

## 5. Public display, value management workshop and additional investigations

Inputs from the public display of the route options (for the whole project) and the Value Management Workshop (for the Wells Crossing to Harwood section) are key components in the process of recommending a preferred route for the project. A summary of consultation activities and comments and issues raised during the public display of the route options is provided in **Section 5.1** and **Section 5.2**. A summary of the Value Management Workshop is provided in **Section 5.3**. The report from the Value Management Workshop is available separately from the RTA.

These feedback activities provided direction to the project team and identified issues for which further assessment was considered necessary. Following the release of the *Route Options Development Report* (RTA, 2005), a number of additional investigations were undertaken to assist in the decision on a preferred route for the project. Additional investigations are reported in **Section 5.4** and the relevant Working Papers.

### 5.1 Public display activities

#### 5.1.1 Activities leading to the display of route options

A consultation program was developed at the commencement of the project to provide opportunities for community and stakeholder involvement in the development of route options and the preferred route. Two community information sessions were held in early December 2004, to introduce the project to the community and provide general information on the process to follow. Following from this, nominations were invited for three Community Liaison Groups (CLGs), that meet in Grafton, Tucabia and Maclean. The CLGs met three times as individual groups and once as a combined group prior to public display of the route options.

A freecall project telephone line (1800 557 673), email address<sup>8</sup> and web site<sup>9</sup> were established at the start of the project. The public are able to use these to communicate with the project team at any time during the route development process. Comments from the public have been recorded throughout the project and issues raised by the community considered in the development and assessment of route options and the preferred route.

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<sup>8</sup> [wellscrossingtoiluka@skm.com.au](mailto:wellscrossingtoiluka@skm.com.au)

<sup>9</sup> [www.rta.nsw.gov.au/pacific](http://www.rta.nsw.gov.au/pacific)

### 5.1.2 Public display of the route options

The NSW Minister for Roads announced the commencement of the four week public display of the route options on 21 October 2005. In response to feedback from the community and other stakeholders the display period was extended from 18 November 2005 to 2 December 2005.

The key components of the consultation program during the display of the route options included:

- Advertising in local and state press to let the community know about the public display of the route options.
- Written communications distributed to the local community included a Community Update, flyer, fact sheets, maps and the *Route Options Development Report* (RTA, 2005).
- Information displays (staffed and unstaffed) were held at various locations in and around the study area.
- Face-to-face meetings were held with individuals and groups of people.
- The freecall community information line was used by the community for general day to day contact with the project team, and to arrange meetings with property owners.
- The project email address was available to the public to send submissions and ask questions.
- The project web site contained information about the project, including the *Route Options Development Report*, *Community Update* and other background information. Project documents could be downloaded and there was a link to enable the public to make submissions through the web site.
- A combined meeting of the three CLGs was held during the display period.
- Focus group meetings were held to discuss specific issues including hydrology, indigenous heritage, business, ecology and maritime, in relation to the route options.

Submissions and queries from the community raised during the display period were recorded. This included all submissions, regardless of whether they were submitted by email, fax, mail or the web site.

### 5.1.3 Overview of issues raised by the community

Over 1500 submissions were received from around 760 individual households and organisations. The breakdown of submissions received during the display period<sup>10</sup> is:

- 869 submissions received by community feedback form.
- 309 submissions received by letter.
- 151 submissions received by email.
- 120 submissions received by internet community feedback form (from the project web site).
- 101 submissions received by the NSW Minister for Roads (these were forwarded to the project team for consideration).
- 32 submissions received by fax.
- 1 submission received by video.

The issues that were raised by the community and other stakeholders were categorised broadly as listed in **Table 5-1**.

■ **Table 5-1: Issues raised in submissions during the route options display**

Issue	No. of times raised
Flora and fauna impacts	304
Suggestions for other route options (including the Summerland Way)	270
Amenity and /lifestyle impacts	202
Impacts on residential areas, rural -residential areas and rural communities	193
Impacts on agricultural production and farmland impacts	167
Local economic impacts	156
Flooding	152
Property acquisition and compensation	148
Noise impacts	121
Route selection process	102
Community consultation processes	100
Road safety	95
Cost estimates	91
Air quality impacts	80
Rail transport as an alternative to upgrading the highway	69
Water quality impacts	63

<sup>10</sup> While the display period was officially from October to December 2005, submissions were received and reviewed up to February 2006.

Issue	No. of times raised
Land use and planning impacts or issues	62
Traffic issues	56
Locations and design of interchanges	52
Severance of (properties and communities)	38
Local traffic access to and from the new road, or changes to local roads	38
Geotechnical issues (soils and geology)	33
Fog and other hazards	27
Non indigenous heritage impacts	27
Maintenance of existing Pacific highway	25
Whether the new road would be operated as a toll road	21
Construction methods, traffic management	20
Tourism	20
Property access	17
Visual impacts	15
Indigenous heritage impacts	12
Timing of construction	11
Emergency vehicle access to the new road	9
Funding mechanisms and funding availability	9
Harwood Bridge	8
Design of the route options	6
Staging of construction	5
Extension of study area	3
Number of lanes on the new road	2

The submissions received and responses to the issues raised are documented in detail in the *Route Options Submissions Summary Report* (RTA, 2006h).

## 5.2 Issues raised in relation to options between Wells Crossing and Harwood

Many of the submissions received from the community and other stakeholders indicated a preference for a particular route option for the section of the project between Wells Crossing and Harwood. There was no clear overall preference for one option from the submissions. A broad spectrum of opinions was provided by the community in relation to the options, including opposing views in relation to some of the impacts of the options. Some of the submissions gave a number of reasons for the preference, and important issues were raised for consideration by the project team.

A summary of the reasons for preferences for the various route options given in submissions is provided in the sections that follow. It should be noted that not all of the reasons listed below are consistent with the outcomes of the studies on the routes. More detailed information on issues related to each of the route options can be found in the *Route Options Submissions Summary Report* (RTA, 2006h).

### 5.2.1 Orange/A option

Reasons indicated in submissions for a preference for the Orange/A option included:

- Best meets the objectives of the Pacific Highway Upgrade Program and the project.
- Minimises impacts on communities, including:
  - Minimises impacts eg. noise, air pollution, lifestyle, amenity, severance and land value impacts on communities that were previously not affected by the highway eg. Gulmarrad, James Creek and Pillar Valley.
  - Devaluation of land would be less significant as current land values would already reflect their close proximity to the existing highway.
  - Minimises impacts on agricultural land.
  - Doesn't hamper the development potential of Gulmarrad and James Creek.
  - It incorporates bypasses of Ulmarra and Tyndale, which have been talked about for years.
  - Minimises development pressure on small coastal communities such as Minnie Water and Wooli, which do not have the capacity for increased visitation.
- Would provide the greatest local economic benefits, including:
  - The best access to Grafton and other towns eg. Ulmarra, thereby providing benefits to the local economy as motorists would be more likely to stop.
  - Benefits the local community by providing better access to services and employment.
  - Minimises impacts on businesses that rely on through traffic eg businesses along the existing highway.
  - Greatest benefits for the development of the area.
- Minimises ecological impacts:
  - Minimises impacts on the habitat of the endangered Coastal Emu.
  - Avoids wildlife corridors, ecologically significant wetlands, State Forests and National Parks.
  - Best meets the principles of ecologically sustainable development and is not likely to result in irreversible impacts.
  - Best for tourism eg. doesn't affect the environmental qualities of the coast.

- Traffic benefits, such as:
  - Attracts the highest traffic volumes and therefore will provide the greatest safety benefits.
  - Provides benefits to local traffic.
  - Provides relatively direct access for emergency vehicles.
  - Provides better connections between the Pacific Highway and other major roads eg. Gwydir Highway and Summerland Way.
- Is more cost effective, because it:
  - Minimises the cost of maintaining the existing highway.
  - Follows the alignment of the existing highway and therefore capitalises on existing infrastructure and minimises disruption to untouched areas.
  - Has a cheaper cost per vehicle.
- Has benefits in terms of flooding and soils such as:
  - Better soil conditions and flood immunity than the other options and doesn't degrade new areas of floodplain.
  - Requires minimal earthworks thus minimising changes to flooding in the floodplain.
  - Would not impede the movement of water coming off the hills, thereby minimising local flooding impacts around Pillar Valley.
- Able to be constructed in stages and therefore, the benefits of the upgrade would be realised faster.
- Minimises impacts on potential mineral resources.
- Personal reasons such as minimising impacts on the author's property or their local area.

### 5.2.2 Purple/B option

Reasons indicated in submissions for a preference for the Purple/B option included:

- Minimises impacts on communities, including:
  - Impacts such as noise, air pollution, severance and visual impacts on communities that were previously not affected by the highway eg. Gulmarrad, James Creek and Taloumbi.
  - Affects the least built-up communities and therefore doesn't affect as many people.
  - Minimises impacts on coastal strip and relatively undeveloped areas to the east.
- Minimises ecological impacts including:
  - Impacts on wetlands, remnant habitats and threatened species, populations and ecological communities.

- Avoids Yaegl Nature Reserve.
- Minimises impacts on prime agricultural land.
- Able to be constructed in stages – sections of the new motorway could be completed sooner, thereby improving safety.
- Utilises existing highway corridor / infrastructure at southern and northern ends.
- Would provide local economic benefits, such as:
  - The southern interchange is closer to Grafton and the Grafton Airport than the interchange of the Green/C and Red/D options, thereby providing easier access to the town and airport for the community, business and tourists
- Would provide benefits for traffic including:
  - Reduced length compared to the Orange/A option.
  - Caters for through traffic.
  - Removing heavy traffic from existing highway thus improving safety.
  - Provides better access to the Summerland Way and Gwydir Highway than the Green/C and Red/D options.
  - Provides better access for emergency vehicles.
- Minimises impact on flooding compared to the Orange/A option.
- Better foundation for road construction compared to the Orange/A option.
- Is more cost-effective than the Orange/A option.
- Personal reasons eg. minimises impacts on the author's property or area.

### **5.2.3 Green/C option**

Reasons indicated in submissions for a preference for the Green/C option included:

- Provides greatest safety benefit.
- Has the least impact on people and communities, including:
  - Affects the least number of homes (in terms of acquisition).
  - Minimises impact on Maclean.
  - Least noise impact.
  - Avoids areas of urban growth and minimises impacts on development applications which have been approved or are pending.
- Minimises agricultural impacts including:
  - Prime agricultural land.
  - Minimise impacts on the sugar industry.

- Uses state owned land.
- Lower visual impact than westerly options.
- Does not impact on indigenous land.
- Benefits businesses along existing highway as local traffic and some tourists would continue to use the existing highway
- Provides the following traffic benefits:
  - Shortest and most direct route, thereby providing greatest travel time savings for through traffic.
  - Will help remove heavy traffic and through traffic from existing highway, thus improving safety.
  - More room for interchanges and access roads to and from the highway.
- Has the following design and construction benefits:
  - Best meets design objectives.
  - The shortest length of floodplain crossing, thereby minimising potential flooding impacts.
  - Cheapest to construct.
  - Availability of on-site construction material.
  - Will cause least disruption to local residents and highway traffic during construction.
- Provides a good fire break for the State Forest.
- Minimises impacts on ecology.
- Personal reasons eg. minimises impacts on the author's property, business or area.

#### **5.2.4 Red/D option**

Reasons indicated in submissions for a preference for the Red/D option included:

- Best meet project objectives.
- Minimal impacts on communities and people, including:
  - Minimises impact on private property owners.
  - Minimises the impacts on homes (in terms of acquisition).
  - Minimises impact on Maclean.
  - Minimises noise impacts.
  - Minimises visual impacts.
- Provides the greatest traffic benefits including:
  - Best safety performance.



- Shortest and most direct route, thereby providing greatest travel time savings for through traffic along with reduced fuel costs and emissions.
- Will help remove heavy traffic and through traffic from existing highway, thus improving safety.
- Provides an alternative route for use in times of emergency such as bushfires, floods or accidents.
- Leaves local road network for locals.
- Only crosses two main roads.
- Minimises agricultural impacts including:
  - Prime agricultural land.
  - Minimise impacts on the sugar industry.
  - Uses state owned land.
- Minimises impact on indigenous and non-indigenous heritage.
- Benefits businesses along existing highway as local traffic and some tourists would continue to use the existing highway.
- Has the following design and construction benefits:
  - Reduced length of floodplain crossing compared to the Orange/A and Purple/B options, thereby minimising potential flooding impacts and potential disturbance of acid sulphate soils.
  - Cheapest to construct.
  - Availability of on-site construction material.
  - Minimises impacts on major developed areas and areas already zoned for residential development.
  - Easier and faster to construct.
  - Will cause least disruption to local residents and highway traffic during construction.
  - Does not need to be staged.
  - Better road foundation.
- Does not encroach on environmentally sensitive areas eg. conservation areas, forests, National Parks wetlands, flora and fauna habitat.
- Least negative impacts on the Clarence Valley.
- Located closer to the coast.
- Minimises impacts on potential mineral resources.
- Personal reasons eg. minimises impacts on the author's property, business or area.

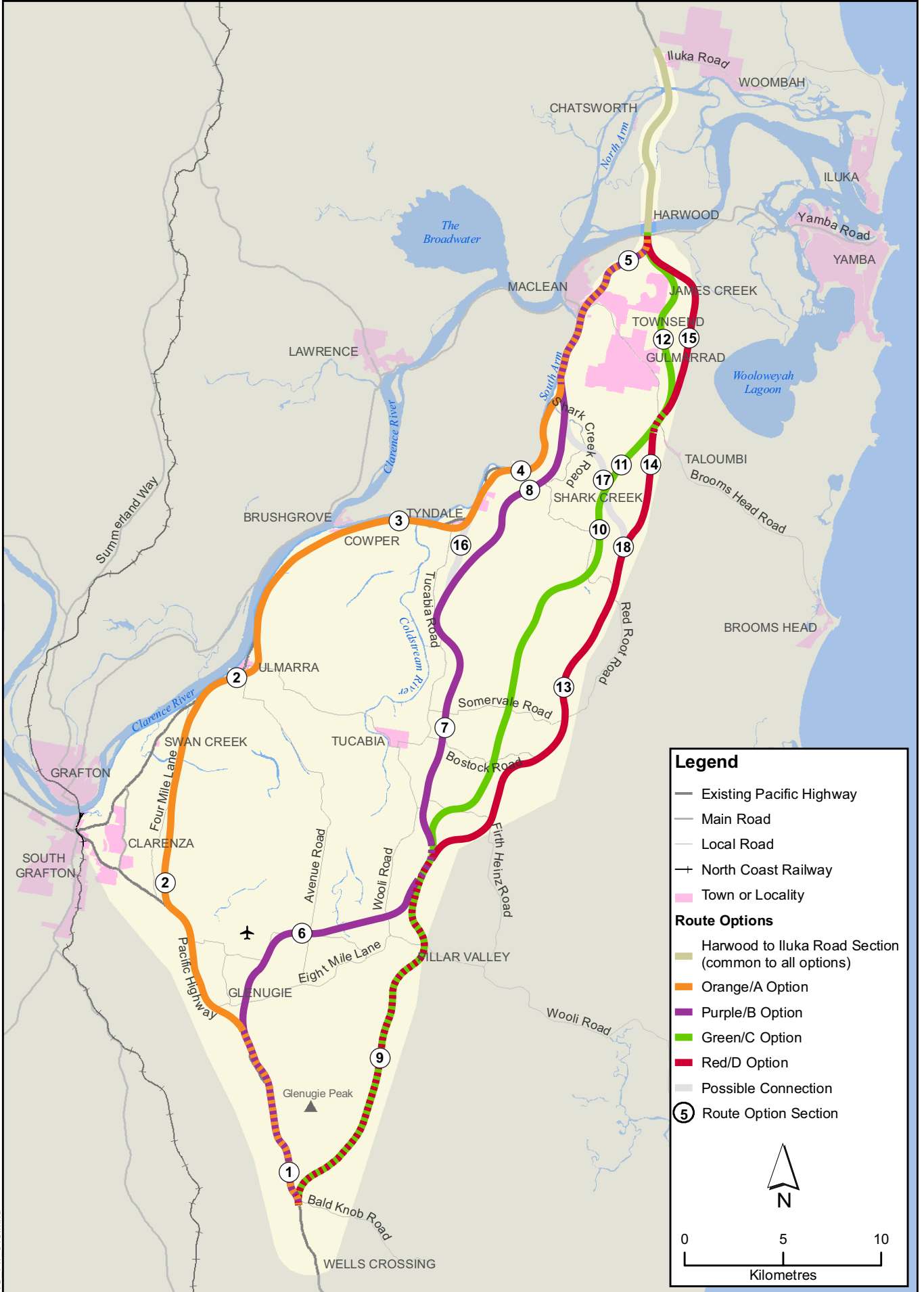
### 5.2.5 Combinations of sections of the options

The community was also asked to indicate if there was a preference for a route option comprising a combination of sections of routes. The sections of route options are shown on **Figure 5-1**. **Table 5-2** summarises the combinations of options that were put forward in submissions and the reasons given for the suggestions.

■ **Table 5-2: Combinations of route options suggested in submissions**

Suggested combination of routes	Reasons Provided
Purple/B from Wells Crossing to the Tyndale connection, then Orange/A to Harwood Bridge Sections 1, 6, 7, 16, 4 and 5)	<ul style="list-style-type: none"> <li>■ Minimises impacts on communities that are not currently affected by the existing highway</li> <li>■ Minimises impacts of land de-valuation</li> <li>■ Minimises ecological impacts</li> <li>■ Provides access to Grafton and the Grafton Airport</li> <li>■ Minimises impacts on forests, wetlands, and rural and residential areas</li> <li>■ Cost-effective</li> </ul>
Purple/B from Wells Crossing to Pillar Valley, then Green/C to the Shark Creek connection, then Purple/B to Harwood Bridge (Sections 1, 6, 10, 17 and 5)	<ul style="list-style-type: none"> <li>■ Provides access to Grafton and the Grafton Airport</li> <li>■ Minimises impact on Pillar Valley, Gulmarrad and James Creek</li> <li>■ Able to be constructed in stages</li> <li>■ Avoids impacts on fauna corridor between Yaegl Nature Reserve and the coast</li> </ul>
Purple/B from Wells Crossing to Pillar Valley, then Green/C to Harwood Bridge (Sections 1, 6, 10, 11 and 12)	<ul style="list-style-type: none"> <li>■ Provides access to Grafton and the Grafton Airport</li> <li>■ Minimises impacts on Pillar Valley</li> <li>■ Provides an opportunity to cross the Clarence River to the east of the Harwood Mill</li> <li>■ Minimises impact on homes</li> <li>■ Minimises impacts on flooding</li> <li>■ Cost-effective</li> <li>■ Minimises impacts on highway traffic flow</li> <li>■ Minimises impacts on property owners</li> </ul>
Purple/B from Wells Crossing to Pillar Valley, then Red/D to the Shark Creek connection, then Purple/B to Harwood Bridge Sections 1, 6, 13, 18, 17 and 5)	<ul style="list-style-type: none"> <li>■ Minimises ecological impacts</li> <li>■ Provides access to Grafton and the Grafton Airport</li> <li>■ Minimises impacts on established properties</li> </ul>
Purple/B from Wells Crossing to Pillar Valley, then Red/D to Harwood Bridge Sections 1, 6, 13, 14 and 15)	<ul style="list-style-type: none"> <li>■ Minimises impacts on people and homes</li> <li>■ Cost-effective</li> <li>■ Provides an opportunity to cross the Clarence River to the east of the Harwood Mill</li> <li>■ Minimises impacts on flooding</li> </ul>
Green/C - Red/D from Wells Crossing to Pillar Valley, then Purple/B to Harwood Bridge Sections 9, 7, 8 and 5)	<ul style="list-style-type: none"> <li>■ Minimises noise impacts on residential areas that are currently not affected by highway noise</li> <li>■ Minimises impacts on cane farms and grazing areas to the east of the existing highway</li> <li>■ Utilises existing highway infrastructure between Shark Creek and Harwood Bridge</li> <li>■ Cost-effective</li> </ul>

Suggested combination of routes	Reasons Provided
	<ul style="list-style-type: none"> <li>■ Reduced length compared to the Orange/A and Purple/B options</li> <li>■ Minimises impacts on Glenugie State Forest</li> <li>■ Minimises impacts on ecological areas</li> <li>■ Minimises number of home to be acquired</li> <li>■ Will help remove heavy traffic and through traffic from existing highway, thus improving safety</li> <li>■ Able to be constructed in stages</li> <li>■ Minimises disruption to local residents and highway traffic during construction</li> </ul>
<p>Green/C from Wells Crossing to the Shark Creek connection, then Purple/B to Harwood Bridge            (Sections 9, 10, 17 and 5)</p>	<ul style="list-style-type: none"> <li>■ Minimises impacts on the Gulmarrad and James Creek communities</li> <li>■ Benefits properties along the existing highway</li> <li>■ Utilises existing highway infrastructure between Shark Creek and Harwood Bridge</li> </ul>
<p>Green/C from Wells Crossing to Brooms Head Road, then Red/D to Harwood Bridge            Sections 9, 10, 11 and 15)</p>	<ul style="list-style-type: none"> <li>■ Minimises impacts on people</li> <li>■ Minimises impacts on agricultural land, particularly cane farms</li> <li>■ Minimises impacts on flooding</li> <li>■ Cheapest to construct/cost-effective</li> <li>■ Would affect the least number of houses</li> <li>■ Reduced length of route</li> <li>■ Located on higher ground</li> <li>■ Minimises impact on ecology</li> <li>■ Minimises disruption to local residents and highway traffic during construction</li> </ul>
<p>Red/D from Wells Crossing to the Shark Creek connection, then Purple/B to Harwood Bridge            (Sections 9, 13, 18, 17 and 5)</p>	<ul style="list-style-type: none"> <li>■ Minimises noise impacts on residential areas that are currently not affected by highway noise e.g. Gulmarrad and James Creek</li> <li>■ Minimises impacts on cane farms and grazing areas to the east of the existing highway</li> <li>■ Minimises impacts on existing highway businesses</li> <li>■ Avoids areas of urban growth</li> </ul>
<p>Red/D from Wells Crossing to Brooms Head Road, then Green/C to Harwood Bridge            Sections 9, 13, 14 and 12)</p>	<ul style="list-style-type: none"> <li>■ Future cargo haulage benefit</li> <li>■ Minimises impacts on agricultural land</li> <li>■ Minimises impact on flooding</li> <li>■ Cheapest to construct</li> <li>■ Less disruption during construction</li> <li>■ Minimises ecological impacts</li> <li>■ Reduced length of route</li> <li>■ Better soil foundations to construct a motorway</li> </ul>



**Legend**

- Existing Pacific Highway
- Main Road
- Local Road
- + North Coast Railway
- Town or Locality

**Route Options**

- Harwood to Iluka Road Section (common to all options)
- Orange/A Option
- Purple/B Option
- Green/C Option
- Red/D Option
- Possible Connection
- ⑤ Route Option Section

Wells Crossing to Iluka Road  
Upgrading the Pacific Highway

**Figure 5-1: Route option sections**

### 5.2.6 Issues raised in relation to the Harwood Bridge to Iluka Road section

Issues relating to the Harwood Bridge to Iluka Road section of the project were provided to the project team through submissions during the display period, and at a community meeting at Harwood held on 13 December 2005. The main issues that were raised by the community in relation to this section of the study area include:

- The potential for impact on Harwood village.
- Harwood bridge design and impacts of existing Harwood Bridge.
- Noise impacts on the Harwood community from traffic through the town and from vibration on the bridge.
- Visual impacts/urban design.
- Air quality impacts associated with a major road passing through the town.
- Consideration of a tunnel under the river.
- Impacts on property values.
- Property acquisition and compensation.
- Flooding and hydrology.
- Agricultural impacts in particular the loss of cane land.
- Local road access for the community and for cane haulage.
- Interchange locations.
- Bridge over the Serpentine Channel.
- Whether a toll road is being considered.
- Timing of construction.
- Impacts during construction.
- Concern over the consultation process.
- Legislation and planning processes, including changes arising from Part 3A of the NSW EP&A Act.

The key issue to arise from consultation with the community in the Harwood area was the request that the RTA consider route options that bypass Harwood village. The local community asked the RTA to consider options either to the east or west of the town, as a way of reducing the potential for impacts on the village and its community. In response to community concerns, the RTA undertook to investigate options within and outside the study area around Harwood. The outcomes of that assessment are discussed in **Section 6.2**.

### **5.3 Wells Crossing to Harwood Bridge Value Management Workshop**

A Value Management Workshop was undertaken for the section of the project between Wells Crossing and Harwood Bridge. Options north of the river were further investigated and considered separately.

#### **5.3.1 The value management process**

The Value Management Workshop was held over three days from 8-10 March 2006. It brought together a wide range of stakeholder interests and expertise to review the outcomes of investigations undertaken to date and, on the balance of issues and consideration of the options against agreed assessment criteria, to determine a preferred direction for further investigation to progress the project's development.

The Australian Centre for Value Management (ACVM) was commissioned to facilitate and report on the three day workshop, which was attended by a range of stakeholders including representatives from government agencies, the local community and project team members. A list of participants who attended the workshop can be found in the *Value Management Workshop Report* (RTA, 2006).

The purpose of the workshop was to “*obtain a common understanding of the project and its objectives, review the work undertaken to date and to recommend a preferred direction, if appropriate, so as to progress the project to the next stage of development.*” The workshop objectives to achieve this were stated as being to:

- Clarify the objectives of the project.
- Examine the short listed options developed to meet the project objectives.
- Recommend a preferred route(s) to the RTA to progress the project.
- Develop an action plan to progress the project.

The workshop commenced with a tour of the study area by bus, which was attended by nearly all of the workshop participants. This provided an opportunity for further familiarisation with the study area, and for community representatives and other workshop participants to identify key issues and points of interest within the area.

The facilitated sessions of the workshop commenced with an overview of the process and introduction of participants. The first tasks for workshop participants related to review of information and included:

- Background papers that were issued to Value Management Workshop participants prior to the workshop.

- A brief presentation on traffic and transport issues.
- Participants identifying and sharing with the group what was important about the project from their individual perspectives.
- A review of the problem situation and the program objectives.
- Assumptions being made about the project were identified and challenged from various points of view.

Using the statements that had been developed by the whole group describing what was important about the project, a group developed a set of criteria for use in evaluating the options. The other participants were involved in a parallel exercise to develop lists of assumptions that would guide the evaluation of the project. The criteria and assumptions were presented to the whole workshop for review and agreement. These criteria were then grouped within three main categories: functional, social and local economic, and natural environment. Weightings, indicating the importance of the criteria, were agreed collectively by the group.

The workshop group then undertook the evaluation of the route options using a process comprising three phases, as follows:

- **Phase 1** – Assessment, using the criteria, of the sections of the options (shown on **Figure 5-1**) to identify combinations that performed better than the route options (ie. Orange/A, Purple/B, Green/C and Red/D).
- **Phase 2** – Review by the whole group of whether the combinations performed better than the route options, and determination of “modified” options. This was for all options except for Orange/A, which has no potential for improvement through different combinations.
- **Phase 3** – Assessment of the modified options and Orange/A option against the assessment criteria for the full length of the section (ie. Wells Crossing to Harwood Bridge).

The workshop participants then collectively reviewed the assessment and conclusions were drawn from the overall assessment.

### 5.3.2 Outcomes and conclusions of the Value Management Workshop

#### Criteria

The workshop participants agreed criteria as a basis for assessment of the route options. These are listed in **Table 5-3**.

■ **Table 5-3: Assessment criteria and weightings from the Value Management Workshop**

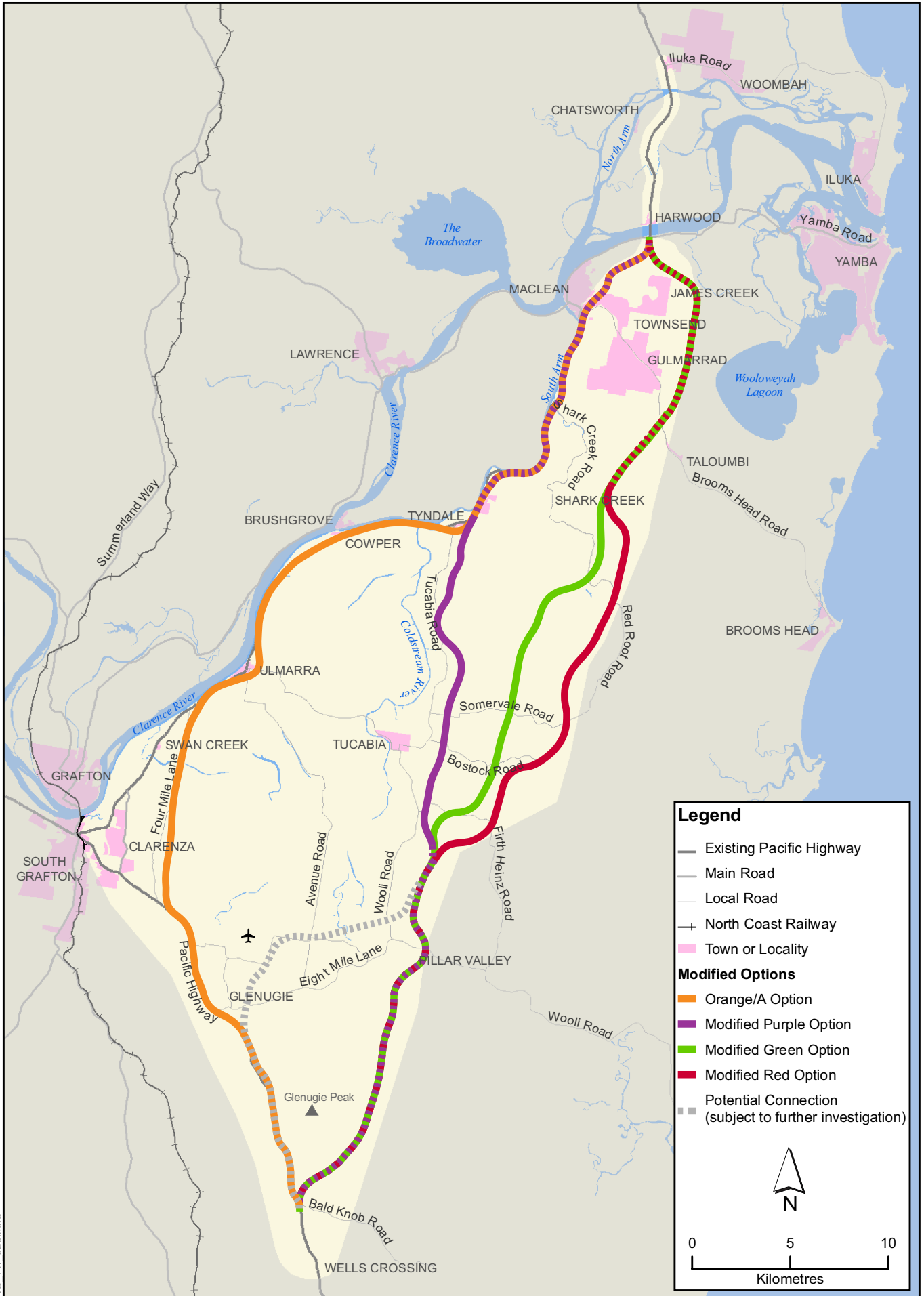
Functional	Social and Local Economic	Natural Environment
<ul style="list-style-type: none"> <li>■ Travel times within the study area (all categories of travel/vehicle) (16.5%)</li> <li>■ Engineering risks (ie. soft and acid sulphate soils, work under or near traffic, resource access, safety for workers and road users) (13%)</li> <li>■ Effective access to highway and local road network (14%)</li> <li>■ Ability to stage (4.5%)</li> <li>■ Safer “traffic corridor” (from a study area perspective for management of traffic volumes) (39%)</li> <li>■ Energy savings (ie. volume, weight, route length, number of routes, efficiency, etc) (13%)</li> <li>■ Visual/Urban design impacts experienced by the road user (0%)</li> </ul>	<ul style="list-style-type: none"> <li>■ Impact on Aboriginal heritage and culture (17%)</li> <li>■ Impact on non-Aboriginal heritage and culture (5.5%)</li> <li>■ Visual/urban design impacts for the community (1%)</li> <li>■ Impact of noise on existing and new receivers (10%)</li> <li>■ Extent of community severance (11%)</li> <li>■ Extent of homes/residences lost (14%)</li> <li>■ Impact on future land uses (2.5%)</li> <li>■ Impact on local businesses (9%)</li> <li>■ Impact on farms and productive lands (including forests and fragmentation) (12%)</li> <li>■ Social and economic risks of changes in flood impacts (5%)</li> <li>■ Impacts on lifestyle environment choices (including degree of change, bush/rural and town settings) (10%)</li> <li>■ Impact on NSW DEC estates and State Forest Conservation Zones (ie. land use/use of public estate) (3%)</li> </ul>	<ul style="list-style-type: none"> <li>■ Area of native vegetation lost (including high value habitat) (16%)</li> <li>■ Impact on Endangered Ecological Communities (EECs) (18%)</li> <li>■ Threatened and regionally significant flora impacts (14%)</li> <li>■ Threatened and regionally significant fauna impacts (14%)</li> <li>■ Impacts on wildlife corridors (4%)</li> <li>■ Environmental impacts of changes to hydrological regimes (4%)</li> <li>■ Impacts on SEPP 14 and other wetlands (16%)</li> <li>■ Impacts on water quality and the aquatic environment (including proximity, number of bridges, length across the floodplain, fish passage, etc) – not assessed by other criteria above (14%)</li> </ul>

Note: The weighting of each criterion is indicated in brackets.

#### Modified options

A key outcome of the Value Management Workshop was the development of modified options by combining sections of the Purple/B, Green/C and Red/D options and the potential connections. The modified options developed at the workshop and the Orange/A option are shown on **Figure 5-2**. The Orange/A option remained un-modified, as it is not able to be improved by combinations with sections of other options. The Orange/A option was assessed against the modified options in phase 3 of the Value Management Workshop.





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Wells Crossing to Iluka Road  
Upgrading the Pacific Highway

**Figure 5-2: Modified options developed at the Value Management Workshop**

The Value Management Workshop did not provide clear direction to the RTA on a recommended preferred route. However, it did provide a clear direction for further investigation to progress the project.

The ranking of options from the Value Management Workshop, in terms of performance against the criteria is presented in **Table 5-4**. A ranking of 1 indicates the best performing option.

■ **Table 5-4: Ranking of options from the Value Management Workshop**

Corridor Options	Assessment Perspective			
	Functional	Social & Local Economic	Natural Environment	Strategic Cost Estimate (\$M)
Orange	372.5 (1)	299 (3)	464 (1)	\$1530
Modified Purple	381.5 (1)	311.5 (3)	282 (2)	\$970
Modified Green	362 (1)	358 (1)	252 (3)	\$830
Modified Red	345.5 (1)	363.5 (1)	214 (4)	\$820

Note: The number is the raw score of the option when assessed against the criteria within each assessment perspective. The number in brackets is the ranking of the options based on the raw score. Where the difference in raw scores between the paired comparisons was not greater than the value of the highest weighted criterion (as shown in **Table 5-4**), the options were considered to have performed equally and were therefore ranked equally. For the functional criteria the value of the highest weighted criterion was 39, for social and economic this was 17 and for natural environment this was 18.

### Conclusions of the Value Management Workshop

The conclusions from the Value Management Workshop (as presented in the *Value Management Workshop Report*) were that:

- The Modified Green option performs overall and on balance better than the other options (if strategic cost estimates are included in the comparison). Modified Green option ranked first from a social and local economic perspective, equal first from a functional perspective and third from a natural environment perspective.
- The Modified Green option includes the Line 9 component rather than the Line 1+6 component at the southern end of the study area (see **Figure 5-1**). There was no consensus reached in the workshop as to which offered the better line combination (ie. Line 1+6 or Line 9 at the southern end). It was agreed by the participants to move forward in the workshop with section 9, on the basis that further investigation would be undertaken by the project team to resolve the issues raised before a recommendation as to the preferred line in this area could be reached.
- There are a number of issues associated with both Line 1+6 and Line 9. Line 1+6 has environmental issues (ie. impacts on Endangered Ecological Communities, impacts on SEPP 14 and other wetlands, insufficient information on threatened and regionally significant flora and fauna, etc) whereas Line 9 has a number of social and local economic issues (ie. impacts on aboriginal heritage and cultural sites, visual impacts, impacts on

future land uses and impacts for convenient access to local businesses and Grafton). Also there are some significant ecological issues with Line 9 which may have a cost.

- If strategic cost estimates are excluded from the comparison, Modified Green option and the Orange option are closely ranked. The Orange option has the least impact on the natural environment but has the greatest potential risk to flood impacts.
- Modified Purple, Modified Green and Modified Red options have more potential scope for improvement than the Orange option.
- The Orange option and the Modified Purple option have greatest impact from a social and local economic perspective, because of potential impacts on houses and agricultural land. However, they also have the greatest potential benefits in terms of maintaining access for local road users and supporting local businesses that rely on the highway.
- There was a larger difference between scores in the ranking from a natural environment perspective than from a social and local economic perspective.
- There needs to be a further analysis of traffic data before a preferred route is chosen (to ensure the crash safety rate objectives are met).
- If an easterly option (ie. an option other than Orange/A) is selected as the preferred route, improvements to the existing highway will need to be explored to address road corridor safety issues.

#### **5.4 Investigations following the route options display**

Following the start of the public display of the route options in October 2005 a number of further investigations were undertaken. Some investigations were in response to issues raised in submissions received during the route options display period, while others were needed to address specific questions raised at the Value Management Workshop. The following sections outline the findings of these investigations. Further detail is contained in the Working Papers.

##### **5.4.1 Upgrade of the existing Pacific Highway**

One of the key issues arising from the route options display and Value Management Workshop was the expected traffic distribution under any of the Purple/B, Green/C or Red/D options. Thirty-five per cent of traffic would be expected to use these routes, with 65 per cent continuing to use the existing highway. As such, review was undertaken to examine the potential benefits of improving the existing highway in conjunction with these options.

Much of the existing alignment is suitable for a 100km/h design speed. Accident data were analysed as part of the review. The distribution of accidents along the length of the existing highway provides little indication of accident 'black spots' that would need to be upgraded. This means that there are no specific locations that can be targeted on the existing highway, but that general improvements are required to be considered along the length of this section of the

highway. This includes improvements to address specific design issues in certain locations, such as tight bends and poor sight distances and measures to reduce the severity of accidents that result from driver error. Other improvements would address a wide range of potential accident types and would be spread along the existing highway. These include treatments to reduce the risk of fatality or serious injury accidents, measures to improve driver awareness and to enable drivers to maintain a constant speed.

In the cost estimates for the Modified Purple, Green and Red options, allowance has been made for inclusion of a range of measures as part of the upgrade of the existing highway between Eight Mile Lane and Harwood Bridge. Specific improvements have not yet been determined, but the range of measures may include some or all of the following, subject to further assessment of needs and negotiation with Clarence Valley Council:

- Realignment of bends that do not currently meet 100km/h design standards.
- Widening of road shoulders in some sections where they currently provide insufficient room for vehicles to pull off the carriageway.
- Upgrade of some major intersections to “seagull” treatments.
- Provision of additional overtaking lanes.
- Upgrading in the vicinity of Ulmarra to reduce impacts of traffic passing through the town.
- Installation of wire rope on the road edges or medians in areas where the potential for accidents involving head on collisions or vehicles running off the road is highest.

The estimates for the upgrade of the existing highway between Eight Mile Lane and Tyndale include a provision for a substantial package of works based on the above measures. This allowance has been included in the estimates for all three easterly options. An allowance has also been included for the above improvements on the existing highway between Tyndale and Harwood Bridge for the Modified Green and Modified Red options only; but not for the Modified Purple option as it is anticipated to carry the majority of local, regional and through traffic between Harwood and Tyndale, where an interchange is proposed. These amounts exclude provision for service roads where the alignment is adjacent to the existing highway.

#### **5.4.2 Ecological impacts**

A number of ecological issues were identified in the course of the Value Management Workshop that required more detailed investigation. These included:

- Further investigation of the potential impacts of Line 6 of the route options (as shown on **Figure 5-1**) on the Endangered Ecological Communities associated with the Coldstream River north of Sandy Crossing.

- Further investigation and assessment of the potential impacts of the modified route options on the coastal Emu population.
- Obtaining a more detailed understanding of habitat values and wildlife corridors and the potential impacts of the route options on these.
- Inclusion of costs for mitigation and management measures for ecological impacts into the cost estimates for the options, which is discussed further in **Section 5.5**.

Additional investigations included further analysis of information from previous field work, updating threatened species lists for the study area, further consultation with government agencies and other ecological specialists and additional targeted field work. The results of these investigations have been incorporated into the *Biological Working Paper* (RTA, 2006a) and are summarised below.

### **Condition assessment of Endangered Ecological Communities**

The condition of the remnant Endangered Ecological Communities potentially affected by the route options was assessed, based on the results of previous field work undertaken for the project, further review of aerial photography and supplementary field work at some specific sites. The following are important considerations from the assessment of potential impacts of the modified route options on Endangered Ecological Communities:

- The Modified Purple option has a reduced potential for impacts on Endangered Ecological Communities when compared to the Purple/B option because it avoids direct impacts on the Shark Creek wetlands.
- The Modified Green option has less potential to impact on Endangered Ecological Communities when compared to the Green/C option because it avoids these communities in the area around James Creek.
- With some exceptions, the modified options generally impact on areas of relatively low quality Endangered Ecological Communities.

The condition of Endangered Ecological Communities in the area where Line 6 of the Modified Purple option (as shown on **Figure 5-2**) crosses the Coldstream River is relatively degraded compared to remnant floodplain vegetation in other parts of the study area, and elsewhere within the Coldstream wetlands. Higher quality remnants exist both to the north and south. While this option would sever the ecological community, the condition of the vegetation to be directly impacted is poor.

The potential for impacts on this Endangered Ecological Community was a key factor in the ranking of sections 1+6 against section 9 at the Value Management Workshop. The additional investigations indicate that section 6 would impact on a low quality area of Endangered

Ecological Community, and that impacts would be less substantial than were evaluated at the Value Management Workshop. On this basis, it was concluded that sections 1+6 would be preferable to section 9 from an ecological perspective and that sections 1+6 should be considered further in the assessment of the route options.

Further refinement of the preferred route also has the potential to reduce impacts on Endangered Ecological Communities through measures such as narrower footprints and further refinement of the alignment. Opportunities for refinement are discussed further in **Section 6.3**.

### **Habitat values and wildlife corridors**

Mapping of high value habitat areas and identification of wildlife corridors was further refined after the public display of the route options, based on field work undertaken in November 2005 and May 2006, and other investigations. This assessment showed that the Modified Green and Modified Red options have a much greater potential to impact on the high quality habitats of the study area than the Modified Purple option and the Orange/A option. The Modified Green option is assessed to have less direct impact than the Modified Purple option on high quality habitats (in terms of the total area of habitat that would be directly cleared). However, the Modified Green option would fragment a very large section of high quality habitat associated with the range from McRaes Knob to Round Mountain on the eastern side of Tucabia Road. The Modified Purple option would result in fragmentation of high quality habitat in the area between Tucabia and Tyndale, but this is mostly confined to the edge of the main habitat areas. When both direct clearing and habitat fragmentation are considered, the Modified Green and Modified Red options are assessed to have greater potential impacts than the Modified Purple option.

The Modified Green and Modified Red options would result in potential severance of wildlife corridors in the east of the study area. This would include important links between the Yuraygir National Park and wetlands in the Coldstream Basin, at Shark Creek, and the Yaegl Nature Reserve. Purpose built fauna crossings would need to be incorporated into the design of these options to assist in reducing impacts on important movement corridors. In the absence of effective fauna crossings incorporated in the design of these options, substantial reduction in the availability of habitat would result from the loss of these important movement corridors.

The Modified Purple option would impact on movement corridors to a lesser extent than the Modified Green and Red options. This is mainly because it avoids severance of connections between the forested ranges to the east and wetland habitats such as Shark Creek and Yaegl Nature Reserve. The Modified Purple option would impact on access to the Coldstream basin wetlands. Large bridge structures are proposed at the crossing of the Coldstream River for drainage purposes. It is anticipated that, because of the length and height of these structures, they would be effective as fauna crossings for a wide range of species, thereby minimising the

potential loss of access to floodplain habitat. Overall the Modified Purple option presents less comparative risk of impacts on fauna corridors than the Modified Green and Modified Red options.

### **Potential impacts on the coastal Emu population**

Further assessment of the potential impact of the project on the coastal Emu sub-population was undertaken following the Value Management Workshop. This assessment was based on further information obtained in relation to Emu sightings and movement patterns, described in **Section 3.6.3**.

Despite further investigation of the potential impacts of the project on the coastal Emu population, uncertainty remains associated with paucity of data relating to the characteristics of the population, movement patterns and the potential effectiveness of crossing structures. For this reason, assessment of the impacts of the route options requires a conservative approach and has focused on avoiding the potential for impacts to the greatest practicable extent. The RTA intends to undertake substantial further investigations to assist in understanding the likely impacts of the project and identifying mitigation measures that will be effective for the Emu.

Investigations to date have shown that there are insufficient data available to determine whether purpose-built crossing structures with directional fencing would provide crossings suitable for the Emu. Fencing is used very successfully in Emu farming and local Emus are regularly seen near rural roads and close to the existing Pacific Highway in and around the study area. This suggests both that traffic noise may not be a significant issue for underpasses and that fencing would be effective in preventing Emu road kill on the new road. Well placed bridges at relatively short intervals with interconnecting fences would in theory be appropriate measures to provide for Emu crossings. However, there is a lack of firm evidence from previous studies or from scientific research to support this.

Movements between Yuraygir National Park and the floodplain wetlands are an important component of the life-cycle events of these birds. These passageways are impacted by sections 7, 10, 11, 13, 15 and 18 (as shown on **Figure 5-2**) of the modified options.

The Modified Green and Modified Red options would fragment a significant portion of the habitat known to be used by this Emu population. This in itself may not directly result in a significant threat to the viability of the population given the existence of Yuraygir National Park, but could contribute to a greater or lesser degree to the cumulative impact over the next several decades on the habitat as more clearing and development occurs. This would increase the vulnerability of the population to events such as drought and create a high risk of fragmenting the population into smaller less viable units.

The Modified Purple option between Tucabia and Pillar Valley dissects a passageway used by the Emu for access to the Coldstream River wetlands. These wetlands have been identified as locally significant habitat for the sub-population, particularly during drought and within the pre and post-breeding phases. Large bridge structures (for drainage purposes) could be considered in the design of Section 6, south of the Coldstream wetlands, and this could provide a suitable road crossing for the Emu to access these important habitats. Other crossing structures north of Pillar Valley, around the intersection of Firth Heinz Road and Wooli Road, would also be incorporated in the design. Even in the event that this structure is not effective as a crossing for Emus, the extent of habitat to which access would be restricted by the Modified Purple option is substantially smaller than for the Modified Red and Modified Green options and the area of habitat west of the Modified Purple option is a very small proportion of their known range. The Modified Purple option is therefore less likely to substantially impact on the viability of the coastal Emu population than the Modified Green or Modified Red options.

The Modified Green and Modified Red options would restrict access to the three main wetland areas of Coldstream River, Shark Creek and Yaegl Nature Reserve, as well as forest and open habitats in the north of the study area. Large drainage structures (that may also be effective as fauna crossings) would be included in the design of the Modified Green and Modified Red options at Shark Creek and around Pillar Valley, as well as in the vicinity of Brooms Head Road. In the event that these structures are not effective as Emu crossings, access to a substantial proportion of the wetland habitats utilised by the sub-population would be restricted and this has the potential to substantially impact on the population.

The Orange/A option would not result in any further restriction of access to habitat for the Emu as it is generally located outside or at the limit of known distribution of the sub-population.

### **Provision for environmental mitigation measures in cost estimates**

One of the recommendations from the Value Management Workshop was that cost estimates for environmental mitigation measures be further considered. The costs estimates were reviewed and updated to ensure that there is adequate provision for a range of mitigation measures and the likely requirements based on the findings of additional ecological investigations.

Key environmental considerations relate to providing sufficient fauna crossings along the length of the route, particularly in regards to the coastal Emu, and maintaining the hydrological and ecological functions of the wetlands. It is anticipated that some of the mitigation measures can be incorporated with other structures such as bridges and drainage culverts that are incorporated into the design of the options for hydrology reasons. In addition to these crossings, significant lengths of fauna (floppy-top) fencing are anticipated to be required. Preliminary allowances for wildlife crossings (excluding modifications to required bridges and culverts required for drainage) for these options are listed in **Table 5-5**.



■ **Table 5-5: Additional provision for fauna mitigation in cost estimates**

Section	Land bridges <sup>1</sup>	Fauna underpasses	Fauna fencing <sup>2</sup>
Eight Mile Lane to Pillar Valley (Purple, Green and Red options)	1	6	7500 metres
Pillar Valley to Shark Creek (Purple, Green and Red options)	1	7	13400 metres
North of Shark Creek (Green and Red options)	1	5	6600 metres

1 for the purposes of preliminary consideration, land bridges are assumed to be 50m long x 30m wide.

2 Fauna fencing excludes other fencing (separately costed). This would also be a barrier to native fauna.

For the Modified Green option, allowance has been made in the design for a full length bridge crossing of the Shark Creek SEPP 14 wetland for drainage purposes. For the crossing of the wetlands along the Coldstream River, north of Sandy Crossing, within route option section 6, allowance has been made for two bridges totalling in the order of 600 metres in length, again for drainage purposes. These structures are likely to also provide suitable crossings for fauna.

No allowance has been made at this stage for the purchase of land as compensatory habitat. This would need to be considered as part of the concept design and detailed environmental assessment of the preferred route.

Overall, it is estimated that an amount in the order of \$17 million would be required for the Modified Purple option and in the order of \$24 million for the Modified Green and Modified Red options. This amount excludes drainage culverts and bridges already included in the design (and separately costed), which could be readily modified to serve a dual purpose and incorporate fauna underpasses. Costs for other environmental mitigation measures, such as sediment basins, are also included in the cost estimates for the project, but are not itemised as part of the environmental mitigation costs described above.

This amount relates to physical works and does not include any ongoing management measures, studies, preparation of species rescue plans or management plans or similar that may also be considered.

### 5.4.3 Heritage impacts

A number of issues relating to Aboriginal heritage were raised through submissions and at the Value Management Workshop. These issues related to knowledge of places of cultural significance to the Aboriginal community and the potential impacts of the route options on these. Further investigation into the location, significance and potential impacts of options on sites of cultural significance was undertaken prior to selection of the preferred route. This primarily consisted of additional consultation with representatives of the local Aboriginal community including Local Aboriginal Land Councils (LALCs), tribal and elders groups.

In particular, a number of meetings and site visits were attended by the project team with the Garby Elders, who speak for country south of the study area along the coast, and extending into the southern end of the study area including the areas of Glenugie, Pillar Valley and extending north along the Coldstream River to Tyndale. The outcomes of additional consultation with Aboriginal groups since the display of the route options are:

- The route options are not likely to impact on the cultural significance of Glenugie Peak to the Garby Elders, as they are sufficiently distant from the peak. Minor re-alignment of the Green/C and Red/D options to the west (along the boundary of the Glenugie State Forest) also would not impact on the significance of this area.
- Sites of cultural significance to the Garby Elders at Pillar Valley are not likely to be affected by any route option providing the RTA can demonstrate that water quality impacts of the options would be adequately managed. However, the Purple/B option (Section 6) is preferable to the Green/C and Red/D options (Section 9) in this area.
- The crossing of the Coldstream River for the Purple/B option (Section 6) does not pass through any areas of cultural significance known to the Garby Elders, however, the Coldstream River generally has a high potential for Aboriginal sites.
- A significant site at Pillar Valley, identified by the Burraway Wajid group, is unlikely to be impacted by any of the route options.
- An important cultural site in the Clarence River near Tyndale is unlikely to be impacted by any of the route options, as the significance of the place is understood to be limited to the item in the river itself.
- Maclean Hill and Yaegl Nature Reserve are identified as important sites and the dedication of Yaegl as a Nature Reserve is in part because of its importance to the Aboriginal community. The Orange and Purple options follow the existing road corridor through this area and would require some widening of the existing road reserve. There is some potential for minor impacts on these important areas as a result of these options.
- Wooloweyah Lake is identified as culturally important by the Birrigan Gargle LALC, however, the route options would not directly impact on the lake and are set back well from the lake edge, minimising the potential for indirect impacts.

#### **5.4.4 Geotechnical**

In November 2005, during the period of the route options display, additional geotechnical investigations were undertaken east of James Creek and Gulmarrad to supplement the geotechnical information for this part of the study area. The purpose of the testing was to provide more detailed information on the expected depth of the soft soils in this area and constructability issues associated with the northern sections of the Green/C and Red/D options. More information is contained in the Geotechnical Working Paper.

### **Green/C option**

The most noticeable geotechnical surface feature identified in this assessment was the close proximity of the Green/C option to rock exposures in the foot slopes leading down from the elevated ridgeline to the west. The rock exposures comprise small steps of weathered sandstone that are exposed at the edge of the floodplain surface. The slopes above the rock outcrops appear to be underlain by thin residual soils over weathered rock. At the base of the foot slopes (below the rock outcrops) isolated narrow swamp areas were observed.

The Green/C option crosses over two of these elevated, residual soil slopes. Through the remainder of this area the route crosses three sections of the Wooloweyah Lagoon floodplain, generally within 300 metres of the base of the foot slopes and the rock exposures.

Tests undertaken along the Green/C option, within each of the three floodplain sections, encountered relatively shallow deposits of transported soil, between two to eight metres thick. Beneath the transported soils is a thin residual soil layer (one to two metres thick), then weathered rock. The shallow buried rock is approximately 300 metres east of the foot slopes and rock exposures, and this indicates a gently sloping bedrock surface extending towards Wooloweyah Lagoon. No evidence of a deeper infilled channel was identified in the test holes.

The additional testing along the northern portion of the Green/C option indicates that ground conditions for road construction are better than previously assessed. The approximate depth of the more problematic softer transported soils is between two to five metres. Previously this depth was assessed to be between six metres and 15 metres. The depth to weathered bedrock in the northern floodplain sections approximately nine metres, where it had previously thought to be approximately 15 metres.

### **Red/D option**

In the initial geotechnical investigations, one piezocone test was undertaken near the Red/D option alignment (Amos Road) in the vicinity of the Wooloweyah Estuary floodplain. An additional piezocone test was undertaken on the Red/D option in this area. The two tests are two kilometres apart and provided the only subsurface information for the section of the Red/D option that crosses the Wooloweyah Lagoon floodplain.

Both cones encountered soft clay (likely to be recent estuarine swamp muds) to depths of about five to six metres. Below the soft muds are stiff to very stiff clays to about 16 metres depth over very stiff to hard residual soils or sandy clay basal soils. No gravels were encountered in the two cone holes.

The revised information indicates that the depth of the upper soft layer is slightly less than previously assessed. The overall depth of transported soil is assessed to be about 21 metres,

compared with the 30 metres previously assessed. However, the additional piezocone test on the Red/D option alignment has not changed the geotechnical constraints and recommendations previously provided for construction of the highway upgrade through this area, which include deep soft soils.

#### **5.4.5 Flooding and drainage**

Following the display of the route options, more detailed flood modelling was undertaken for sections of the Orange/A and Red/D options to re-evaluate the allowances in the preliminary designs for bridges and culverts, and to confirm if they were consistent with what would be required to achieve the road design objectives in relation to maximum flooding impacts in those areas. The Orange/A option was modelled across the floodplain from Swan Creek to Maclean. The Red/D option was also modelled across the floodplain in the area east of Gulmarrad and James Creek.

The modelling undertaken as part of the assessment of the options provided adequate information on the flows crossing segments of the alignments and the size required for waterway openings, but did not include the embankments that would be required for the options. The more detailed modelling included the actual alignments and embankments for the options and provided openings to represent the dimensions of the bridge and culvert structures. A summary of the findings of the additional modelling is presented below, and more information is provided in the Hydrology and Hydraulics Working Paper (RTA, 2006d).

#### **Additional flood modelling for Orange/A option**

Modelling of the Orange/A option indicates that the required length of waterway openings would likely be longer than that previously estimated. The primary reason for this is due to the need to bridge sections of the road to pass the 100 year ARI flows (ie. elevate the under-side of the bridge above the 100 year ARI flood levels), whereas previously, clearance for the 20 year ARI flood level had been included in the model.

There are a number of locations where the existing Pacific Highway forms an important control of flow into and out of the floodplain, such as just west of the mouth of Coldstream basin. While the objective for the design of the road is to provide flood immunity up to at least the 20 year ARI flood immunity, it is not possible to achieve this and retain the same flood flow conditions without building the road higher than the 20 year ARI level. This issue is exacerbated for the consideration of the 100 year ARI event.

As an example, just west of the mouth of Coldstream basin, the existing Pacific Highway road level is at 4.5 mAHD (approximately). The 20 year ARI flood level is 5.0 mAHD and the 100 year ARI flood level is 5.8 mAHD. It is not possible to include culverts with an invert of 4.5mAHD (to preserve the existing level of control for inflow into the Coldstream Basin) and

still have a road crest at 5.2 mAHD (the required height to achieve the 20 year ARI flood immunity), as the depth of the structure from road crest to the top of the culvert would be a minimum of 0.7m. It would be necessary to build the road higher and this would add to the cost of the project.

It may be necessary in situations such as that described above to construct two lanes on a bridge with an under-side above the 100 year ARI flood level. This arrangement would include another two lanes (ie. the existing Pacific Highway) at the existing levels to maintain the current control for flows into and out of the basin. This would require a considerably longer length of bridging to meet the project objectives in relation to flooding impacts.

The detailed modelling has highlighted the potentially high risk that existing flood behaviour in the vicinity of the existing highway would not be maintained with the construction of the Orange/A option. The existing highway plays a significant role in the overtopping and floodplain filling behaviour within the Coldstream Basin. These risks are specific to the section of the Orange/A option which passes through the Coldstream Basin between Swan Creek and Tyndale. The section of the Orange/A option north of Tyndale, and the other options, are less complex in regard to crossings of floodplain areas and present less risk in terms of upstream impacts on flood levels and behaviour. This is because the Coldstream Basin is the major flood storage in the Clarence River catchment, and has particularly complex flooding characteristics. Other catchments, such as Shark Creek, are much smaller and subject to less influence from back-flows from the Clarence River.

Updated modelling for the crossings of Harwood and Chatsworth Islands indicates the time of inundation experienced currently may be maintained through the design of the existing highway. The upgraded highway may result in increases in flood levels of between 80mm to 120mm. Further consultation with the local community in this area is required to determine management of flooding impacts, and this will be undertaken as part of the concept design of the preferred route.

The modelling has also confirmed the expected sensitivity of flood impacts near the South Grafton area. An impact of less than a five millimetres increase in the flood level in the river is predicted to result in an increase in the flood level of 60 millimetres inside the South Grafton levee system. This is principally due to the high proportional increase in overtopping depth of the levee system (which is quite shallow) and the increased length of time for overtopping (at the peak of the flood event).

In summary, the detailed assessments have confirmed that achieving a flooding design solution to the Orange/A option would pose very high risks from an engineering design perspective and is likely to be more expensive than previously anticipated. As flood modelling is predictive and

not precise, there are inherent risks associated with the assessment in terms of changes to flood behaviour that can not be accurately predicted, and which may have implications for surrounding properties and towns. This risk is particularly high for the Orange/A option between Swan Creek and Tyndale, within the Coldstream Basin

#### **Additional flood modelling for Red/D option**

Detailed modelling assessments for the northern section of the Red/D option indicate that the required length of waterway opening would be likely to be slightly longer than that previously estimated. This would result in an increase in afflux of approximately 50mm for this part of the alignment. Recognising the land uses in this area, this magnitude of impact is expected to be acceptable.

#### **5.4.6 Noise assessment**

Numerous submissions on the route options raised the issue of cumulative noise effects. Submissions suggested that the impacts of all traffic in the road corridor (including traffic on the route options and traffic that would remain on the existing Pacific Highway) should be investigated. Given the potential for a relatively high proportion of traffic to remain on the existing highway (particularly during the day) for some options, additional modelling of both the route options and the existing highway was undertaken, based on the predicted traffic volumes on each road in 2021. Predictions were also provided for the existing Pacific Highway in 2021 without any of the route options, so that the relative impacts of traffic being diverted to the options could be evaluated. Further detail of the assessment is provided in the *Noise and Vibration Working Paper* (RTA, 2006f). The key findings from the assessment are:

- Noise modelling for the existing Pacific Highway for 2006 (based on estimated traffic volumes in 2006 and without any of the route options) indicates that approximately 270 receivers currently experience noise levels above the daytime criteria for a redeveloped road, and approximately 390 receivers at night experience noise above the criteria.
- By 2021 this is predicted to increase to 375 (daytime) and 525 (night time) receivers, due to predicted increases in traffic volumes and the proportion of heavy vehicles using the highway.
- Reductions in daytime noise affectation along the existing highway for the Modified Purple, Green and Red options are minimal as up to 70 per cent of traffic and half of the heavy vehicles would remain on the existing highway.
- All the modified options (Purple, Green and Red) result in reduced noise affectation along the existing highway at night, because the majority of night time traffic is through traffic and heavy vehicles, and this traffic would use the modified options rather than the existing highway.

- The cumulative noise impact of all options (that is, the overall noise impact from the existing highway and the upgraded highway) would be a reduction in the number of noise affected receivers above the NSW DEC criteria.
- The greatest reductions in noise affectation above the NSW DEC criteria for all options are in the ranges above 60 dB(A). Therefore, while some receivers would still experience night time noise above the criteria, the level of exceedence would be reduced for many of these.
- When property acquisitions that would result from each of the options are factored into the assessment, the Orange/A option would result in the least cumulative noise impact, because it would require acquisition of a substantial number of houses that are currently affected by highway noise.

These findings do not change the assessment of noise impacts of the route options, as required to be undertaken by the NSW DEC. However, they provide an indication of how noise would be distributed across the study area as a result of the options for upgrading the Pacific Highway.

## 5.5 Development of the cost estimates

Cost estimates have been provided for the route options at each stage from the long list of options through to the preferred route. At each stage of the project the estimates have become more detailed and refined, as more information on the design of the options has emerged.

The *Route Options Development Report* (RTA, 2005) included a strategic cost estimate for each of the route options. These costs were updated in the period following the route options display and an updated estimate for each option was provided for the Value Management Workshop

Following the Value Management Workshop, cost estimates were updated. **Table 5-6** summarises these estimates, along with an updated estimate for the section of the project between Harwood Bridge and Iluka Road. The estimates provided below are appropriate for the purpose of comparing the costs of the options.

### ■ Table 5-6: Revised cost estimates, from the Value Management Workshop

Option	Length (km)	Cost Estimate
Orange/A	65.6	\$1,620 million
Modified Purple	61.5	\$1,190 million
Modified Green	62.4	\$1,050 million
Modified Red	63.2	\$1,100 million
Harwood Bridge to Iluka Road section	10.0	\$ 550 million

Note: The estimate for Harwood Bridge to Iluka Road includes costs for upgrading to Class M, which would involve two new bridges over the Clarence River. Costs are in \$2005.

These estimates differ from those provided for the route options display in late 2005 for the following reasons:

- The rates used in the estimates have been updated to March 2006 – currently the rates for construction projects on the highway increase at around 14 per cent per annum in recent years.
- Rates of some key items (earthworks, pavements and bridges) have been modified across all Pacific Highway Upgrade Program projects.
- An allowance for the upgrade of the existing highway (as described in **Section 5.4.1**) have been included in the estimates for the Modified Purple, Green and Red options, whereas these had previously been considered separately as part of the economic analysis. This allowance is in the order of \$110 million for the Modified Purple option and \$120 million for Modified Green and Modified Red options. The amount that would be required is subject to further assessment.
- An increased allowance has been made for environmental mitigation. The amount that would be required is subject to further detailed assessment but may be in the order of \$17 million for the Modified Purple option and \$24 million for the Modified Green and Modified Red options (as discussed in **Section 5.4.2**).
- To account for the full potential cost of the Modified Purple, Modified Green and Modified Red options, sections 1+6 rather than section 9 were adopted in the cost estimates, as sections 1+6 are more expensive than section 9 and no decision had been made between these sections at the Value Management Workshop.
- The estimate for the Modified Purple option includes an additional interchange at Tyndale.
- The estimates for the Modified Purple option and Harwood to Iluka Road section now assume that both carriageways would be constructed above the 1 in 20 year flood level. The original estimates allowed for one carriageway only above the 1 in 20 year flood level.

Following the route selection workshop an updated estimate was prepared for the Refined Purple option, including the highway improvements and environmental mitigation measures to be considered as part of the project.