact assessment based upon:

- Noise survey findings
- Predicted traffic volumes for 2015 (designated opening year for study purposes only) and 2035
- Concrete road surface
- 110 kph posted speed limit
- No noise mitigation

Assessments consider all dwellings within 300m of corridor. At greater distances, noise levels are normally within EPA criteria and other noise sources become significant.

Summary of Findings:

Short-List Corridors

Excepting option 3B, all options will offer beneficial noise impact for the community in general when considered against the 'do-nothing' scenario.

Noise impact due to change in noise level during year of opening is generally worse. Over time, the community would become acclimatised to some extent, with the noise impact reducing.

'Hotspots' exist at Broadwater, north-west Wardell and Pimlico, where higher population density exists close to corridor option.

Section	Option	No. dwellings within 300m of corridor
1	1C	5
	1A	57
2	2D	176
	2B	57
3	3A	10
	3B	16

Noise Impact Findings – Section 1

Option	Advantages	Disadvantages
1A	• Northern section follows existing highway – affected dwellings already have traffic noise exposure • Potential for localised noise barrier to partially mitigate noise at Woodburn	• Noise impact on Woodburn sports fields • Route passes close to densely populated area
1B	As above	As above
1C	• Avoids densely populated areas • Northern section follows existing highway – affected dwellings already have traffic noise exposure • Fewer than ten dwellings will require mitigation	-

Noise Impact Findings – Section 2

Option	Advantages	Disadvantages
2A	Avoids densely populated areas	Introduces traffic noise to previously unaffected areas, including Rileys Hill
2B	Avoids densely populated areas	Introduces traffic noise to previously unaffected areas
2C	- Almost half of assessed noise impact occurs within Broadwater - community already having some traffic noise exposure - Potential for localised noise barrier to partially mitigate noise	- Route passes close to densely populated area - Introduces traffic noise to previously unaffected areas
2D	- Almost half of assessed noise impact occurs within communities already having some traffic noise exposure - Potential for localised noise barrier to partially mitigate noise	- Route passes close to two densely populated areas - More than 150 dwellings potentially requiring mitigation - Noise impact on Wardell sports ground
2E	- Some of assessed noise impact within community already having some traffic noise exposure - Potential for localised noise barrier to partially mitigate noise	- Route passes close to densely populated area - Noise impact on Wardell sports ground
2F	- Most noise impact within community already having traffic noise exposure - Potential for localised noise barriers to partially mitigate noise	- Route passes close to densely populated areas - Noise impact on caravan park

Noise Impact Findings – Section 3

Option	Advantages	Disadvantages
3A	• Avoids densely populated areas	-
3B	• Avoids densely populated areas • Follows route of existing highway – affected community already has traffic noise exposure	-

Social Impacts

Carolyn Stone

Socio-Economic Impacts

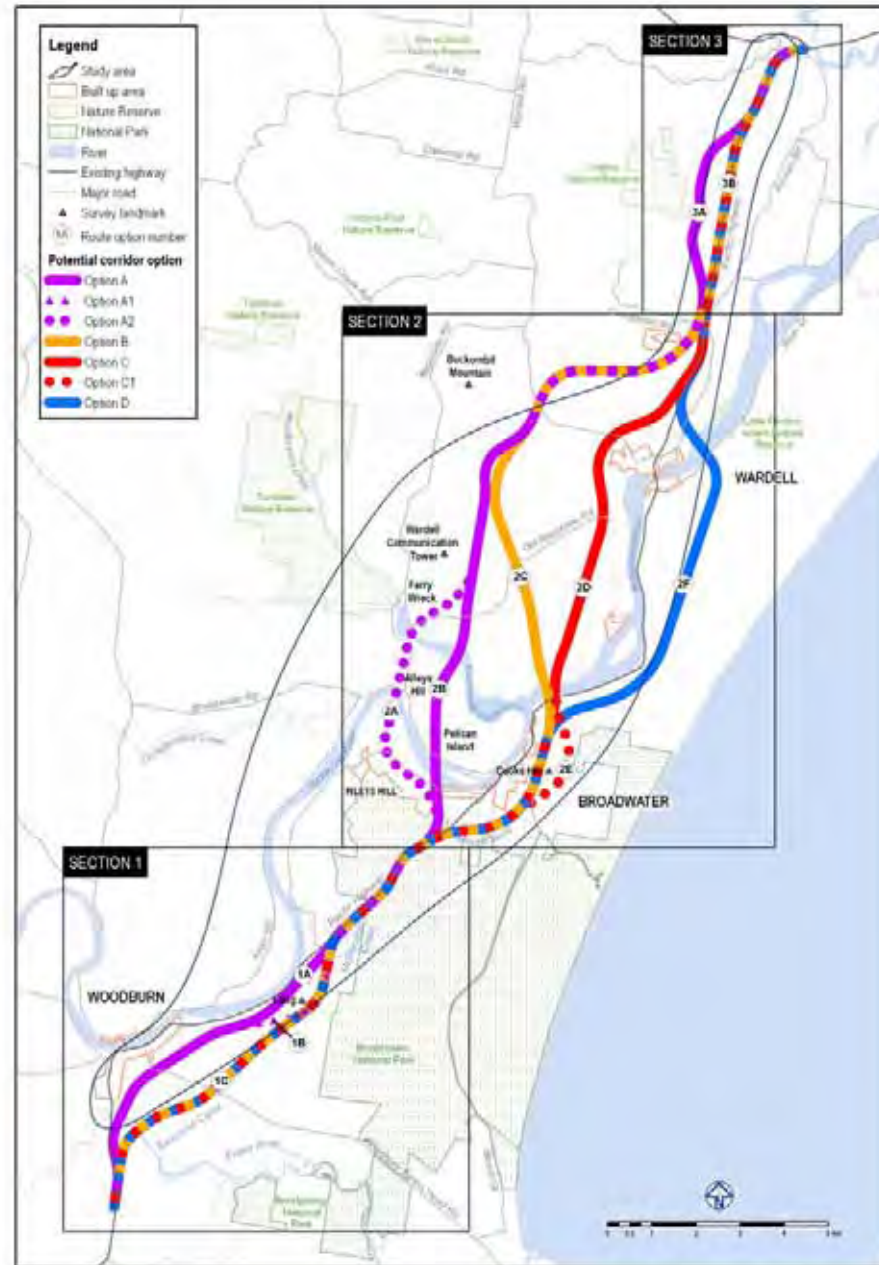
Mike Butler

Socio-Economic Impacts

- Six key impacts - Quantified
 - RUCBA
 - Agriculture
 - Amenity (Urban)
 - Business Impacts
 - Ecology
 - Rec. & Tourism

Socio-Economic Impacts

Assumed Corridors



Road User Cost Benefit Analysis (RUCBA)

- Costs (Construction & Maintenance)
- Benefits
 - Travel Time
 - Accident Costs
 - VOCs
- Key Drivers
 - Costs – Length & Terrain
 - Benefits – Distance & Speed

→ Length and Terrain

Agriculture

- Focus on productive capacity, transportation, drainage
- Sugar Cane
 - Land most productive
 - Most disruptive
- Grazing / Timber
 - Lower value
- Number of buildings affected
- Rural residential blocks (direct impact)

Agriculture... cont.

Section	Strength	Weakness
1	• Agricultural Value – reduced Sugar Cane 1C	• Agricultural Value – Sugar Cane 1A/1B
2	• Agricultural Value – Grazing & Forests 2C – Edge Cane 2D • Rural Residential – less for 2B/2C	• Agricultural Value – Large Areas of Grazing / Impact upon Sugar Cane (2A, 2B, 2F)
3	• 3A – reduced disruption to sugar cane network < disruption drainage and production	• 3B – Greater impact on Sugar Cane land & Rural Residential • 3A – impacted dwellings

Amenity - Urban

- Relative position of the road alignment to urban centers (townships)
- Greater relative value if further away
- All - improved to existing
- Focus on urban impacts (general)

Amenity (Urban)

- Relative position of the road alignment to urban centers (townships)
- Greater relative value if further away
- All - improved to existing
- Focus on urban impacts (general)

Section	Strength	Weakness
1	• Distance from Woodburn (1C)	
2	• 2B – avoids Broadwater, Woodburn and further from Rileys Hill • 2C – avoids Wardell	
3		• 3B – Closer to rural residential blocks (North Wardell)

Business Impacts

- Measure Short and Long Term Impacts
- Key - Townships to attract visitors
- Destination not Stopover
- Short Term – favor existing businesses (Woodburn)
- Long Term – development of individual character
- Longer term benefits > short term costs

Business Impacts

- Measure Short and Long Term Impacts
- Key - Townships to attract visitors
- Destination not Stopover
- Short Term – favor existing businesses (Woodburn)
- Long Term – development of individual character
- Longer term benefits > short term costs

	Strengths	Weaknesses
Short Term	• Central Corridors	• Western Corridors
Long Term	• Western Corridors	• Central / Eastern Corridors

Ecological Impacts

- Measured / Quantified
 - Native Vegetation
 - Wetlands
 - National Parks
- Valued based on area of natural environment impacted
- Willingness to pay for preservation

Broad Comment

Strengths	Weaknesses
• Corridor D – reduced areas of impacted environment	• Corridor A2 - SEPP 14 • Corridor C & C1 - Veg Class 4 • Corridor A/A1/A2 - Veg Class 3

Recreation & Tourism

- Affects driven by local attractions
- Focus on river and river related activities (local council initiative)
- Favors routes away from river/townships

Section	Strengths	Weaknesses
1	• Further from townships (1C)	
2	• Avoids Wardell (2A, 2B, 2C)	• Wardell – high bridge/fishing (2F) • Pimlico Road – Cycling (2F)
3	na	na

Socio-Economic Impacts

- Benefit Cost Ratio / NPV
 - Relative standing
 - Quantifiable
 - Value for Money

Socio-Economic Impacts

- Benefit Cost Ratio / NPV
 - Relative standing
 - Quantifiable
 - Value for Money

Strengths	Weaknesses
• Central Corridors	• Eastern Corridor • Western Corridor

Socio-Economic Impacts

- BCR/NPV
- Quantified Costs & Benefits
- Trade-off between quantifiable and non quantifiable

Appendix 6. Presentation on Feedback from the Corridor Options Display

Feedback from the display period

Annette Ross

Feedback from the display period

- Written Submissions and Feedback Forms
- 189 written submissions have been received from 154 individuals and organisations.
- 380 Feedback Forms were received.
- Written submissions do not include the Feedback Forms.
- Authors of submissions generally live or own property within or adjacent to the study area.

Data Management

- Each Submission and Feedback Form received a unique identification number.
- All Submissions and Feedback Forms were scanned and entered into a database.
- The database has the capacity to generate a number of reports to interrogate the data.
- Issues raised in Submissions were identified in categories.
- Responses are being prepared to the issues and entered into the database.
- A Submissions Report is currently being prepared. (See the Macksville to Urunga Submissions Report on the RTA's website.)

Landowners Issues

Landowner Issues Register

Search

Add new landowner

Hyder REF No

Geolink ID No

DB ID

First name

Surname

Full Name

Route Affected Landowner

ADDRESS

Impacted properties

Route Option (s)

Interview

Phone

Mobile

Fax

Email

22 Old Beggotville Road Wardell 2477

5552179

0413 974 869

jb@yahoo.com.au

Add team member

Add issue summary

Add project group

Back to startup page

All Written submissions

Count of issues in written submissions

Late submission notification

Outstanding actions

issues_subform_from_qry

	DB_ID	issue_id	date	source	Issue	issue_sum	response	
▶	984	2173	20/06/2005	Written Submission	Dear Sir I am writing to express my objection to the proposed highway route 2A and 2B for the following reasons: 1□The impact on the habitat of waterbirds and their breeding areas on and around Tuckean Broadwater. 2□Destructions of mangroves on the riverbanks, due to bridge	Environment Concerns		
✱	984	(AutoNumber)						

Community Feedback

Community feedback forms

Add issue summary

Hyder REF No:
 Geolink ID No:
 DB ID: 715

ADDRESS: 230 Stibbert Ln Dungenbee NSW 2408
 Impacted properties:
 Route Option (s):
 Interview:
 Phone:
 Mobile:
 Fax:
 Email:

First name: **Anderson Family**
 Surname: **Anderson Family**
 Full Name: Anderson Family
 Route Affected Landowner:

Section 1 Preference Count:
 Section 2 Preference Count:
 Section 3 Preference Count:
 Section 1 Issue:
 Section 2 Issue:
 Section 3 Issue:

Section 1 Preferences and Reasons:
 Section 2 Preferences and Reasons:
 Section 3 Preferences and Reasons:

DB ID: 715
 Construction Cost: 2
 Construction Impact: 1
 Impact on Business: 3
 Impact on Environment: 1
 Impact on Heritage areas: 1
 Impact on Agricultural Activity: 2
 Impact on Properties: 2
 Impact on Traffic to Towns when complete: 1
 Improvements to Road Safety: 1
 Local Flooding Issues: 2
 Loss of Views: 2
 Maintains or Improves Access to Surrounding Areas: 1
 Travel Times on Pacific Highway: 2
 Land Use: 1 The study area and districts

Section 1 preference: 1C
 Section 2 preference: 2D
 Section 3 preference: 3B

DB ID	Issue ID	Section 1 Reason	Section 1 Sum	Section 2 Reason
715	521	Least number of affected private property. Shortest route length (km). Low construction impact. Adequate distance from residential areas. I see 1C as the only beneficial route.	Property - Impact	Least waterways to cross. Most direct route. Minimal environmental impact. Minimal potential noise impact.
715	522	see issue 521	Route Length Comment	see issue 521
715	523	see issue 521	Construction - Impact	see issue 521

A count of issues raised

- Environment
- Property
- Traffic Noise
- Flooding and drainage
- Lifestyle of local residents
- Agricultural land
- Air quality
- Business

Snapshot of Issues Raised

- Route Options Development Process
- How were options chosen?
- Dissatisfaction/disappointment with routes selection.
- Role of the CLG in formulating options.
- Options are different to ones nominated by CLG members.

Issues: Concept Design

- Height of the new highway will dam water, making part of the farm unusable for farming
- Number of river crossings
- Length of bridges
- Bridge foundations in soft soils
- Disturbance of soft soils and acid sulfate soils during construction
- Location of access roads and additional impacts on residences and residential areas
- Heavy fogs occur from early evening to mid-morning creating a traffic hazard.
- Amount of fill required to build a flood-free highway.
- Alternative routes suggested

Issues: Environmental

- Tuckean Swamp is a major contributor to the acidification of the Richmond River
- Remnant Melaleuca and Casuarina habitat on the northern side of Tuckean Broadwater is of high conservation value and of regional significance
- Acoustic impacts along the Blackwall Range from an 'amphitheatre' effect which will amplify traffic noise
- Encroachment of a new road into Broadwater National Park
- Impact on wildlife corridors
- Impact on fisheries
- Number of endangered and vulnerable species of flora and fauna, especially koalas
- Cumulative effects of particulates in the air from increased traffic together with emissions from the sugar mill
- Insufficient ecological studies for Option 3A
- Area supports the highest density of threatened species habitats and Endangered Ecological Communities and nationally significant native vegetation.

Issues: Planning & Zoning

- Town expansion opportunities in Wardell
- New highway will encourage rapid urbanization, land subdivision and loss of rural properties
- Ballina Council's rezoning proposal near Blackwall Range

Issues: Property

- Impact on farming operations and the movement of stock and machinery
- Access to separated sections of a farm
- Impact on traditionally owned land
- Acquisition and compensation
- RTA's policies and procedures relating to property acquisition and compulsory acquisition

Issues: Hydrology/ Hydraulics

- Extent of flooding and flood levels experienced over various flood events
- Prolonged property inundation during floods with a new highway
- Route option will affect known flooding regimes

Issues: Socio-economic

- Impact on small farms will render them unsustainable and economically unviable
- Opportunities to expand residential component of the Sandalwood Caravan and Leisure Park would be inhibited and lack of growth would have an adverse effect on existing service providers in Wardell
- Access to existing bus services
- Social disruption of a new road in a previously quiet rural residential area
- Cost of the highway vis a vis bus and train
- There are more issues going through farmland and close proximity to local towns than going through Broadwater National Park.
- Maintaining country lifestyles
- Area of cane land affected
- Cane harvesting and transport
- Expansion of production at Broadwater mill and new business opportunities
- Effect on quality of life through increased noise and traffic
- Displacement of families

Issues: Heritage

- Heritage sites of interest to Aborigines not identified
- River crossings could affect sacred sites and the spirits and souls of people

Issues: Consultation Process

- Details on the brochure did not include cadastral or topographic information
- Rushed decision is politically motivated
- Landowners were never consulted when the route options became a big issue
- Information on the internet was not up-to-date and scant
- Not enough time to consider the options

Options – opinions and preferences

- Submissions that mentioned preferences or opposition to options mainly addressed options in Section 2.
- Improve rail infrastructure to reduce energy depletion
- Provide fast, long distance freight transport instead of a new road

Feedback Forms

- 380 Feedback Forms have been received. Respondents were requested to provide feedback on the importance of identified issues in Section 1, Section 2 and Section 3. Many respondents did not indicate a preference or provide feedback on the importance of the issues.
- Respondents indicated preferences as follows:
- Section 1 – 1C, 1A and 1B (223 respondents did not identify a preference) on the basis of low level of impact on high value habitat areas, meets construction criteria, least impact on residential areas and high value agricultural land.
- Section 2 – 2F, 2E and 2B, 2D, 2A, 2C for environmental reasons – habitat value, traffic noise, no resumption of private residences.
- Section 3 – 3B (preferred by 226 respondents) makes use of existing highway corridor, no encroachment into rural areas, less wildlife affected.

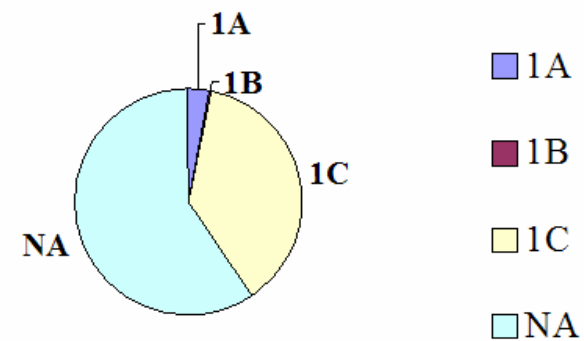
FEEDBACK FORM REPORT

Section 1

Option Preferences as of 20 July 2005

Route Option	Number in favour
1A	11
1B	2
1C	139
NA	224

Section 1 Community Preferences



NA=No Answer

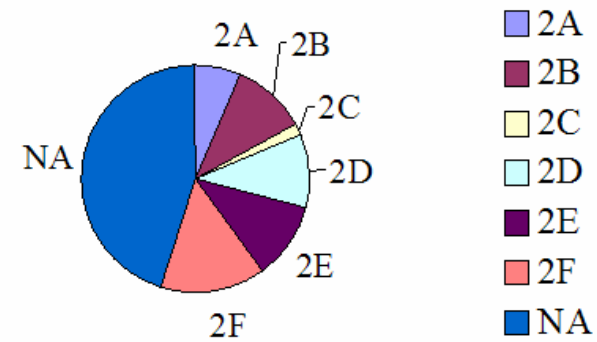
FEEDBACK FORM REPORT

Section 2

Option Preferences as of 20 July 2005

Route Option	Number in favour
2A	25
2B	40
2C	6
2D	39
2E	40
2F	56
NA	170

Section 2 Community Preferences



NA=No Answer

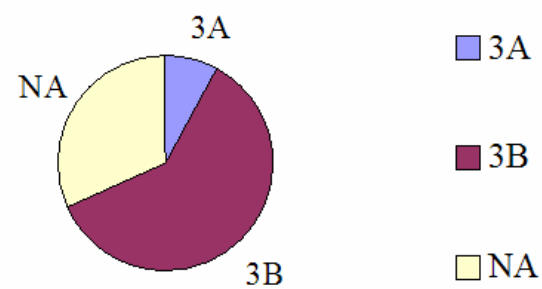
FEEDBACK FORM REPORT

Section 3

Option Preferences as of 20 July 2005

Route Option	Number in favour
3A	30
3B	228
NA	120

Section 3 Community Preferences



NA=No Answer

Appendix C

Assessment of short list of options

Short list options plus modified routes performance table

(Note: Performance measures related to area are based upon the project ‘footprint’, which is less than the corridor width. The footprint assessed for all options excludes interchanges, local road crossings and rest areas.)

	Assessment Criteria	Measure	Option 1A	Option 1B	Option 1C	Option 1C modified	Option 2A	Option 2B	Option 2C	Option 2C modified	Option 2D	Option 2E	Option 2F	Option 3A	Option 3B	Best Performer
Project Objective 1: Efficiency of travel, safety and accessibility	Quantitative Measures															
	Travel time.	Minutes	6.2	6.4	6.1	6.3	9	8.5	9.2	9.7	8.2	8.5	8.6	3.9	3.7	1C 2D 3B
	Vehicle operating costs	Corridors assessment, see below														
	Accident costs.	Corridors assessment, see below														
	Mitigation measures (crash barriers length).	Metres	12291	10771	6000	6000	4760	6520	4280	4280	4880	4916	18278	0	0	1C/1Cmod 2C/2Cmod 3A/3B
	Local motorway access.	Metres	2200	2200	2450	2450	7360	7360	1260	1260	1260	1560	6500	7360	9650	1A/1B 2C-D 3A
	Changes to local traffic movements and access.	Metres	10946	6857	8709	1340	8923	11901	6326	9226	9084	4555	18204	7864	0	1C mod 2E 3B

Project Objective 2:

Provide a flowing road alignment responsive to and integrated with the landscape; optimising views, elegant design and planting opportunities

Qualitative Indicators:

✓✓✓✓ Very High

✓✓✓ High

✓✓ Medium

✓ Low

Assessment Criteria	Measure	Option 1A	Option 1B	Option 1C	Option 1C modified	Option 2A	Option 2B	Option 2C	Option 2C modified	Option 2D	Option 2E	Option 2F	Option 3A	Option 3B	Best Performer
Quantitative Measures															
Road responds to the topography.	Av. height of embankments (cuts and fills)- larger height embankments will rate more poorly	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓✓	✓✓✓✓	✓✓✓	✓✓✓✓	✓	✓✓✓	✓✓✓✓	1A/1B/ 1Cmod 2E 3B
Corridor alignment responds to existing landscape patterns.	Location of corridor along junctions of landscape - larger lengths of junction will rate higher	✓✓	✓✓	✓✓✓	✓✓✓✓	✓✓✓	✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓	✓✓✓	✓✓	1C mod 2C-E 3A
Maximise potential to have visual access to existing mature native vegetation as part of route landscape experience.	Options which have a greater length of corridor adjacent/ through existing woodland or heathland will rate higher	✓✓	✓✓	✓✓✓✓	✓✓✓✓	✓✓✓	✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓	✓✓✓	✓✓	1C/1Cmod 2C-E 3A
Minimise adverse perceived impacts of road on towns.	The distance of an option from the towns or settlements- the closer an option the poorer the rating	✓	✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓✓	✓✓	✓✓✓	✓	✓✓	✓	✓✓✓✓	✓✓✓✓	1C/1Cmod 2B 3A/3B
Minimise visual impact of road on context.	Measured by the scale of the proposal in relation to the sensitivity of the context- a higher visual impact will rate more poorly	✓	✓✓	✓✓✓	✓✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓✓	✓✓✓	✓✓✓✓	✓	✓✓✓	✓✓✓✓	1Cmod 2Cmod/2E 3B
Maximise the richness of the highway experience.	Interesting and more varied views will rate more highly cultural, natural and topographic landmarks	✓✓✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	1A 2C/2Cmod 3A

Project Objective 4:

Identify and enhance potential beneficial environmental effects, and mitigate potential adverse environmental effects

Assessment Criteria	Measure	Option 1A	Option 1B	Option 1C	Option 1C modified	Option 2A	Option 2B	Option 2C	Option 2C modified	Option 2D	Option 2E	Option 2F	Option 3A	Option 3B	Best Performer
Quantitative Measures															
<i>Conserve biological diversity and ecological integrity/function.</i>															
Number of threatened species known or likely to occur within the corridor.	Number	66	66	74	74	85	85	85	85	78	78	66	61	61	1A/1B 2F 3A/3B
Extent of Endangered Ecological Communities impacted	Hectares	5.30	8.24	18.82	22.47	23.85	22.72	24.80	17.14	9.34	11.20	6.70	12.56	12.36	1A 2F 3B
Extent of National Park estate impacted	Hectares	3.71	3.71	3.79	0	4.49	4.29	3.74	0	3.74	3.74	3.78	0	0	1Cmod 2Cmod 3A/3B
<i>Minimise noise impact on the local community</i>															
Community noise burden – noise change.	% population 'bothered'	0.7	0.6	0.5	0.4	4.1	4.0	3.7	4.0	4.5	4.2	4.1	1.1	0.7	1Cmod 2C 3B
Community noise burden – steady state change.	% population 'bothered'	0.9	0.8	0.3	0.3	1.6	1.5	2.6	1.8	3.1	2.2	3.4	0.9	0.6	1C/1Cmod 2B 3B
<i>Conserve items of cultural and archaeological significance.</i>															
Number of non-Aboriginal heritage items impacted.	Number	0	0	0	0	2	2	2	2	0	0	0	0	0	1A-Cmod 2D-F 3A/3B
Number of known Aboriginal heritage items impacted.	Number	1	1	0	0	0	0	1	4	1	3	0	0	0	1C/1Cmod 2A/2B/2F 3A/3B
<i>Minimises impact on water bodies</i>															
Extent of SEPP 14 Coastal Wetlands impacted	Hectares	0	0	0	0	1.29	1.23	0	0	0	0	0	0	0	1A-Cmod 2C-F 3A/3B
Number of waterways crossings – Class 1 & 2.	Number of named waterway crossings	2 (Tuckombil Canal, Mcdonalds Creek)	2 (Tuckombil Canal, Mcdonalds Creek)	2 (Tuckombil Canal, Mcdonalds Creek)	1 (Tuckombil Canal)	2 (Richmond River, Tuckean Broadwtr)	2 (Richmond River, Tuckean Broadwtr)	2 (Richmond River, Rattle Gully)	2 (Richmond River, Eversons Creek)	4 (Saltwater Creek, Richmond River, Rattle Gully, Bingal Creek)	3 (Saltwater Creek, Richmond River, Bingal Creek)	7 (Swampy Creek, Saltwater Creek, Richmond River, Rattle Gully, Eversons Creek, Boundary Gully, Andersons Gully)	1 (Randles Creek)	1 (Randles Creek)	1Cmod 2A-Cmod 3A/3B

Project Objective 4:

Identify and enhance potential beneficial environmental effects, and mitigate potential adverse environmental effects

Qualitative Indicators:
✓✓✓✓ Very High
✓✓✓ High
✓✓ Medium
✓ Low

Assessment Criteria	Measure	Option 1A	Option 1B	Option 1C	Option 1C modified	Option 2A	Option 2B	Option 2C	Option 2C modified	Option 2D	Option 2E	Option 2F	Option 3A	Option 3B	Best Performer
Qualitative Indicators															
Potential non-Aboriginal heritage areas impacted.	Descriptive	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	1B-Cmod 2Cmod-F 3A/3B
Potential Aboriginal heritage areas impacted.	Descriptive	✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓✓✓	✓✓✓✓	✓	✓✓✓	✓✓	1C/1Cmod 2D/2E 3A/3B

Project Objective 5
Minimise adverse socio-economic effects on the local community and maximise socio-economic benefits arising from the project.

Assessment Criteria	Measure	Option 1A	Option 1B	Option 1C	Option 1C modified	Option 2A	Option 2B	Option 2C	Option 2C modified	Option 2D	Option 2E	Option 2F	Option 3A	Option 3B	Best Performer
Quantitative Measures															
Ecological Impact	<i>Corridors assessment, see below</i>														
Business Impact	<i>Corridors assessment, see below</i>														
Social Amenity Impacts	<i>Corridors assessment, see below</i>														
Recreation and tourism impacts	<i>Corridors assessment, see below</i>														
Agricultural displacement	<i>Corridors assessment, see below</i>														
Agricultural production	<i>Corridors assessment, see below</i>														
Number of Buildings impacted	Number: d = dwellings s = shed i = industrial/ commercial	3 (2d, 1s)	2 (1d, 1s)	3 (1d, 2s)	5 (2d, 2s, 1i)	10 (2d, 8s)	3 (1d, 2s)	6 (2d, 1s, 3i)	12 (2d, 4s, 3i)	6 (2d, 4s)	17 (2d, 4s, 11i)	7 (4d, 3s)	6 (5d, 1s)	1 (1d)	1B 2B 3B
Qualitative Indicators															
Access to opportunities	Descriptive	<i>See note (1) below</i>													
Amenity	Descriptive	✓✓ (around Woodburn) ✓✓ (north of Woodburn) (Note 2)	✓✓ (around Woodburn) ✓✓ (north of Woodburn) (Note 2)	✓✓ (north of Woodburn)	✓✓ (north of Woodburn)	✓✓✓ (for Riley's Hill, depending on design quality of bridges) ✓✓✓ (for Wardell) ✓✓✓ (for Wardell)	✓✓✓ (for Riley's Hill, depending on design quality of bridges) ✓✓✓ (for Wardell) ✓ (Meridian Heights)	✓✓✓ (for Wardell) ✓✓ (Meridian Heights) ✓✓ (Meerscham Vale)	✓ (for Wardell) ✓✓✓ (Meridian Heights) ✓✓✓ (Meerscham Vale)	✓ (for Wardell) ✓✓✓ (north of Wardell)	✓✓ (from visual point of view) ✓ (from noise point of view)	✓✓✓ (between Broadwtr and Wardell) ✓✓ (for Wardell) ✓✓✓ (north of Wardell)	✓	✓✓	(See note 3)
Social Character to the towns	Descriptive	<i>See note (4) below</i>													

Qualitative Indicators:
✓✓✓✓ Very High
✓✓✓ High
✓✓ Medium
✓ Low

- (1) No distinction can be made amongst the options from the point of view of access to opportunities, as all options are likely to result in an overall improvement in access to opportunities, both regional and local.
(2) Except around McDonald's Creek where 1B might be preferred on visual grounds, but not necessarily on noise grounds
(3) 1C between Woodburn and Broadwater; 2F between Broadwater and Wardell; 2D or 2F north of Wardell; 3B north of Meridian Heights
(4) No distinction can be made amongst the options from the point of view of likely changes to the social character of the towns

Project Objective 6:
Achieve high quality design and constructability

Assessment Criteria	Measure	Option 1A	Option 1B	Option 1C	Option 1C modified	Option 2A	Option 2B	Option 2C	Option 2C modified	Option 2D	Option 2E	Option 2F	Option 3A	Option 3B	Best Performer
Quantitative Measures															
Length of highway bridges and viaducts	Metres	1730	1730	1230	1230	1170	1560	780	846	1180	1180	5110	0	0	1C/1Cmod 2C 3A/3B
Length of highway in flood affected areas. (Q100)	Metres	8710	8920	8360	8380	4860	4630	4370	2950	8630	7190	11780	3320	4290	1C/1Cmod 2Cmod 3A
Highway length over deep soft soils.	Metres	2090	1930	1910	1950	550	260	600	590	690	620	7590	3470	5090	1C 2B 3A
Volume of external borrow to fill material	Cubic metres	630171	649849	676638	967915	436437	303127	316301	None	439337	252349	534784	202062	None	1A 2Cmod 3B
Total Volume of fill material	Cubic metres	679069	711944	751072	1062997	682038	555419	617830	502625	633270	527180	621393	305210	17430	1A 2Cmod 3B
Area of potential high risk Acid Sulphate Soils.	Hectares	49.5	46.9	34.4	23.0	22.5	29.1	25.2	15.1	48.5	38.9	67.3	23.9	26.6	1C 2Cmod 3A
Qualitative Indicators															
Potential for change in the flooding regime.	Afflux	< 50mm	< 50mm	< 50mm	< 50mm	< 50mm	< 50mm	< 50mm	< 50mm	< 50mm	< 50mm	< 50mm	< 50mm	< 50mm	See note 1 below
	Increase in Flood Duration	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	See note 1 below
	Local flow direction change	✓✓✓	✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓✓✓✓	✓	✓✓	1B 2E 3A

Qualitative Indicators:
✓✓✓✓ Very High
✓✓✓ High
✓✓ Medium
✓ Low

(1) The initial concept design of the proposed upgrade used in the assessment has been designed to mitigate afflux to maximum 50mm, and with a negligible increase in the duration of flooding. Therefore, the performance of these options cannot be differentiated according to these criteria.

Project Objective 7:

Value for money.

[illegible]

For the socio-economic elements of the assessment, the route options have been classified into 'assumed corridors'. These corridors have been assumed since it is necessary to evaluate corridors that run the full length of the study area for the quantitative aspects of the socio-economic assessment.

There are four main corridors identified with three minor deviations that together make seven assumed corridors. These corridors are outlined in the table below.

Corridor	Option	Option	Option
A	1A	2B	3A
A1	1B	2B	3A
A2	1A	2A	3A
B	1C	2C	3B
C	1C	2D	3B
C1	1C	2E	3B
D	1C	2F	3B

	Assessment Criteria	Measure	Corridor A	Corridor A1	Corridor A2	Corridor B	Corridor C	Corridor C1	Corridor D	Best Performer
Project Objective 1: Efficiency of travel, safety and accessibility	Quantitative Measures									
	Vehicle operating costs	\$ m	-22.80	-22.80	-22.80	-29.20	-9.80	-9.80	-16.70	C/C1
	Accident costs	\$ m	42.90	42.90	42.90	42.90	44.00	44.00	43.00	C/C1
Project Objective 5: Efficiency of travel, safety and accessibility	Quantitative Measures									
	Ecological Impact	PV \$ m	0.12	0.12	0.13	0.11	0.17	0.21	0.07	D
	Business Impact	PV \$ m	28.7	28.7	28.7	28.7	28.7	28.7	28.7	*
	Social Amenity Impacts	PV \$ m	33.5	33.5	33.5	33.5	30.5	30.5	30.5	A/A1/A2/B
	Recreation and tourism impacts	PV \$ m	4.0	4.0	4.0	4.0	4.0	4.0	4.0	*
	Agricultural displacement	Number	107	115	123	90	89	86	105	C1
	Agricultural production	\$ m	2.43	2.39	2.15	1.71	1.73	1.76	1.94	B
Project Objective 7: Efficiency of travel, safety and accessibility	Quantitative Measures									
	Project budget	\$ m	760.2	727.9	722.3	653.0	645.4	634.9	895.8	C1/C/B
	Net present value	PV \$ m	-351.5	-332.2	-334.1	-289.8	-252.2	-246.6	-407.9	C1/C/B
	Benefit cost ratio		0.27	0.28	0.28	0.29	0.37	0.38	0.27	C1/C/B

* Ranked equally between route options

Appendix D

Ecology review by Dr Andrew Benwell

1 November 2005

Dr Andrew Benwell
Ecos Environmental Pty Ltd
PO Box 641
Mullumbimby
NSW 2482

Annette Ross/Tanya Coates
Hyder Consulting Pty Ltd
Level 5, 116 Miller Street
North Sydney
NSW 2060.

**Re: Addendum to the Vegetation Section of the Proposed Woodburn to Ballina
Pacific Highway Upgrade Phase I & 2 Investigations.**

To Whom it May Concern,

I have read the Addendum to the vegetation section of the Phase I & 2 investigations prepared by Geolyse Pty Ltd and found that the Addendum along with changes to the Phase I & 2 report satisfactorily address the issues raised in my review. In particular, the issue of the cut-point used in the vegetation classification was clarified and raw data from the analysis provided by way of an appendix, which makes the study more transparent to the reader.

Yours sincerely

Dr Andrew Benwell