

## 6 Development of Route Options

### 6.1 Study Area Zones

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To assist in the development of the initial route options and selection of the long list of options, the study area was divided into three zones as listed below and shown on **Figure 6.1**.

- Tintenbar Zone: southern zone from the southern end of the study area to just north of Knockrow
- Newrybar Zone: central zone of the study area from north of Knockrow to south of Bangalow
- Bangalow Zone: northern zone of the study area from south of Bangalow to just north of Ewingsdale and the northern end of the study area.

Key characteristics of each zone that influenced the development of initial route options and the selection of the long list of route options are listed in **Table 6.1**.

### 6.2 Development of Initial Options

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The first step in the development of initial options was to superimpose the constraints mapping on a three-dimensional digital terrain model (DTM) and on aerial photography of the study area (see **Chapter 5**). Option development commenced with the brainstorming of possible corridor placements that were then developed and refined in three dimensions using specialised road design software which interacts with the DTM. Using the software a three dimensional model was developed for each initial route option showing the physical extent of cuts and fills as the option passes through the terrain. In this way a large number of initial route options were developed, checked against the aerial photography and constraints, and then refined where possible to reduce impacts on the identified constraints while maintaining functionality.

The development of initial route options was generally limited to corridors within the defined study area but options which extended outside the study area boundary in some locations were also considered. Specialist investigations were extended beyond the study area boundary where required.

Following the initial development and refinement of option corridors, a Project Team Feasible Options Workshop was held to identify the weaker performing options. Weaker performing options did not satisfy design criteria, had unacceptable impacts, or would be very difficult or costly to build. These weaker options were removed from further assessment or consideration and the outcome of the workshop was the establishment of a long list of route options for further investigation.

### 6.3 Description of Long List of Route Options

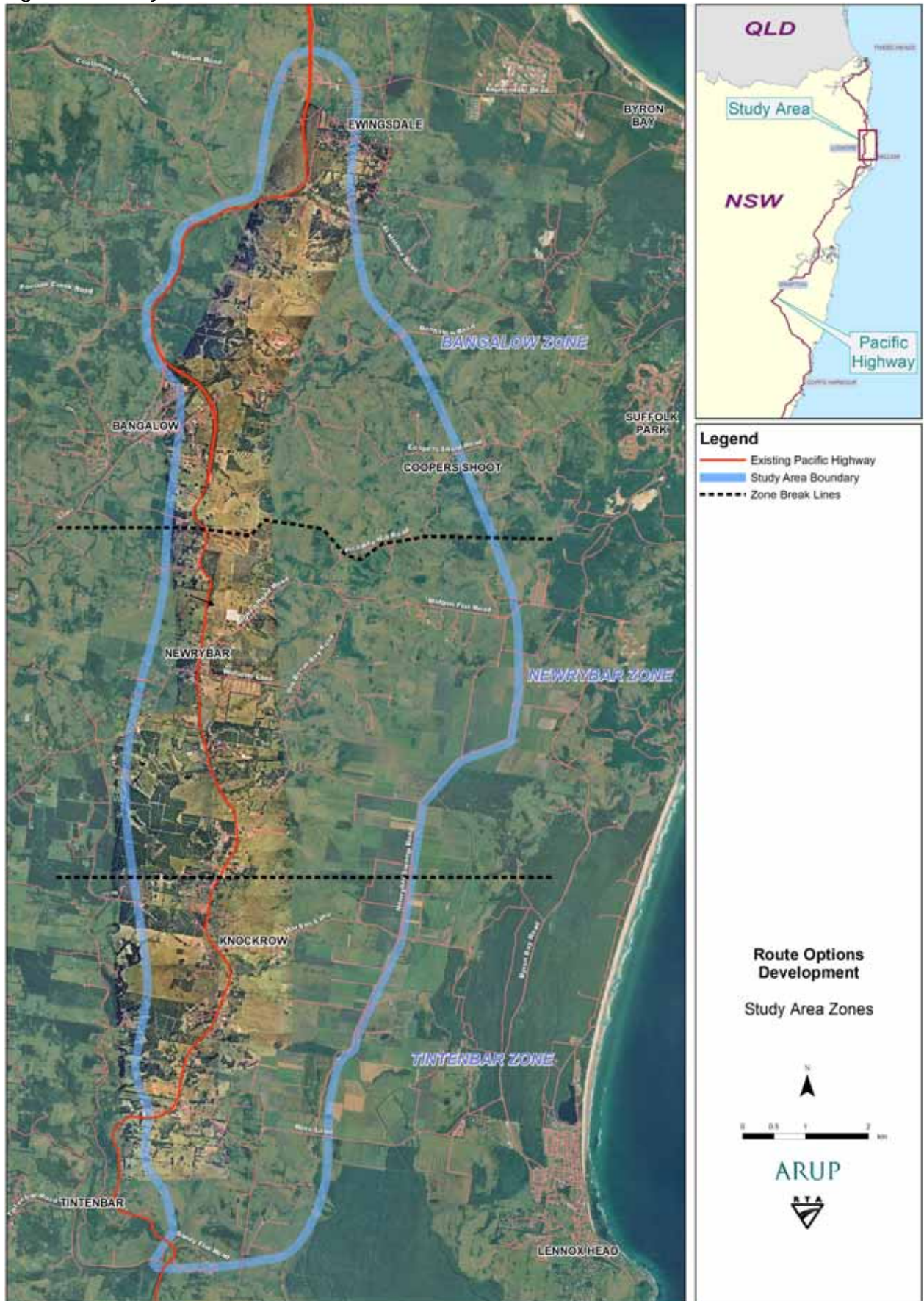
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The selected long list of route options is shown in **Figure 6.2**. The long list is made up of sections and there are some eight to ten section combinations in each of the zones. Locations where it is possible to cross from one section to another are shown as 'nodes'. For ease of presentation, the figure combines the sections into 13 options (A-M). However, through the multiple combinations of the various sections, it is possible to develop over 200 options from the long list.

Option L, shown on **Figure 6.2**, generally follows the existing Pacific Highway. In the Bangalow zone, Section L4 incorporates 'Option B Modified' from the Bangalow to St Helena Environmental Impact Statement (EIS).

The long list of route options are described in the following sections.

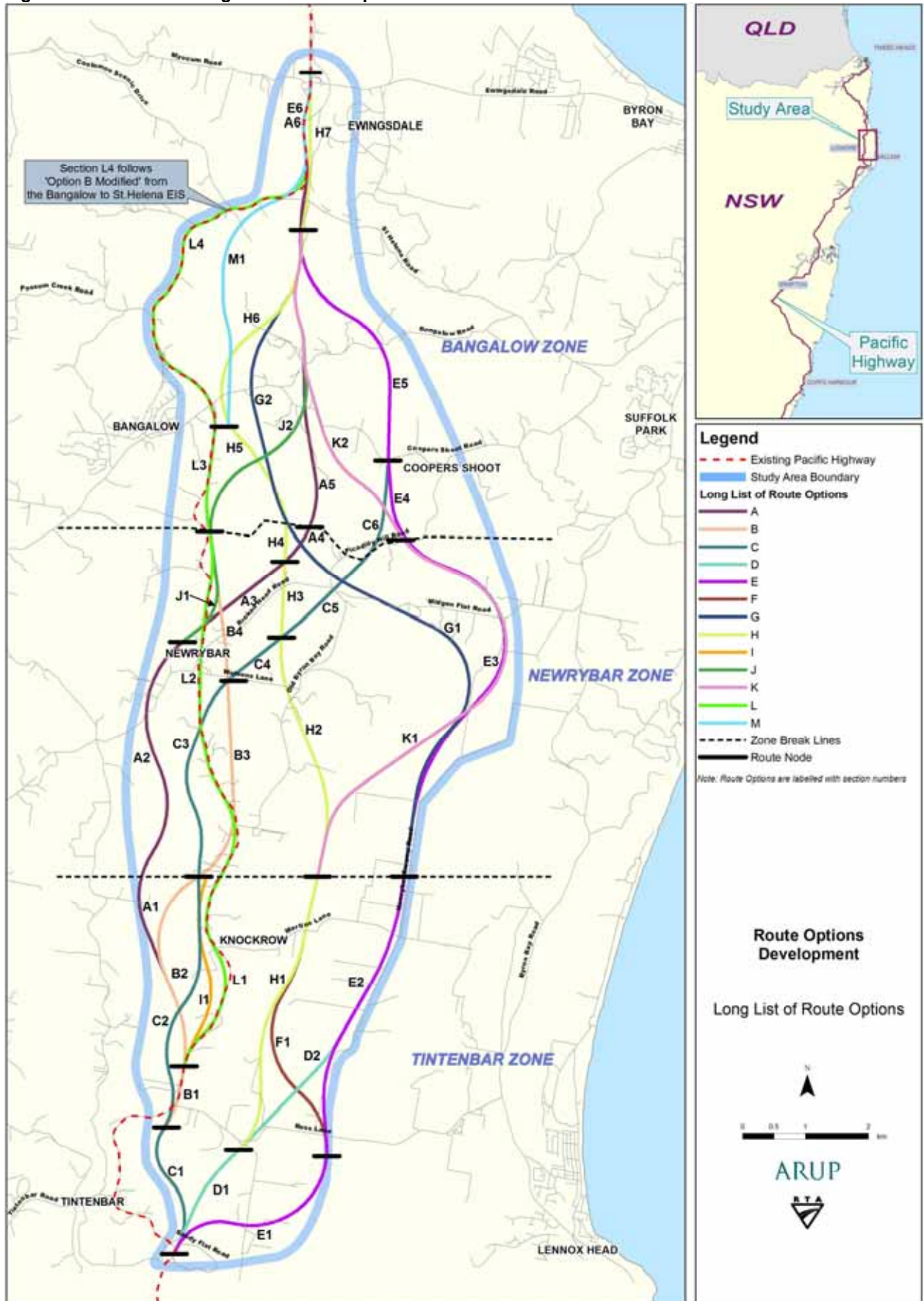
Figure 6.1 Study Area Zones



**Table 6.1 Key Characteristics by Zone**

Zone	Characteristics
Tintenbar	<ul style="list-style-type: none"> <li>• Urban investigation area, including Cumbalum Ridge proposal</li> <li>• Lower reaches of Rous Water's Emigrant Creek Catchment</li> <li>• Areas of geotechnical instability on the eastern escarpment</li> <li>• Ballina Shire Council escarpment protection zoning 7(d1)</li> <li>• Rous Water reservoir and treatment facility at Knockrow, as well as supply pipelines from the west</li> <li>• Telstra's optic fibre cable follows the existing highway</li> <li>• Prominent hills and ridges across the plateau</li> <li>• Contiguous residential clusters along the existing highway, Ross Lane and Martins Lane</li> <li>• High value terrestrial ecology on the coastal plain and Sandy Flat</li> <li>• PAD on the coastal plain</li> </ul>
Newrybar	<ul style="list-style-type: none"> <li>• Newrybar Village and school</li> <li>• Upper reaches of Rous Water's Emigrant Creek Catchment</li> <li>• Areas of geotechnical instability on escarpment</li> <li>• Ballina Shire Council escarpment protection zoning 7(d1)</li> <li>• State significant farmland</li> <li>• Macadamia Castle</li> <li>• Hogans Bluff, an area of high value terrestrial ecology</li> <li>• Prominent hills and ridges across the plateau</li> <li>• Proposed Road Reserve Zoning 9A (extends for about 1.5 km on the eastern side of the existing highway to the north of Newrybar)</li> <li>• Contiguous residential clusters along the existing highway, Old Byron Bay Road, Broken Head Road and Midgen Flat Road</li> <li>• Isolated high value terrestrial ecology on the coastal plain, escarpment and Emigrant Creek areas</li> </ul>
Bangalow	<ul style="list-style-type: none"> <li>• Bangalow Village</li> <li>• Ewingsdale residential area</li> <li>• Coopers Shoot residential area</li> <li>• Proposed Road Reserve Zoning 9A (extends for about 1.5 km on the eastern side of the existing highway to the north of Newrybar)</li> <li>• Areas of geotechnical instability on the northern escarpment of St Helena</li> <li>• Byron Shire Council scenic escarpment zone 7D</li> <li>• State significant farmland</li> <li>• Casino-Murwillumbah Railway</li> <li>• Significant hills and ridges across the full plateau including St Helena Hill</li> <li>• Contiguous residential clusters along the existing highway, Piccadilly Hill Road, Coopers Shoot Road, St Helena Road and Bangalow Road</li> <li>• High value terrestrial ecology at Bangalow Creek, St Helena Hill escarpment and other areas</li> <li>• Ewingsdale Interchange</li> </ul>

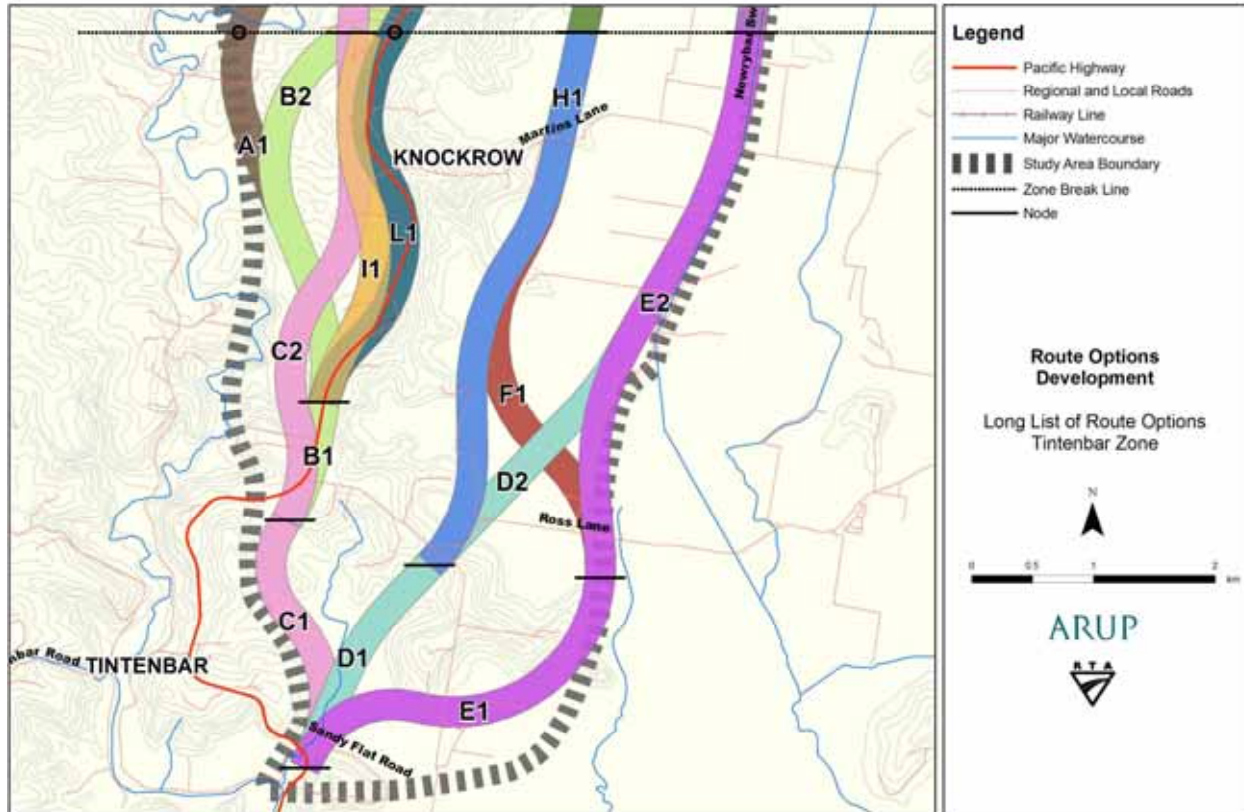
Figure 6.2 Selected Long List of Route Options



6.3.1 Tintenbar Zone Sections

Sections in the Tintenbar Zone are shown in **Figure 6.3**. Options beginning with Section C1 climb the escarpment immediately and remain on the plateau. Section D1 and E1 follow the coastal plain.

**Figure 6.3 Sections in the Tintenbar Zone**



Key characteristics of **plateau options** which begin with C1 are as follows:

- Section C1 follows the approved Ballina Bypass alignment between Sandy Flat and Ross Lane. The horizontal and vertical alignment of this Section approaches minimum design criteria.
- Upgrading of the existing highway south of Ross Lane is not included because of the poor alignment and poor safety record of this area.
- At the south end Section C1 passes through Ballina Shire Council's urban investigation zone.
- The hilly topography on the plateau means that sections would have significant depths of cut and fill.
- The plateau options pass through the Rous Water Emigrant Creek Catchment.
- Section A1 is on the west side of the existing highway and passes close to Emigrant Creek Dam.
- More dwellings would need to be acquired for the options near the existing highway. The majority of the dwellings that would need to be acquired are within 200m of the existing highway.
- Section B1 and L1 follow the existing highway and would therefore have a greater requirement for service/access roads.
- All the plateau options cross the regional wildlife corridor (as do all coastal plain options).

Key characteristics of **coastal plain options** which begin with Section D1 or E1 are:

- Section E1 skirts to the east of the ridge line which Ross Lane follows down from the plateau. Section D1 is a shorter variation which passes through a saddle in this ridge line.

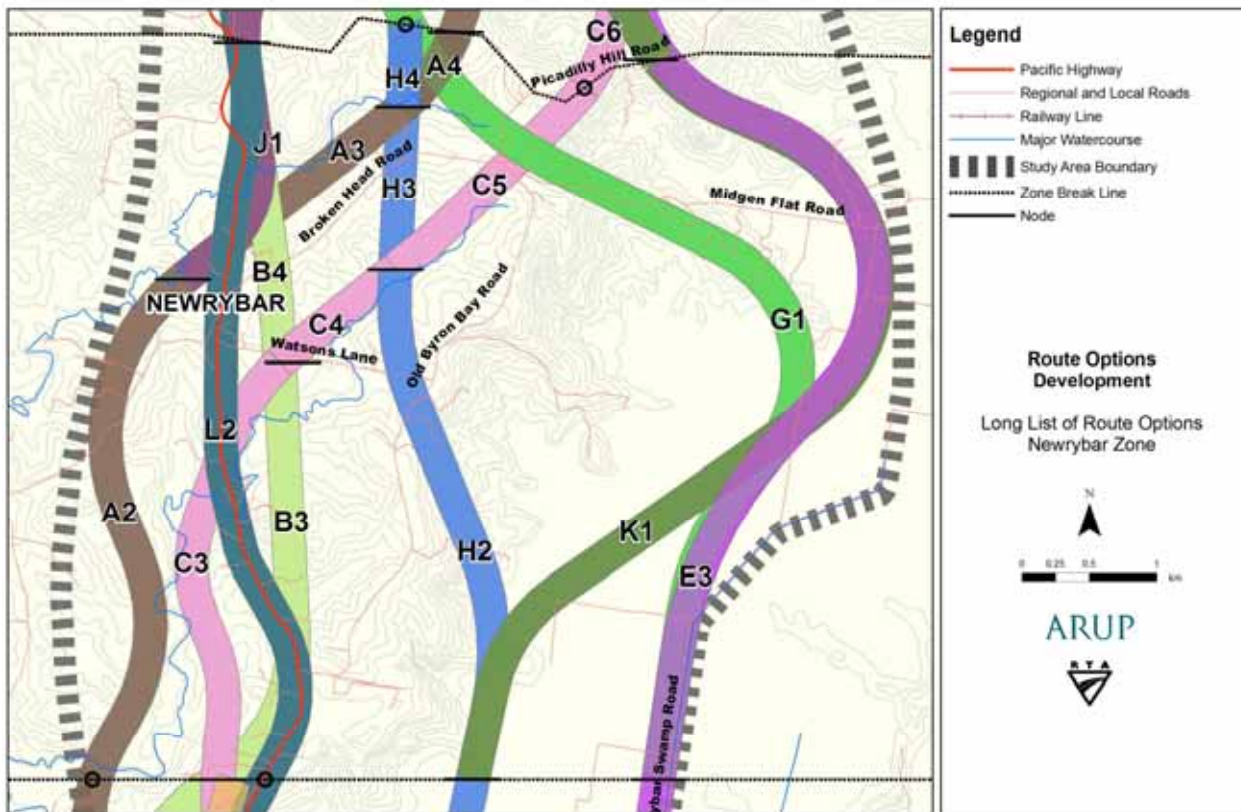
- There is generally less development on the coastal plain and these sections would directly affect fewer dwellings and would require fewer service/access roads.
- All coastal plain options would be raised above existing ground for flood immunity and would have flatter grades.
- On the north side of Ross Lane, Section H1 is located closer to the base of the escarpment while Section E2 follows Newrybar Swamp Road on the eastern side of the study area. Section H1 would have less impact on flooding and would require fewer drainage structures compared to Section E2.
- The coastal plain options impact Ballina Shire Council's urban investigation zones to a greater extent than the plateau options. Sections D1 and E1 go through the Council's proposed Cumbalum development. Of the coastal plain options, Section E1 would have the greatest impact on proposed residential areas within the Cumbalum North development proposal.
- Coastal plain sections are separate from the existing highway and would generally require fewer service/access roads.
- Section E1 passes adjacent to the Ballina Nature Reserve.
- All the coastal plain options cross the regional wildlife corridor (as do all plateau options).

#### 6.3.2 Newrybar Zone Sections

Sections in the Newrybar zone are shown in **Figure 6.4**. Key characteristics of the sections include:

- In terms of severance to contiguous settlements:
  - K1 and E3 perform well.
  - A2 and G1 perform mid-range.
  - B3, C3, H2/H3 perform poorly.
- Sections L2, C3, B3 and B4 pass in close proximity to Newrybar.
- More dwellings would need to be acquired for the sections near the existing highway (e.g. L2). The majority of these dwellings are within 200 m of the existing highway.
- There is generally less development on the coastal plain and Sections H2, K1 and E3 would directly affect fewer dwellings and would require fewer service/access roads.
- The options located on the plateau cut across the east-west valleys and ridges, and generally have greater cuts and fills compared to options in the coastal plain.
- Options away from the existing highway generally require fewer service/access roads
- All plateau options traverse the Rous Water Catchment.
- Floodplain options are raised above existing ground for flood immunity and have flatter grades.
- Sections H4, A4 and G1 pass through areas designated as State Significant Farmland.
- Sections A2-J1, B3-B4 and E3 have less of an impact on vegetation than other sections in the zone.
- Section G1 and C5 perform poorly in terms of impact on vegetation.
- Sections L2, J1 and B4 follow an area of 9(a) zoning for future highway development.

Figure 6.4 Sections in the Newrybar Zone



6.3.3 Bangalow Zone Sections

Sections in the Bangalow zone are shown in **Figure 6.5**. Key features of the sections include:

- There are no clear differentiators by section, but significant engineering challenges exist in this zone.
- In terms of severance to contiguous settlements:
  - Sections L3 and H6 perform well.
  - Sections C6 and E4-E5 perform mid-range.
  - Sections A5, A6, G2, H7, J2 perform poorly.
- All sections cut across east-west valleys and ridges.
- All sections have significant depths of cut and fill across the plateau.
- Sections L3 and J2 (part) follow an area of 9(a) zoning for future highway development, but the zoning may not be wide enough and grades would approach the maximum permissible values.
- Sections following the existing highway come in close proximity to Bangalow.
- Central Sections J2, H5, G2 and A5 pass through areas designated as State Significant Farmland.
- Geotechnical issues, high constraint ecology, topography, aesthetics and contiguous settlements limit feasible options for crossing St Helena Hill.
- Section L4 follows the Bangalow to St Helena EIS Option B Modified. It does not conform to the design criteria set out in **Section 4.3**.
- Apart from Section L4, the only non-tunnel section is M1. Section M1 follows the alignment of 'Option F Modified' from the Bangalow to St Helena EIS where it passes through St Helena ridge.

- All options, except for L4 and M1, pass under St Helena Hill in a tunnel, with the southern approach affecting businesses on the south side of St Helena.
- Based on the geotechnical and engineering investigations, the tunnel length would be relatively short, probably in the range 200 to 300 m depending on portal treatments.
- Three sections were identified for the northern approach to the tunnel. In each case the tunnel would be about the same length and the portals would be in about the same location:
  - Section E6 retains the 900 m of existing duplication that climbs at a 6% grade south from the Ewingsdale interchange, connecting to the south end of this duplication. At this point the grade reduces to 1.8% then increases to 4.4% as it climbs to the tunnel portal.
  - Section A6 is the same as E6 but maintains a steady 3% grade from the south end of the existing duplication. This section would require fill or a viaduct on the approach to the portal.
  - Section H7 involves reconstruction all the way from the Ewingsdale Interchange at a flatter 4.4% grade, on an alignment slightly closer to Ewingsdale. The total length of reconstruction increases but the existing highway could be retained for Bangalow traffic as well as other local traffic.
- Options from Ewingsdale Interchange to St Helena Hill on the west side of the existing highway are not feasible because of adverse geotechnical conditions.
- More dwellings would need to be acquired for the Sections near the existing highway (e.g. L3-L4). The majority of these dwellings are within 200m of the highway. H5-L4 also performs poorly. E4-E5 performs well.
- Most options have an impact on the high value vegetation in this zone as it is scattered from east to west across the study area.

**Figure 6.5 Sections in the Bangalow Zone**

