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.

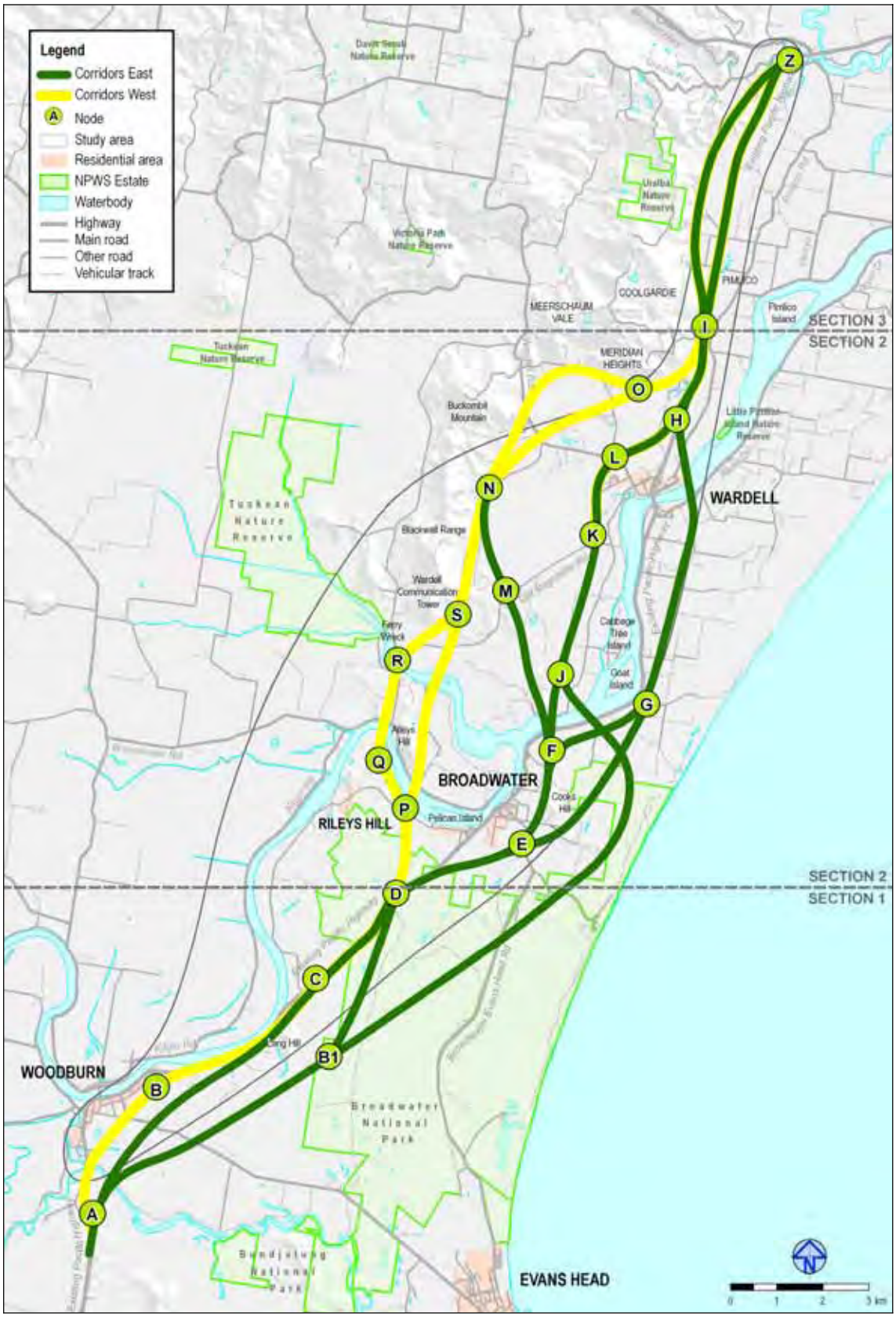

Figure 4-1 Long list of route options

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**.

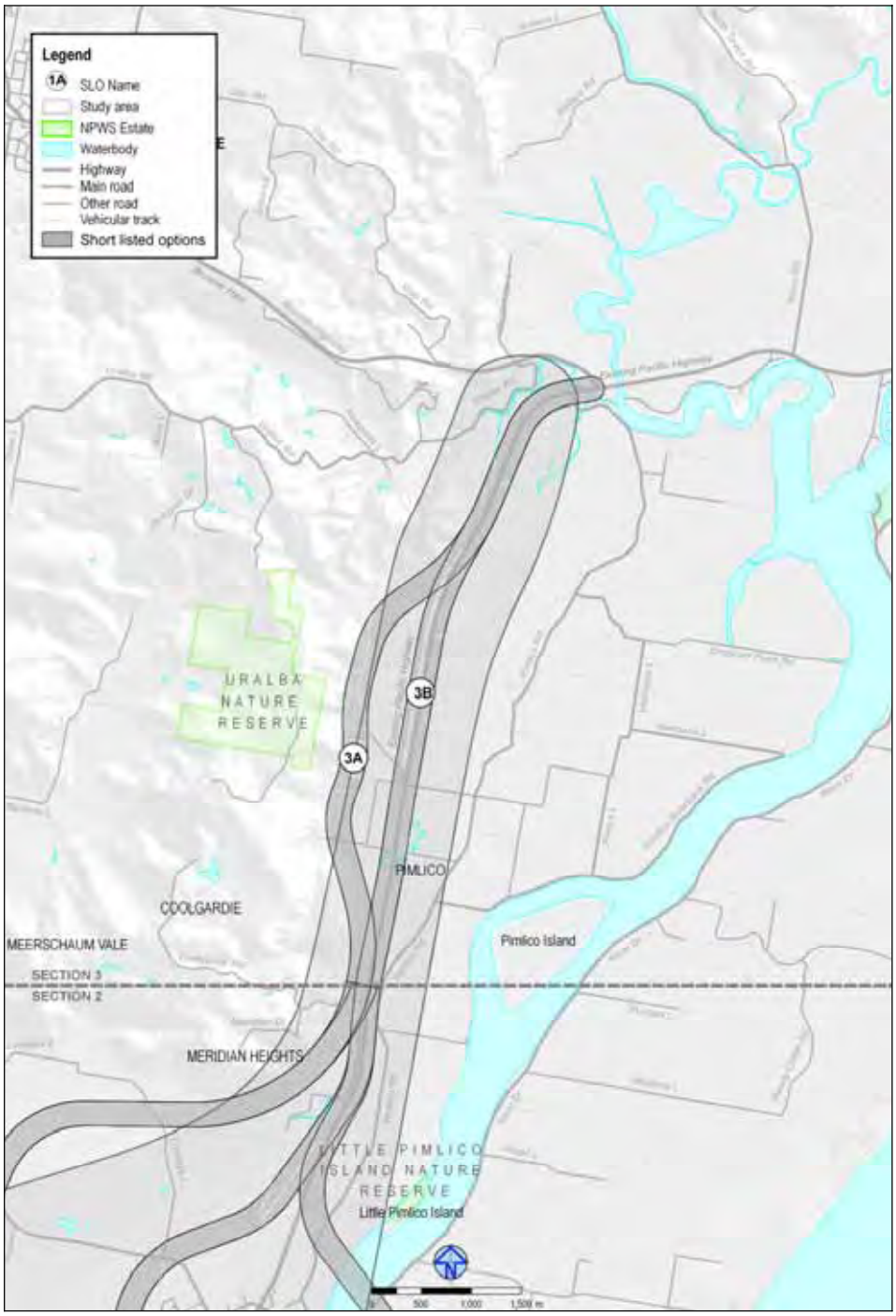

Figure 4-5 Section 3 options

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.

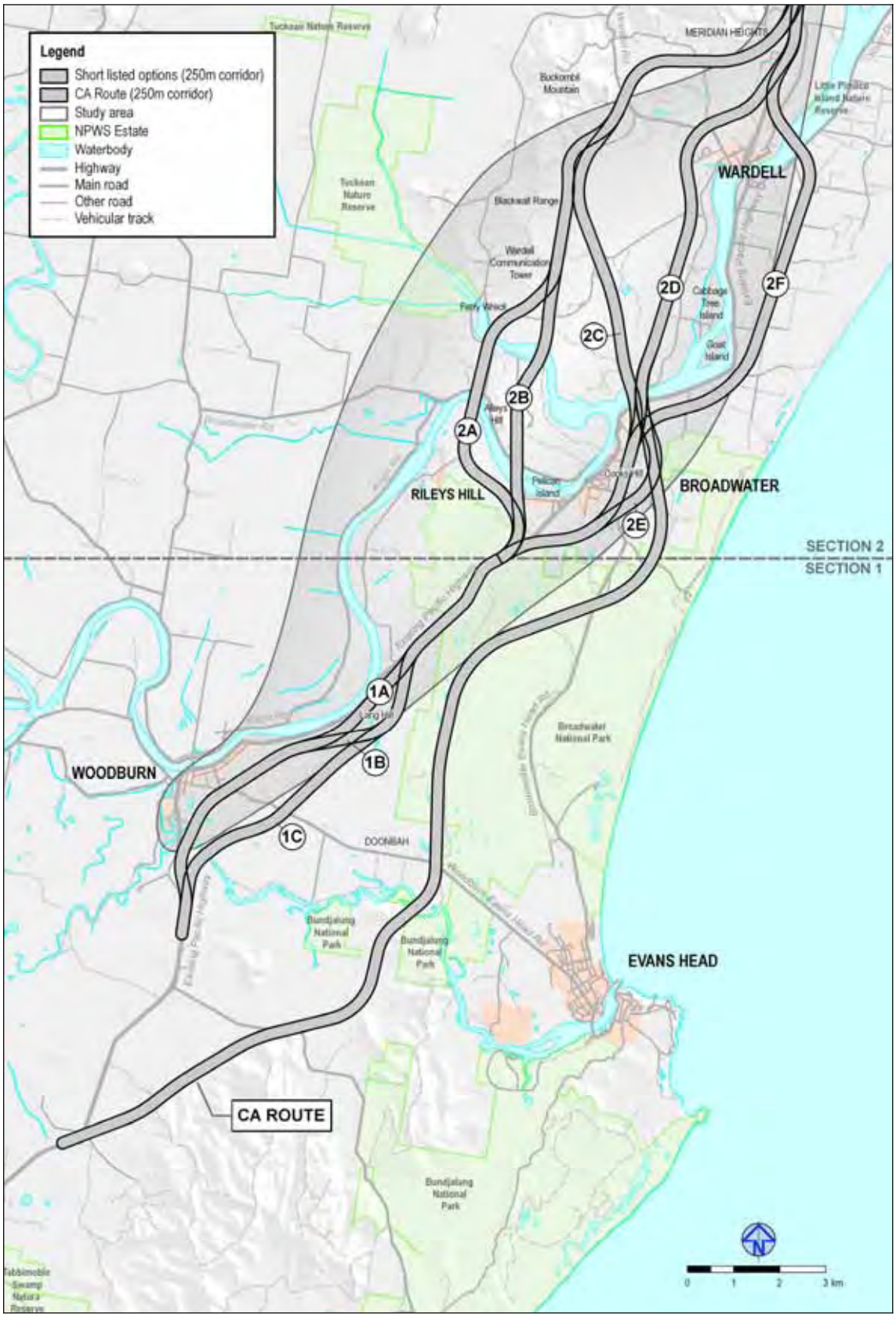

Figure 5-1 Community alternative route

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**).

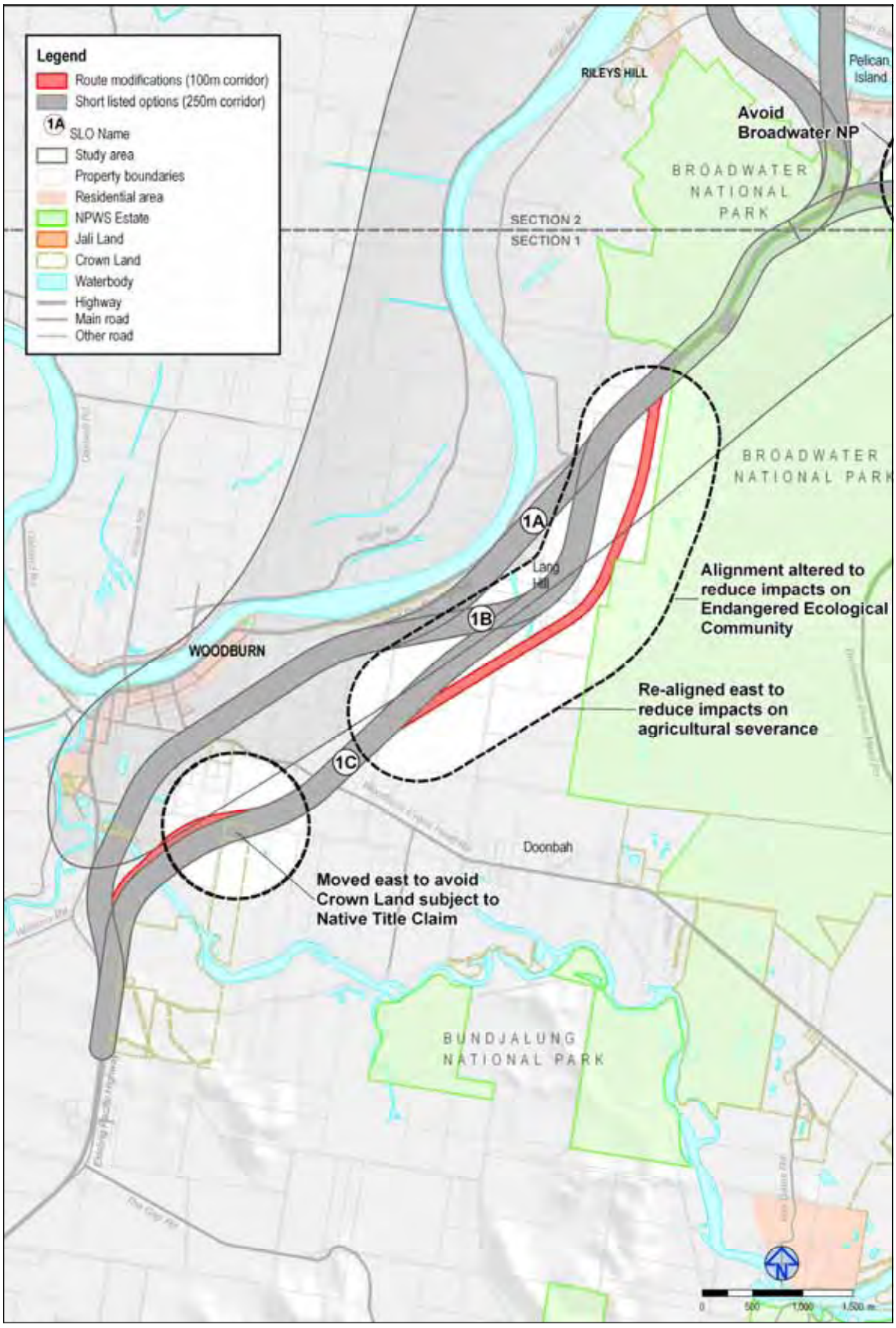

Figure 5-2 Section 1 modifications

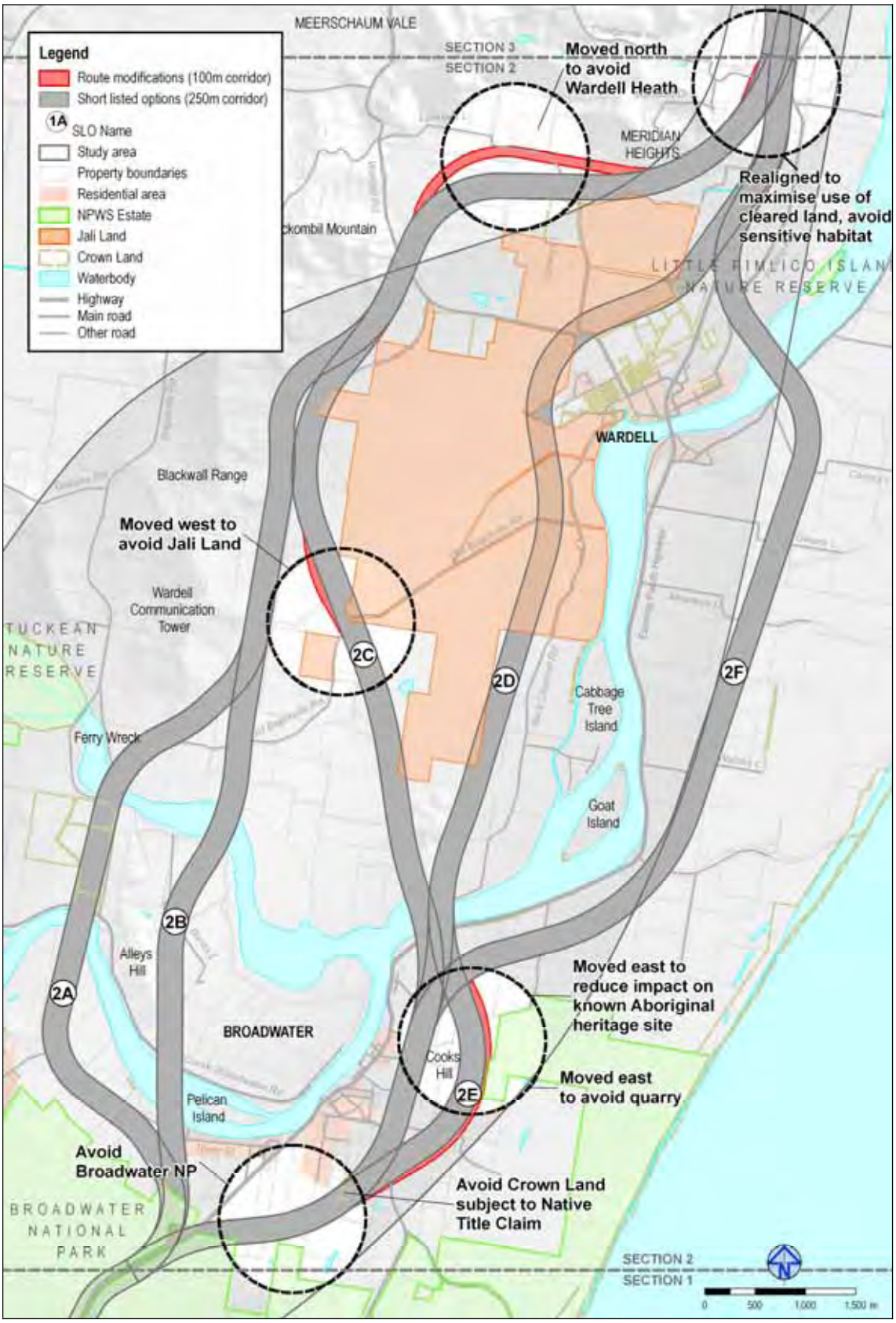

Figure 5-3 Section 2 modifications

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.

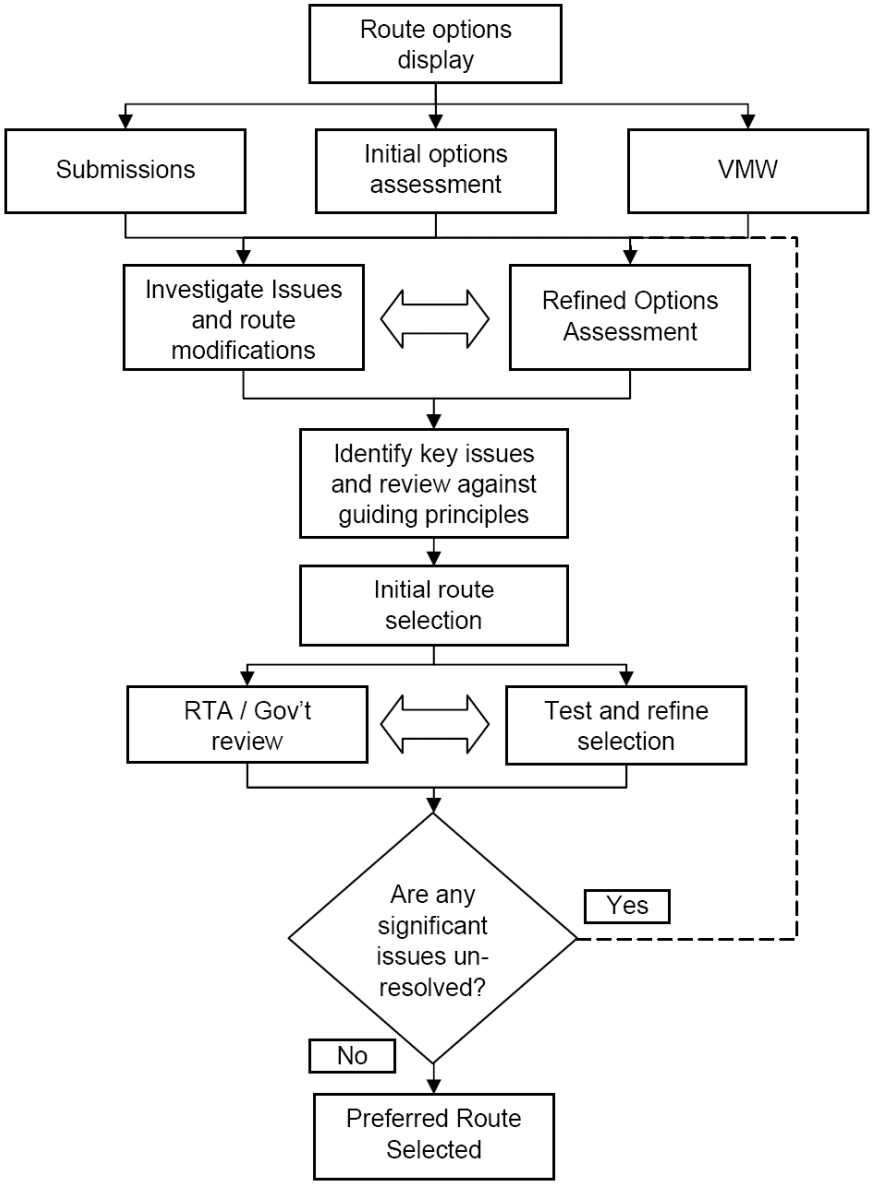

Figure 6-1 Preferred route selection process

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 impapcted 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).