New South Wales Government

RTA

Iluka Road to Woodburn

Upgrading the Pacific Highway

PREFERRED CONCEPT DESIGN REPORT
JULY 2008

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Pacific Highway Upgrade
Iluka Road to Woodburn

Preferred Concept Design Report

Final – July 2008

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Glossary

AADT	Annual average daily traffic volumes
ABS	Australian Bureau of Statistics
ADT	Average daily traffic volumes
AEP	Annual exceedance probability
AHD	Australian height datum
ANZECC	Australian and New Zealand Environment Conservation Council
ARI	Average recurrence interval (for rainfall events)
At-grade	At the same level; eg a t-intersection or seagull
B-double	A combination road vehicle consisting of a prime mover towing two semi-trailers
BCR	Benefit cost ratio
BH	Bore hole
CIS	Community information session
Class A	Divided road with at least two lanes in each direction and shoulders and some direct accesses
Class M	Divided road with at least two lanes in each direction and shoulders with no direct accesses and with flyover type interchanges
CLG	Community liaison group
CMP	Conservation Management Plan
CDR	Concept Design Report – Published March 2006 (ISBN 1920907661)
Concept design	Initial alignment for consultation with community and other stakeholders. Concept design has been developed for the upgrade of the Pacific Highway between Iluka Road to Woodburn
Preferred Concept Design	Revised Concept Design alignment following consultation with community and other stakeholders in March 2006.
CRAFTI	Comprehensive Regional Assessment Aerial Photograph Interpretation vegetation maps
dB(A)	Decibel. Unit used for 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear
DECC	Department of Environment and Climate Change (comprising National Parks and Wildlife Service and Environment Protection Authority)
DNR	Department of Natural Resources
DoP	Department of Planning
Dual carriageway	Double lane divided road
DPI	Department of Primary Industries (NSW Fisheries, NSW Agriculture, NSW Forests)
DHV	Design hour volume
EEC	Endangered ecological community
EA	Environmental assessment
EIS	Environmental impact statement
Endangered	Species listed as 'endangered' under the *Threatened Species Conservation Act 1995*
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC	*Environmental Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically sustainable development
Flyover	An overpass to enable separation of main road traffic and minor crossing traffic
FMZ	Forest Management Zones
Grade-separated	Refers to roads constructed at different levels such as flyovers, interchanges and overpasses
Gradient	Angle of accent of decent expressed as a percentage ratio
Horizontal alignment	Refers to the road geometry on a flat plain i.e left and right hand bends in a road and connecting straights.

Glossary (cont.)

hr	Hour
Interchange	Any junction enabling movements between the main road and a minor road
km/h	Kilometres per hour
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local government area
LOS	Level of Service
MLEP	Maclean Local Environmental Plan 2001
Model Provisions	*Environmental Planning and Assessment Model Provisions 1980*
Mvkt	Million vehicle kilometres travelled
NPWS	National Parks and Wildlife Service
NRMA	National Roads and Motoring Association
NSW	New South Wales
PADS	Potential archaeological deposits
pc/h	Passenger cars per hour
PFM	Planning focus meeting
pH	Value taken to represent acidity or alkalinity of an aqueous solution
PHUP	Pacific Highway Upgrade Program
PVB	Present value of benefits
PVC	Present value of costs
REP	Regional Environmental Plan
RL	Reduced level
RRLEP	*Richmond River Local Environmental Plan 1992*
RTA	Roads and Traffic Authority
Seagull	T-intersection on a divided road with deceleration and acceleration lanes in the median
SEPP 4	*State Environmental Planning Policy No. 4 – Development Without Consent and Miscellaneous and Complying Development*
SEPP 14	*State Environmental Planning Policy No. 14 – Coastal Wetlands*
Service road	Through route adjacent to Class M providing a link to access roads and local communities
Shoulder	The area beside a main road where a driver can stop in an emergency
Threatened	Species listed as 'threatened' under the *Threatened Species Conservation Act 1995*
T-intersection	Where one road meets another without crossing it, forming the shape of a letter 'T'
TSC Act	*Threatened Species Conservation Act 1995*
TSS	Total suspended solids
U-turn bay	Facility to enable one to turn and travel in the opposite direction
Vertical alignment	Refers the changes in grade of a roadway, i.e vertical curves and connecting Grades, up or down.
VOC	Vehicle operating costs
vpd	*Vehicles per day*
Vulnerable	Species listed as 'vulnerable' under the *Threatened Species Conservation Act 1995*

Executive Summary

The Pacific Highway is part of the National Land Transport Network. By 2009, the NSW Government will have spent $2.45 billion and the Australian Government $1.45 billion towards the upgrade of the Pacific Highway.

Currently 267 of a total 679 kilometres are now double-lane divided road. A further 87 kilometres are under construction. The remaining kilometres are either approved for construction or have had a preferred route identified. (Refer to Figure A).

The Iluka Road to Woodburn section of the Pacific Highway forms part of the Pacific Highway Upgrade Program. The Iluka Road to Woodburn project involves the proposed upgrade of approximately 33 km of the Pacific Highway on the North Coast of NSW. The project commences approximately 500 m north of Iluka Road and ends approximately 1.5 km south of Woodburn near Trustums Hill. The aim of the project is to upgrade the highway to a high standard dual carriageway facility mainly using the existing road corridor and by means of duplication of the existing carriageway. The study area is shown in Figures B and C.

This section will join the Wells Crossing to Iluka Road section to the south and Woodburn to Ballina section to the north.

Purpose of the report

This report provides information regarding the development of the preferred concept design for the Iluka Road to Woodburn section of the Pacific Highway Upgrade Programme. This report provides information on the investigations undertaken and the constraints considered in the refinement of the concept design following its issue and subsequent public consultation in March 2006.

Project development

The Iluka Road to Woodburn section of the highway has undergone a process comprising the following:

- Concept Design Report (March 2006).
- Specialist investigations for the development of the concept design and preferred concept design of the route.

Following completion of the concept design phase, further development of the project will be required. These activities could include:

- Environmental assessment
- Property acquisition
- Detailed design
- Further specialist investigations for both the environmental assessment and detailed design phase
- Preparation of construction tender documentation
- Construction of the project

Investigations informing the preferred concept design

A range of investigations have been undertaken in preparing the concept design and the preferred concept design. Investigations include; flora and fauna, non-indigenous heritage, indigenous heritage, traffic and transport, geotechnical, hydrology and hydraulics, public utilities and property impacts.

Key issues arising from the concept design are as follows:

- Impacts on threatened flora species, particularly *Melaleuca irbyana*
- Fauna habitat fragmentation and loss of key habitat
- Impacts on items of heritage significance

- Impacts on items of Aboriginal significance
- Impacts on and acquisition of private property
- Access arrangements

Project description

The project length is 33 km, comprising 27 km of duplication and 6 km of deviation, with 25 km of full reuse of the existing highway. Under current planning the project will have a number of at grade intersections, five bridge creek crossings on the main alignment and one overbridge carrying local traffic over the main alignment at a grade-separated interchange at the northern end.

Design Standards

Two highway upgrade scenarios are being considered as part of the project:

- Arterial road style (referred to as Class A) — two lanes in each direction (median width to accommodate future upgrading to three lanes in each direction), 100 km per hour posted speed, limited access condition roadway with at grade intersections.

- Motorway style (referred to as Class M) — two lanes in each direction (median width to accommodate future upgrading to three lanes in each direction), 110 km per hour posted speed, controlled access condition roadway with grade separated interchange access, and a continuous alternative route.

The arterial style is likely to be adopted in the first instance with further upgrading to the motorway style design potentially occurring at some time following the initial upgrade.

Staging

It is likely that the project will be staged, during the development of the initial upgrade to allow for appropriate consideration of funding, road user safety and construction constraints.

Refinement of the route following publication and consultation of the concept design

The Iluka Road to Woodburn project was announced in October 2004 and the concept design displayed in March 2006.

Following community responses to the published concept design in March 2006 and further investigations, there have been a number of changes to the design to form the preferred concept design. These include but are not limited to:

Strategic changes:

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined u-turn, crossover facilities located at an average of 3 km at:
  - CH 58.000.
  - CH 61.800.
  - CH 65.000.
  - CH 68.500.
  - CH 70.800.
  - CH 73.600.
  - CH 77.300.
  - CH 81.300.
  - CH 81.300 with u-turn north to south only.
  - CH 87.450.
- Bus stops added to egress side of selected side roads.

Specific design changes (from south to north):

- Iluka Road access to be designed to connect final dual carriageway under Wells Crossing to Iluka Road Project, as a result Banana Road would connect to the Iluka Road Interchange via a new slip road.
- U-turn located at CH 59.400 just north of Mororo Road.
- Rest area just north of Mororo Road to be retained under Class A only.
- Southbound rest area to be shifted 30 m north to reduce environmental impact.
- Jacky Bulbin Road seagull to include u-turn.
- Offline section realigned to conform with revised cadastral information.
- Median right turn added at CH 65.650 into private access.
- Merge Taper added at Serendipity Road.
- Median right turn added at CH 80.400 into Cypress Road.
- Cut at New Italy reduced to decrease impact on area, including *Melaleuca irbyana*.
- Road realigned between Cypress Road and New Italy Road to reduce land acquisition and impact of mango trees. Retaining wall added to eliminate batter adjacent to mango trees and well.
- Access to four properties 300 to 600 m north of Cypress Road to be combined to one egress only.
- Parking area to be formalised at New Italy to enable parking for 60 vehicles.
- Median right turn added with u-turn facility at Whites Road.
- Bend at Gap Road realigned to 1000 m to reduce impact on western side.
- Cut at New Italy reduced to decrease footprint and impact on area.
- U-turn located at CH 85.800 Nortons Road.
- Parallel service road from Wondawee Way to Trustums Hill Road added.
- Major design change at northern tie-in due to excessive material requirements for the Woodburn to Ballina project. Full dumbbell interchange to be incorporated into design with future north facing ramps.

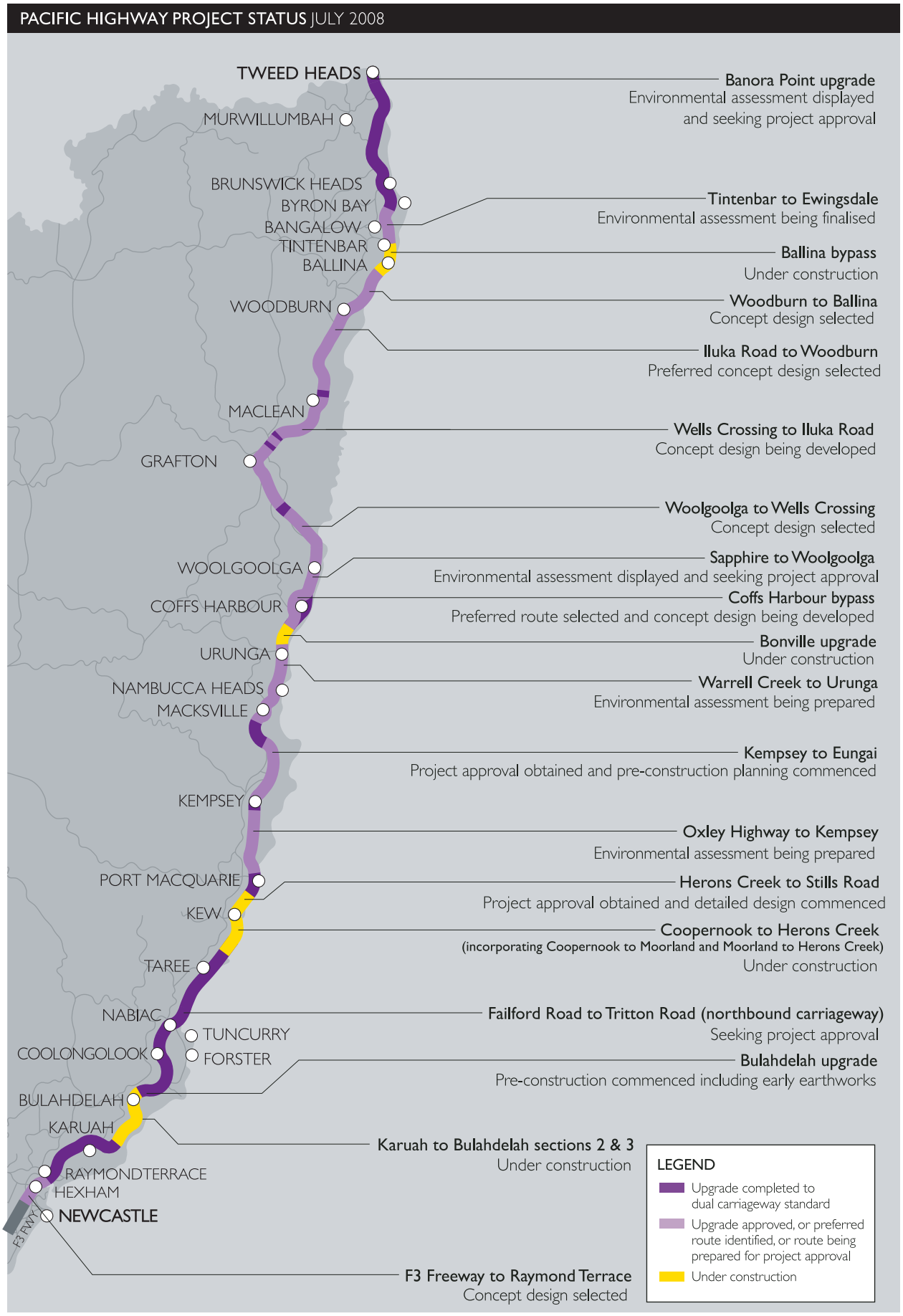
The major design change for the project is the location of a grade-separated interchange between The Gap Road and Trustums Hill Road. Following feedback regarding access to Woodburn and an opportunity to reduce net cut and fill balance of materials for both schemes, the grade-separated interchange has been located 800 m south in order to create a net reduction in fill material required. This has also provided the opportunity for the communities at The Gap Road and Wondawee Way to travel directly to Woodburn via service roads without the need to use the Pacific Highway upgrade when built. The Preferred Concept Design is shown in Figures D1-D5.

Way forward

The information contained in this report provides two key functions:

- Defines a project impact boundary for display in relevant council local environmental plans.
- Provides a basis for the future environmental assessment of the project.

Following the display of the preferred concept design, the Roads and Traffic Authority (RTA) will consider any issues raised. Once this process is finalised the relevant local council will be approached to have the corridor formally reserved in its local planning instrument. The boundaries of the corridor will be based on the final concept design. Detailed environmental assessment will commence and formal planning approval sought closer to construction, the timing of which would depend upon funding availability. Further refinements may occur during the environmental assessment stage of the project and in response to community comments.



N

Figure A

Pacific Highway Upgrade Program as at July 2008

N
0 10km 20km
SCALE

ILUKA TO WOODBURN\1235.09.GE\06.08.07\RC

Figure B

Study Area - North Coast Regional Context

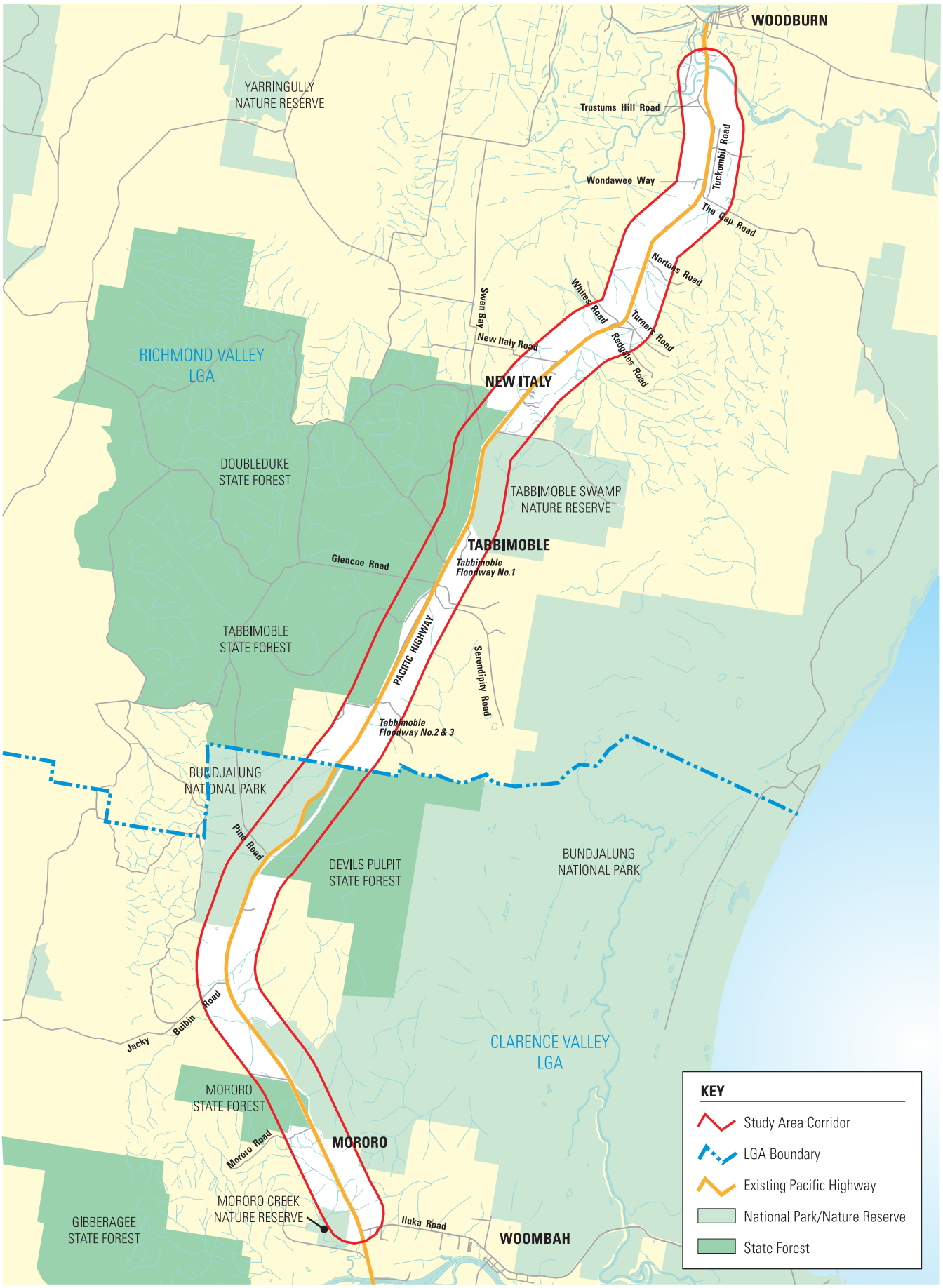


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Figure C

Study area

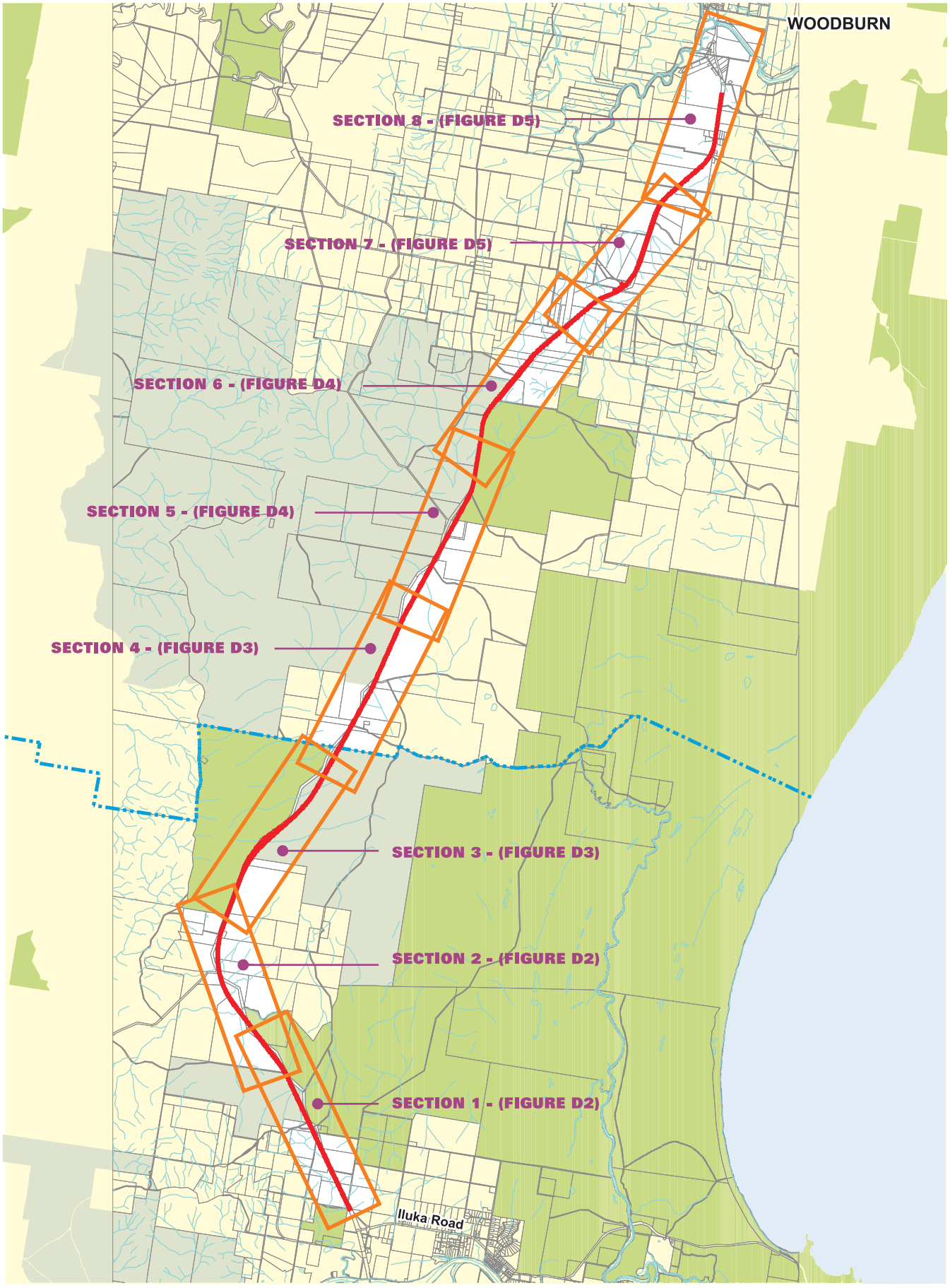

Figure D1

Preferred Concept Design Sections Map - Arterial (class A)

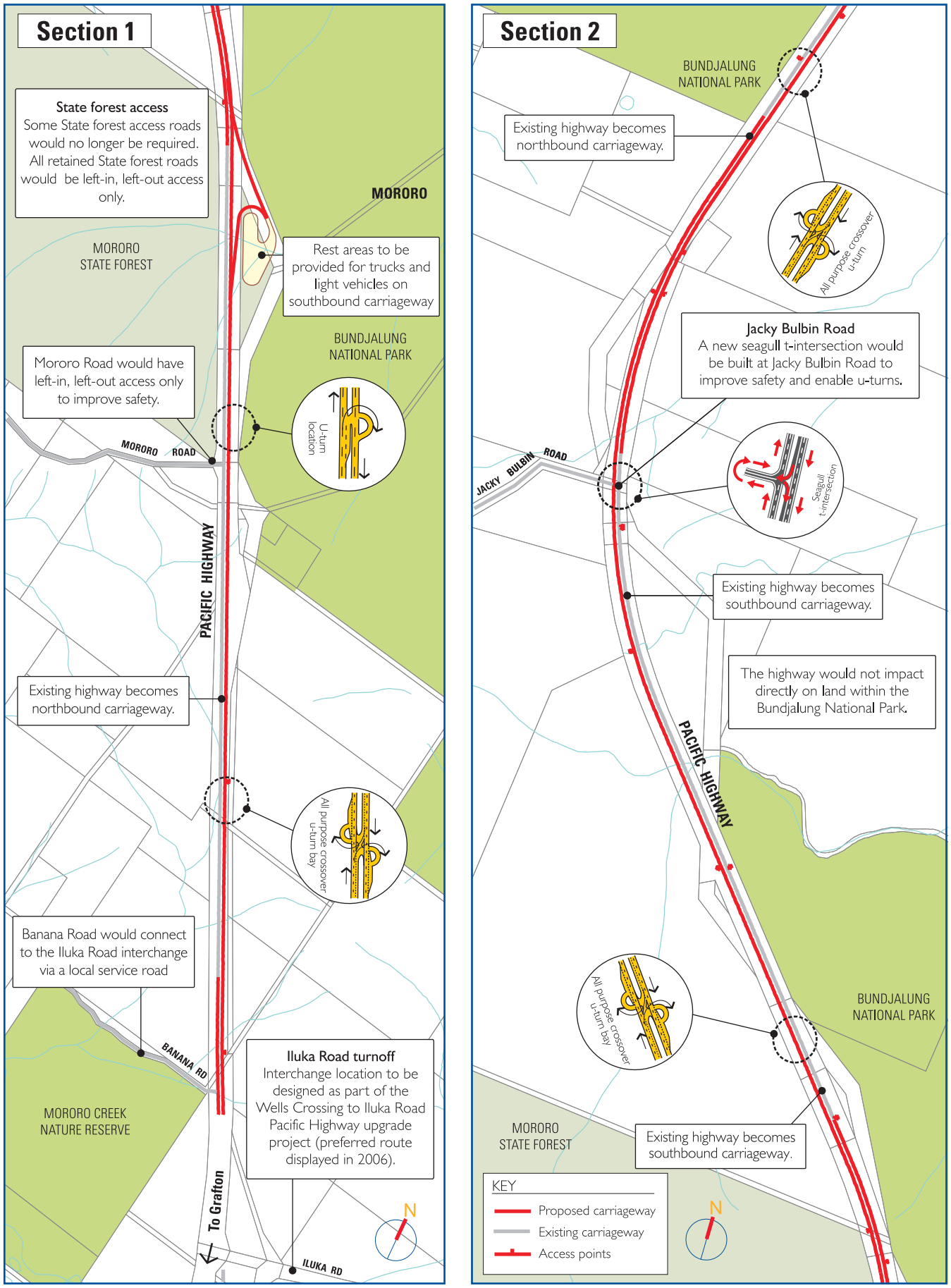

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Figure D2

Preferred Concept Design Arterial (class A)

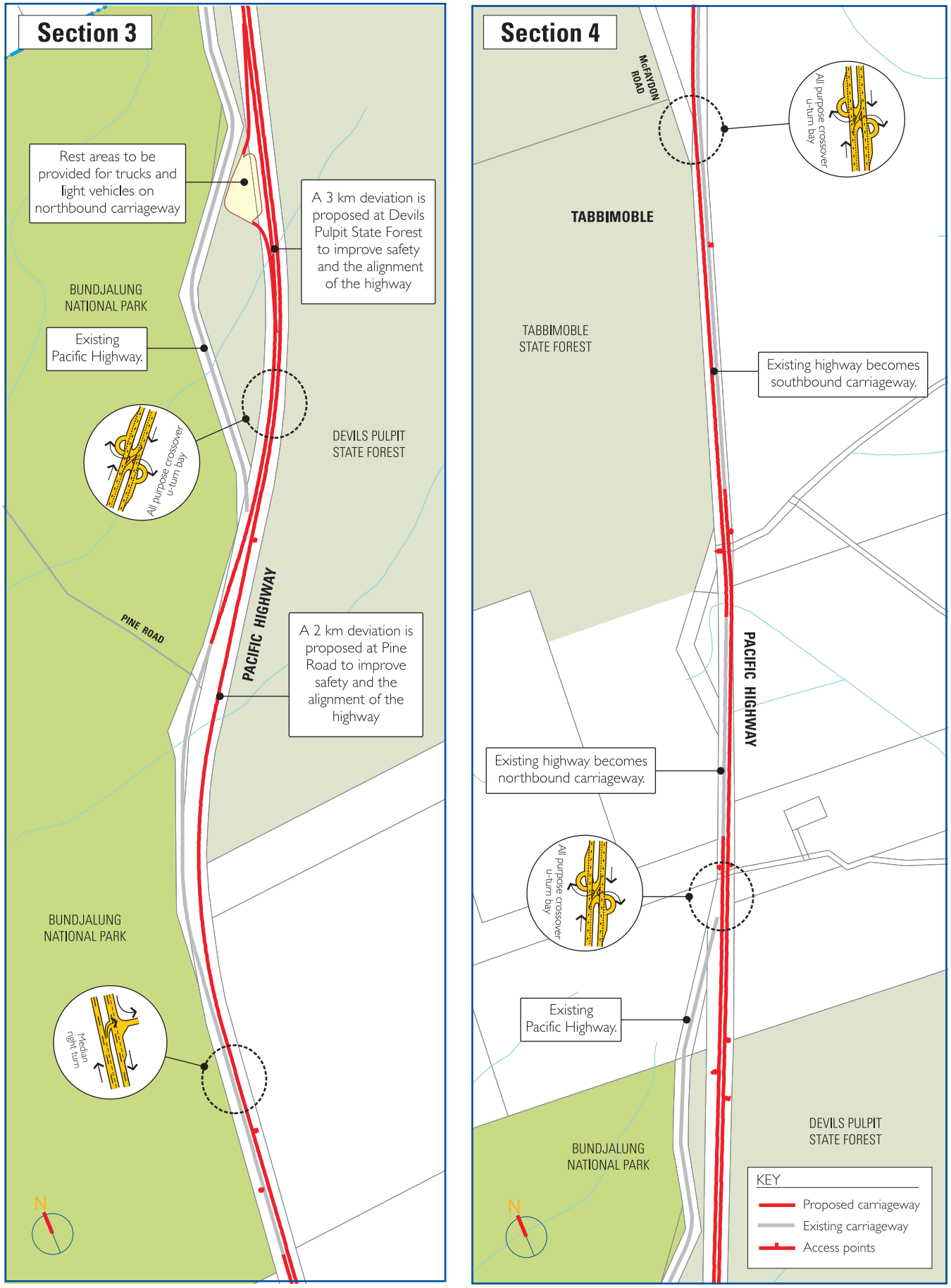

Figure D3

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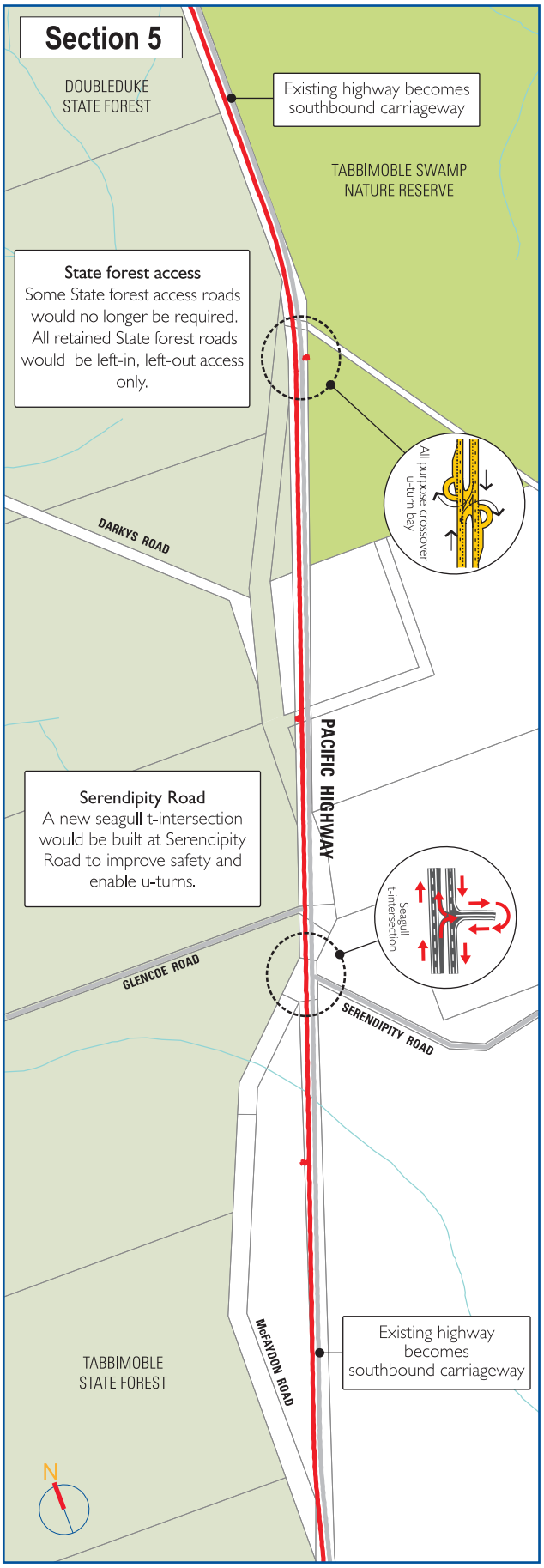
Preferred Concept Design (Arterial (class A)



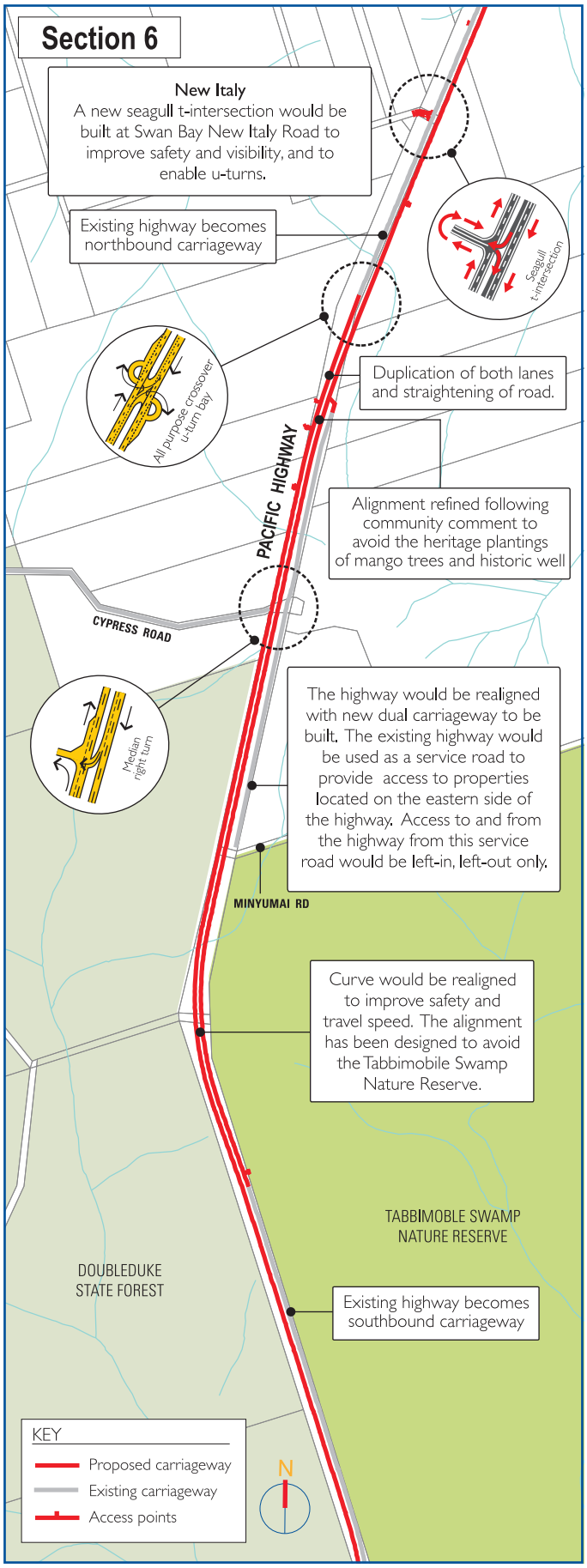


Figure D4

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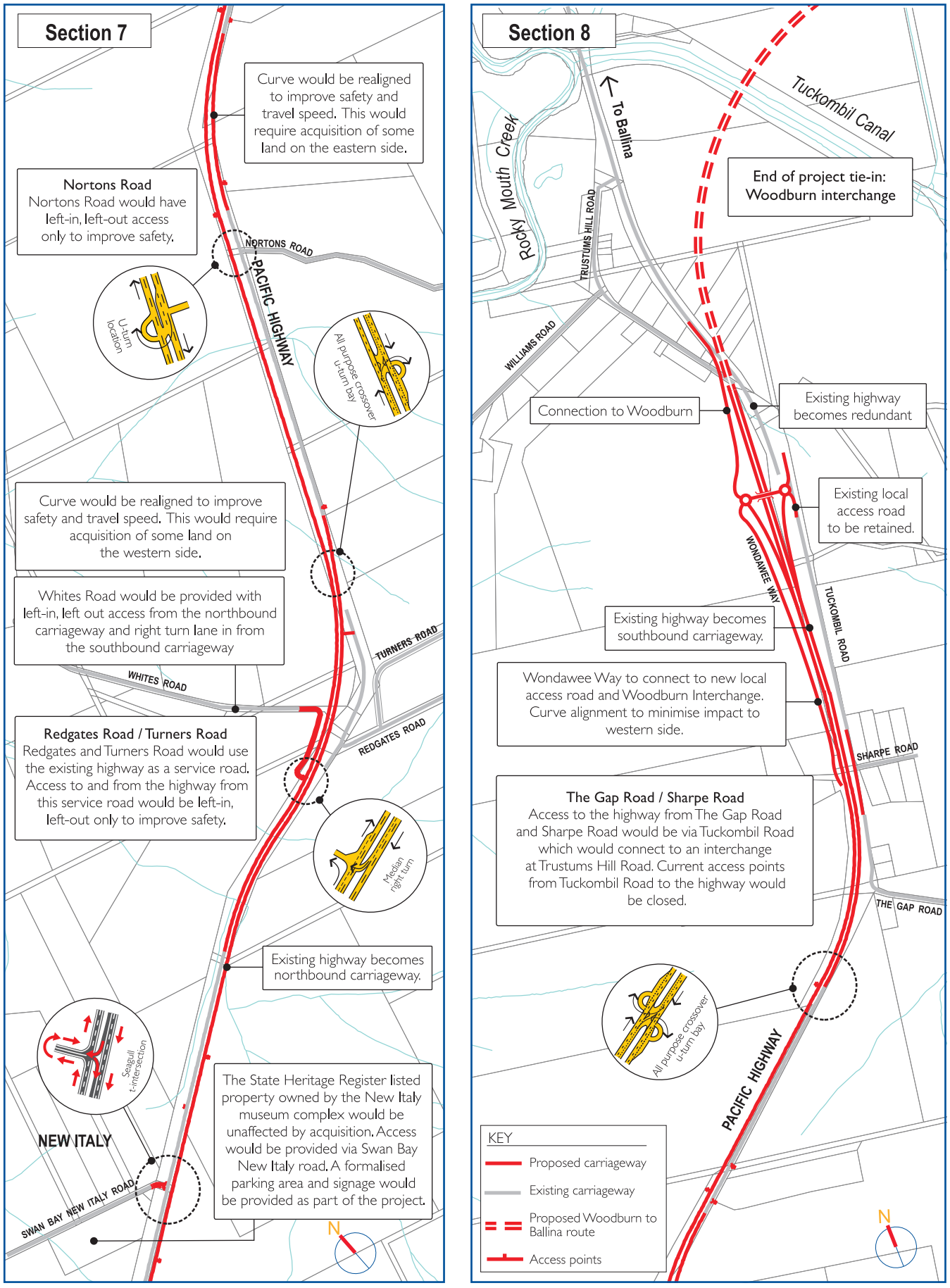
SCALE

Preferred Concept Design Arterial (class A)

ILUKA TO WOODBURN\1235.09.GE\06.08.07\RC



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SCALE

ILUKA TO WOODBURN\1235.09.GE\17.07.08\MAR

Figure D5

Preferred Concept Design Arterial (class A)

1. Introduction

This section provides an outline of the project and describes its context within the greater Pacific Highway Upgrade Program (Pacific Highway Upgrade Program). The study area and process are also outlined along with the general structure of this report.

1.1 The Pacific Highway Upgrade Program

The Pacific Highway is part of the National Land Transport Network. By 2009, the NSW Government will have spent $2.45 billion and the Australian Government $1.45 billion towards the upgrade of the Pacific Highway.

Currently 267 of a total 679 kilometres are now double-lane divided road. A further 87 kilometres is under construction. The remaining kilometres are either approved for construction or have had a preferred route identified. (Refer to Figure A).

The main objective of the Pacific Highway Upgrade Program is to upgrade the Pacific Highway to a high-standard, dual carriageway road for its full length between Sydney and Brisbane. An upgraded Pacific Highway would reduce travel times and improve road safety through the removal of the remaining accident black spots. To this end, the highway has been broken into sections, each of which represents a separate project within the overall Pacific Highway Upgrade Program. As shown in Figure A, there are some 24 individual projects currently in progress, which means that they are:

- In planning.
- Awaiting State Government approval.
- Approved and awaiting construction.
- Under construction.

Between Iluka Road and Woodburn, the Roads and Traffic Authority (RTA) proposes to upgrade the Pacific Highway, generally by following its existing route. This report describes the preferred concept design.

1.2 Project definition

Project:	Upgrading the Pacific Highway Iluka Road to Woodburn
RTA Region:	Pacific Highway Office
Road Name:	Pacific Highway
Road Number:	State Highway 10
Project location:	56.880 km to 89.200 km north of Grafton
Project length:	32.32 km
Local government areas:	Clarence Valley and Richmond Valley Councils

1.3 Route investigations and selection

The project to date has involved two main phases:

a) Route investigations and selection
b) Development of the preferred concept design.

These phases are explained in greater detail in the following paragraphs.

Route investigation commenced with the collection and review of available information about the study area and preliminary investigations of local geography, topography, climate, demographics, and land use. This phase of the project also involved contact and consultation with local residents and businesses. This was critical in establishing an understanding of the study area and establishing the information database on which further studies and investigations could be built.

This phase also involved the examination of the existing highway to assess its condition in terms of the alignment, existing bridges and drainage structure, as well as pavement condition. These investigations identified whether the existing highway could be used as part of the proposed upgrade or whether a new alignment would be needed.

These investigations concluded that a substantial proportion of the existing highway was of a sufficient standard to be used in the upgrade and that an alternative route would conversely have a detrimental effect to the environment, visual intrusion on the landscape and additional impacts to private property. As such, no options were canvassed and the route selection process focussed on achieving an upgrade through the upgrading and/or duplication of the highway through the utilisation of substantial proportions of the existing road and building two new lanes on either the east or west side. A concept design was developed on this basis and displayed in 2006. The results can be found in the Concept Design Report (RTA March 2006).

1.4 Purpose of this report

This report provides information regarding the development of the preferred concept design for the Iluka Road to Woodburn section of the Pacific Highway Upgrade Programme. This report provides information on the investigations undertaken and the constraints considered in the refinement of the concept design following it's issue and subsequent public consultation in March 2006, and seeks to:

- Outline the Iluka Road to Woodburn project in the overall context of the Pacific Highway Upgrade Program.
- Provide an overview of the development of the Iluka Road to Woodburn project to the preferred concept design phase.
- Document the refinement of the concept design following community consultation from March 2006 to develop the preferred concept design.
- Describe the preferred concept design.
- Discuss the processes that will follow the preferred concept design phase of the project.

1.5 The study area

The Iluka Road to Woodburn Project comprises approximately 33 km of the existing Pacific Highway, from the Iluka Road turnoff to the junction of the Pacific Highway and Tuckombil Road at Trustums Hill, approximately 2 km south of Woodburn. The study area, as shown in Figure 1.1, predominantly follows the existing Pacific Highway alignment in a band approximately 1.5 km wide and centred on the existing Pacific Highway corridor.

The southern end of the project adjoins the Pacific Highway upgrade project for Wells Crossing to Iluka Road, while the northern end adjoins the Woodburn to Ballina upgrade project.

1.6 Development of the route

The existing highway route is mostly of a good standard. Therefore, a route concept based on duplication of the existing highway with short sections of new highway where the existing alignment is sub-standard has been used. This includes a 3 km deviation adjacent to the Devils Pulpit State Forest and a 2 km deviation at Pine Road. The RTA has already acquired a corridor of land to the east of the existing highway for this purpose. There would be additional minor land acquisition in certain areas, where the corridor is either too narrow to accommodate the second carriageway, or where realignment for curve straightening is required.

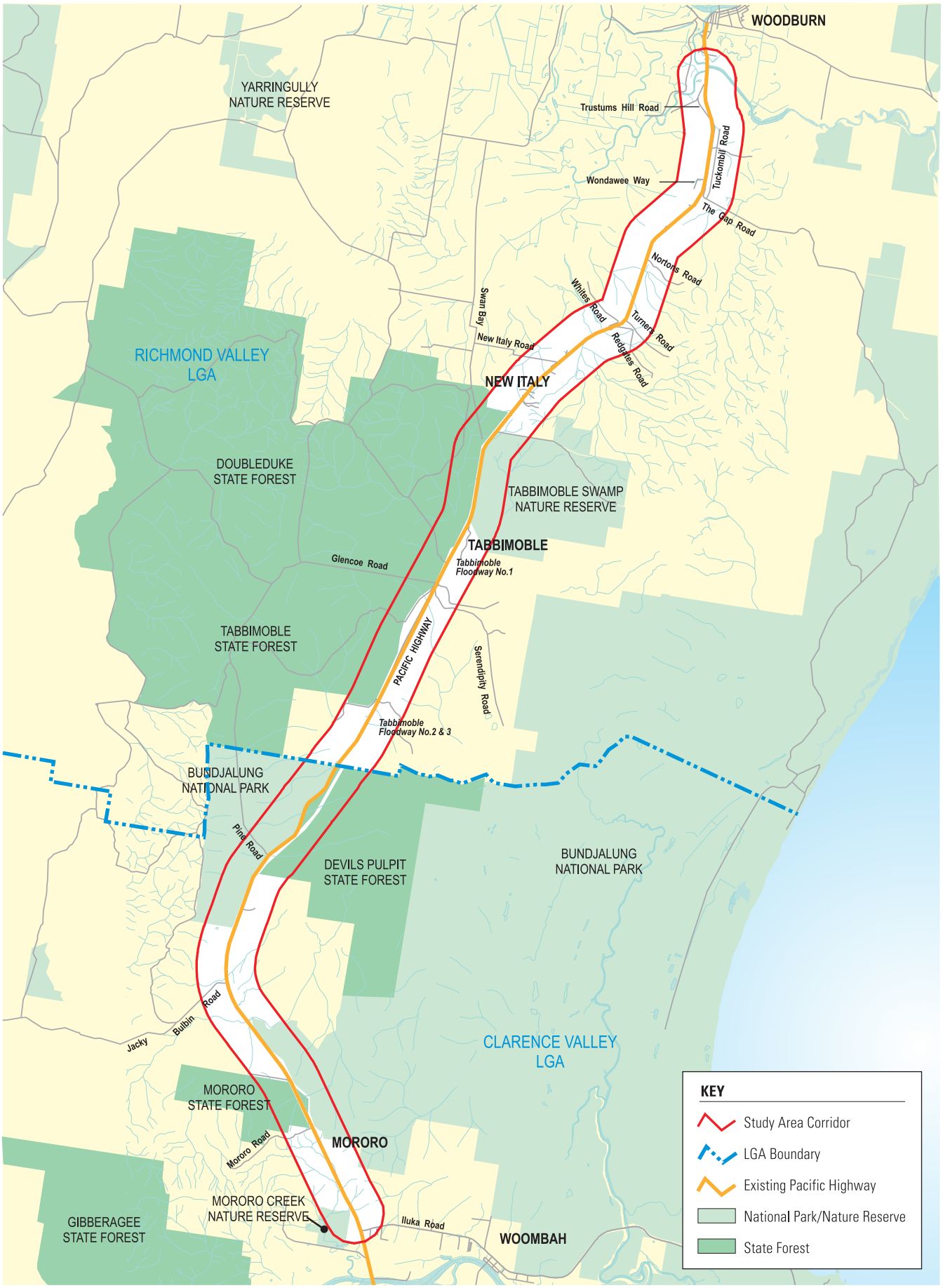

Figure 1.1

Study area

ILUKA TO WOODBURN\1235.09.GE\06.08.07\RC\REV-4

1.7 The study process

The Iluka Road to Woodburn Project was announced in October 2004 and a concept design developed and published in March 2006 for community comment. Development of a proposed preferred concept design for the Pacific Highway between Iluka Road and Woodburn has involved a comprehensive and multi-disciplinary study process. The process is ongoing and will continue throughout the route development. The key components of the study process are as follows:

Preliminary Stage (October 2004-March 2006):

- *Project familiarisation* – collect and reviewing available information; project team orientation and appraisal of the study area; preliminary risk assessment; initial discussions with councils, local communities and other stakeholders.
- *Project objectives and assessment criteria* – establish the project's aims and objectives, and key criteria by which to evaluate options for their achievement of project aims and objectives.
- *Preliminary investigations* – investigate the key technical and biophysical characteristics of the study area including geotechnical, traffic and transport, ecology, heritage, archaeology, land use, planning and zoning, socio-economic, water quality, hydrology, acoustic and survey.
- *Constraints* – identify potential opportunities and constraints to development of an upgraded Pacific Highway through technical and biophysical investigations.
- *Route concept design development* – commence the highway design process.
- *Community and stakeholder input* – inform local communities that the project is underway and invite participation, through open forums and the use of various media and communication channels. Invitations were sent to government agency stakeholders for participation in the process.

Planning focus meeting (PFM), identify issues of relevance and to open dialogue with those agencies.

- *Route concept assessment* – assess the proposed route concept design against project objectives and specific criteria including the potential impacts on the environment and local communities.

Concept Design Display (March-April 2006):

- *Concept design display* – displaying the concept for community participation and feedback. This process included public meetings, face-to-face meetings with landholders and agencies, information boards displayed in public locations and the distribution of project information sheets. Feedback from landholders and the community helped to further refine the project.

Concept Design Refinement (April 2006-July 2008):

- *Community and stakeholder input* - Refining the concept design to address comments by landholders, agencies and other stakeholders
- *Value engineering workshop* – a value engineering workshop was undertaken during the concept design refinement stage involving key members of the RTA and study team. It was conducted to provide a critical evaluation of the concept design.

Preferred Concept Design (July 2008)

A detailed concept and engineering design has been developed, based on the concept design and addresses comments from the community and stakeholders while taking into consideration all relevant constraints and design guidelines.

Next Steps

The key stages following the preferred concept design display are:

- *Environmental Assessment (EA)* – A comprehensive EA would be prepared under the EP&A Act 1979 to identify potential impacts associated with the project. During the EA appropriate mitigation and ameliorative measures will be developed to minimise the environmental impacts of the design, construction and operation phases of the project as far as practicable.
- *Determination and Approval* – a project application will be lodged with the Department of Planning (DoP), for determination and an approval decision by the Minister for Planning under Part 3A of the EP&A Act.
- *Property Acquisition* – Likely to occur nearer to construction, however certainty will be provided to land owners, the community and Councils following display. Support will be sought by Council for the inclusion of land within the LEP's.
- *Detailed Design* – The concept design developed to date may be progressed into a full detailed design with ongoing consultation with the community and stakeholders.
- *Further specialist investigations for both the environmental assessment and detailed design phase* – Further targeted studies will be required to enable refinement of the design nearer to the construction stage of the project.
- *Preparation of construction tender documentation* – Drawings and Construction Specifications may be produced to enable the project to be tendered for construction.
- *Construction* – if project approval is obtained and funding made available, programmed property acquisition, detail design and construction may commence.

Throughout the design refinement process, consultation with the community will continue.

1.8 Report structure

The report follows the structure outlined below:

Chapter 1 Introduction.

Chapter 2 Strategic transportation and planning context of the project, within the overall Pacific Highway Upgrade Program and government strategic transport planning.

Chapter 3 Description of the study area and its biophysical and socio-economic characteristics.

Chapter 4 Discussion of the project objectives and the guiding principles for development of the highway upgrade design.

Chapter 5 The process of and approach to route selection and community involvement.

Chapter 6 Development of the proposed preferred concept design.

Chapter 7 Evaluation of the proposed preferred concept design.

Chapter 8 Description of the proposed preferred concept design, conclusions and recommendations and the process from here.

This report should be read in conjunction with the following reports:

- *Pacific Highway Upgrade Iluka Road to Woodburn - Concept Design Report,* RTA March 2006.
- *Pacific Highway Upgrade Iluka Road to Woodburn - Concept Design Submissions Report*, RTA July 2008
- *Pacific Highway Upgrade Iluka Road to Woodburn - Indigenous Heritage Assessment*, RTA July 2008
- *Pacific Highway Upgrade Iluka Road to Woodburn - Non-Indigenous Heritage Assessment*, RTA July 2008
- *Pacific Highway Upgrade Iluka Road to Woodburn - Preliminary Traffic and Transport Assessment,* RTA July 2008
- *Pacific Highway Upgrade Iluka Road to Woodburn – Ecological Assessment,* RTA July 2008

2. Strategic transport and planning context

Key aspects in relation to transport data and planning requirements have been updated since the release of the Concept Design Report in March 2006. This section provides current information in relation to current and future traffic characteristics and the planning process for the project.

2.1 Existing traffic conditions

Traffic classification counts were undertaken in August 2006 north of Iluka Road and in May 2007 at Tick Gate (12.9 km south of Woodburn) for seven continuous days. Table 2.1 shows the weekday and 7-day Average Daily Traffic volumes (ADT) and Average Daily Heavy Traffic volumes derived from the results of the surveys. Table 2.1 also shows the Annual Average Daily Traffic volumes (AADT) which have been estimated by applying traffic growths to existing counts based on the historical growth at the Tick Gate (RTA permanent count station).

In addition to the counts and classification of through traffic on the highway, surveys of three intersections were undertaken for a 12 hour period (7.00 am to 7.00 pm) on a typical weekday to identify peak hour traffic volumes in 2005. The surveys were carried out at the following key intersections:

- Pacific Highway/Jacky Bulbin Road.
- Pacific Highway/Swan Bay New Italy Road.
- Pacific Highway/The Gap Road.

Table 2.1 Existing traffic volumes – 2007

Location along Pacific Highway	Annual Average Daily Traffic Volume – (AADT) (veh/day)	Average Daily Traffic Volume – (ADT) (veh/day)		Average Daily Heavy Traffic Volume (veh/day)*	
		7-day Average	Weekday Average	7-day Average	Weekday Average
North of Iluka Road	8900	6740	6880	1720 (23%)	2040 (30%)
North of The Gap Road	8530	7210	7460	1660 (26%)	1950 (26%)

* Note: heavy vehicle volume as proportion of ADT is shown in brackets
Source: Connell Wagner, 2007

Table 2.2 shows the traffic volumes along each of the side roads for the AM and PM peaks and for the 12 hour survey period. The low volumes illustrate how these roads generally serve local traffic, and are not used as through routes.

Table 2.2 Traffic volumes along side roads for 12hr period

Side Road	Traffic Volumes (Two Way)		
	AM Peak (veh/hr)	PM Peak (veh/hr)	Traffic Volumes for 12 hour period from 7.00am to 7.00pm
Jacky Bulbin Road	19	16	236
Swan Bay New Italy Road*	24	32	245
The Gap Road	18	16	117

* includes traffic volumes recorded at car park access road to the rest area
Source: Connell Wagner, 2007

The results of the traffic counts and analysis indicate that more than 90% (see Table 2.3) of the traffic travelling within the study area is through traffic (ie it does not have an origin or destination within the study area).

Table 2.3 Through and local traffic comparisons

Location	ADT	Local	%	Through	%
North of Iluka Road	6939	387*	6	6552*	94
North of The Gap Road	7151	599*	8	6552*	92

* Note: as origin-destination surveys were not carried out, these figures are estimates based on ADT (average daily traffic) volumes derived from traffic survey results in 2005.
Source: Connell Wagner, 2007

2.2 Accident statistics

An historical crash analysis was undertaken for the five year period from January 2002 to December 2006 between Iluka Road and Tuckombil Canal. The results of the crash analysis can be summarised as follows:

- A total of 95 crashes occurred, including 12 fatal crashes and 48 injury crashes.
- The majority of the fatal crashes (71% of the fatal crashes) were head-on crashes.
- A total of 20 crashes were reported as speed-related crashes and 23 crashes were reported as fatigue-related crashes.
- A total of 28 crashes involved heavy vehicles, which is an over-representation of heavy vehicles.

The wire rope fences currently being installed in the median of the highway would be expected to reduce the number of head-on collisions within the study area and this measure would also reduce the number of fatal crashes and fatalities.

The following crash rates per 100 million vehicle kilometres travelled (Mvkt) have been calculated for the crashes that were reported between January 2002 and December 2006 within the study area:

- Fatal crashes – 2 per 100 Mvkt.
- Injury crashes – 8 per 100 Mvkt.
- Total crashes – 21 per 100 Mvkt.

The RTA's Economic Analysis Manual (EAM) contains typical crash reductions based on before-and-after studies undertaken by the RTA to test the effectiveness of implementing various alternative road upgrade treatments. The following crash reductions are predicted:

- Since most of the existing fatal crashes are head-on collisions, the majority of these would be expected to be eliminated with the completion of the duplicated highway.
- The reduction in run-off road crashes would be small since the EAM indicates that only 10% of the run-off road crashes would be eliminated by duplicating the highway.
- The EAM indicates that a 30% reduction in rear–end crashes can be expected with the duplication of the highway.
- Based on the current proposal for rest-area provision it is assumed that fatigue-related crashes would continue to occur at the same rate as existing.

One of the project objectives for the proposal is to reduce the crash rate to 15 crashes per 100 Mvkt over the project length. Using the EAM methodology, the current crash rate is predicted to reduced from 21 to 16 crashes per 100 Mvkt for the Class A upgrade proposal as a result of duplicating the highway.

2.3 Future traffic / travel demand

The AADT volume along the highway is predicted to be 11,020 vehicle movements in 2016, and 15,720 vehicle movements in 2036 (20 years after opening). Of these total volumes, heavy vehicle movements make up approximately 2,187 per day (20%) in 2016 and 3,120 (20%) in 2036. Both the total and heavy vehicle traffic movements are therefore predicted to increase by approximately 80% in 2036 compared to existing traffic levels.

2.4 Local road network

Within the study area, the Pacific Highway serves a small, dispersed population that is mainly found in the following locations:

- Banana Road, 36 km south of Woodburn, west side of Pacific Highway.
- Jacky Bulbin Road, 30 km south of Woodburn, west side of Pacific Highway.
- Serendipity Road, 18 km south of Woodburn, east side of Pacific Highway.
- Cypress Road, 12 km south of Woodburn, west side of Pacific Highway.
- Swan Bay New Italy Road, 11 km south of Woodburn, west side of the Pacific Highway.
- Whites Road (west side) and Turners Road (east side), 8.5 km south of Woodburn.
- Tuckombil Road and The Gap Road, 3 to 5 km south of Woodburn, east side of the Pacific Highway.
- Wondawee Way, 3 km south of Woodburn, west side of the Pacific Highway.
- Trustums Road and Williams Road, 2 km south of Woodburn, west side of the Pacific Highway.

Other local roads within the study area serve the extensive areas of State Forest, National Park and nature reserve situated on both sides of the highway.

2.5 Approvals under the *Environmental Planning and Assessment Act 1979*

2.5.1 Part 3A of the Environmental Planning and Assessment Act 1979

Assessment and approval of major infrastructure in NSW, including highway upgrade projects, are controlled primarily under the provisions of the NSW Environmental Planning and Assessment Act 1979. The Environmental Planning and Assessment Amendment (Infrastructure and other Planning Reform) Act 2005 introduced amendments that require major private and government projects to be assessed under Part 3A of the Act. It applies to:
Major infrastructure or other development that, in the opinion of the Minister, is of State or regional environmental planning significance.
Major infrastructure or other development that is an activity for which the proponent is also the determining authority (within the meaning of Part 5) and that, in the opinion of the proponent, would (but for Part 3A) require an environmental impact statement to be prepared under that Part.

The focus of the new Part 3A is on ensuring the appropriate level of community consultation and environmental assessment is undertaken, based on the level of risk or community concern. Part 3A removes the stop-the-clock provisions and the need for single-issue approvals under eight other Acts. It also replaces a separate threatened species assessment with an integrated assessment process.

2.5.2 Critical infrastructure

The 2005 amendments to the Environmental Planning and Assessment Act include the provision that, if Part 3A applies to a project, that project could also be declared critical infrastructure. A "'critical infrastructure" project is a project considered to be essential to the economic, social or environmental welfare of NSW.

The assessment and approval process for critical infrastructure is similar to a Part 3A project, however some notable changes under section 75C:

- Excludes compliance with all environmental planning instruments (except State Environmental Planning Policies specifically relating to the project).
- Excludes third-party appeals under the Act or other environmental protection legislation.

In addition the following orders cannot be made or given to prevent or interfere with the carrying out of an approved project:

- Interim protection orders under the National Parks and Wildlife Act 1974 or Threatened Species Conservation Act 1995.
- Stop Work orders under the National Parks and Wildlife Act 1974, Threatened Species Conservation Act 1995, Fisheries Management Act 1994.
- An environmental protection notice under the Protection of the Environment Operations Act 1997.
- An order under the Local Government Act 1993.

2.5.3 Part 3A, critical infrastructure and the Iluka Road to Woodburn project

On 5 December 2006, the Minister for Planning under 75B(1) of the Act ordered that 13 projects part of the Pacific Highway Upgrade Program, including the Iluka Road to Woodburn Upgrade, be projects to which Part 3A applies. These projects were also declared as Critical Infrastructure under Section 75C of the Act, as being essential to the State for economic and social reasons.

The Part 3A planning approval process is initiated by the submission of a project application to the Department of Planning. A set of environmental assessment requirements is then issued by the Director General of the Department of Planning, in consultation with other government agencies. These environmental assessment requirements outline the key issues which are to be addressed in the Environmental Assessment (EA). After submission of the EA to the Department of Planning, it is placed on public display for a period of no less than 30 days.

At the end of the display, the Department of Planning may provide the RTA with a copy of the submissions received or a summary of the issues raised. The RTA will be asked to respond and may modify the proposal to minimise impacts on the environment as a result of submissions received. If the RTA changes the proposal in response to the issues raised, a Preferred Project Report describing the revised project would be prepared and made publicly available.

The proposal will then be assessed by the Department of Planning and considered for approval by the Minister for Planning. Upon receipt of approval, the RTA will then determine whether or not to proceed with the project.

3. Characteristics of the study area

Further investigations have been undertaken since the release of the Concept Design Report in March 2006, including targeted summer flora and fauna surveys, geotechnical investigations along with indigenous and non-indigenous heritage studies. This section updates the Concept Design Report as a consequence of those investigations.

3.1 Overview of the study area

3.1.1 Regional context

The Iluka Road to Woodburn study area covers 33 km of mostly low-lying rural land between the Clarence and Richmond Rivers, as shown in Figure C. The study area is bounded generally by the Iluka Road turnoff with the Pacific Highway in the south, and Tuckombil Canal to the north. The study area ends approximately 2 km south of Woodburn. The Iluka Road to Woodburn project does not pass through any urban or built-up areas.

Approximately half of the study area lies within each of the adjoining Local Government Areas (LGAs) of Clarence Valley and Richmond Valley. Land use is dominated by State Forest, National Park and Nature Reserve including Bundjalung National Park, the Mororo Creek and Tabbimoble Swamp Nature Reserves, and the Mororo, Devils Pulpit Tabbimoble and Doubleduke State Forests. In the south, private land holdings comprise mostly sugar cane farms interspersed with pockets of grazing land. In the north, there is a greater concentration of rural residential development and numerous small to medium rural holdings. Between New Italy and Woodburn in particular, there is an apparent trend towards smaller rural residential holdings and rural subdivision.

As illustrated in Figures 3.1a and 3.1b, there are established residential communities at:

Woombah – The residents of Woombah occupy a substantial area of land either side of Iluka Road. There are approximately 200 dwellings; however its proximity is south of the southern tie in of this project

Banana Road – the residents of Banana Road occupy an area of land to the west of the highway at its southern tie-in. There are approximately eight households at Banana Road.

Serendipity Road – the residents of Serendipity occupy a substantial area of land between the Pacific Highway and Bundjalung National Park, which is registered under a system of Community Title. There are approximately 12 households at Serendipity, which is the limit of development on the land under the existing development consent.

New Italy – the New Italy community traces its origins to a group of Italian immigrants who settled in the area in the 1880s. The locality retains a strong connection to the past and to its Italian heritage through an active community and the presence of the New Italy Museum and cultural centre adjacent to the Pacific Highway. Swan Bay New Italy Road provides an alternative (low-standard) access between New Italy and Woodburn. New Italy comprises approximately 20 dwellings on medium sized rural allotments.

Whites Road, Redgates Road, Turners Road – Whites Road comprises a cluster of approximately 10 small rural residential holdings in a confined area of mostly cleared land west of the highway. Turners and Redgates Roads provide access to scattered private properties east of the highway.

The Gap Road, Sharpe Road, Tuckombil Road, and Wondawee Way – The Gap Road is one of the only sealed roads of any length in the study area, and connects the highway with the beaches and camping areas within Bundjalung National Park. Sharpe Road is a recent

subdivision of small (1 ha) rural residential allotments adjacent to the eastern side of the highway immediately to the north of The Gap Road. Tuckombil Road is a residual section of the former Pacific Highway, which is now a local road and which has begun to attract new rural residential development close to Woodburn. It comprises approximately 10 dwellings. Wondawee Way is situated opposite The Gap Road on the western side of the Pacific Highway and consists of approximately six dwellings accessed via an unsealed track.

Trustums Hill, Williams Road - Trustums Hill has been identified by Richmond Valley Council as a suitable location to accommodate some future growth in Woodburn's residential population. Existing development at Trustums Hill is focused around the old Pacific Highway, which is now a local road (Trustums Road). It comprises approximately 15 dwellings.

The remainder of the study corridor comprises scattered single residences only. There are no other 'communities' or any concentrations of settlement, that are serviced by roads within the study area although the towns and villages of Woodburn, Evans Head, Woombah and Iluka are located just outside the study area.

3.2 Visual characteristics

Generally, the study area comprises floodplains cut by a variety of creeks. Mountain ranges form the backdrops for views along the highway through the study area, the significant ones being Chatsworth Hill to the south and Mount Doubleduke and Richmond Range to the west. Sugar cane fields are predominant at the southern end of the project. Extensive dense forests of eucalypt, angophera and melaleuca line the highway for considerable lengths.

New Italy provides regional cultural landscape interest. The New Italy Museum Complex is in a pleasant garden courtyard setting, of a scale that is welcoming to and restful for travellers. An earth embankment next to the road edge and the separation to the highway provides an effective acoustic screen. This combined with a stand of significant existing eucalypts presents a pleasant entrance to the New Italy Museum Complex.

3.3 Biophysical characteristics

3.3.1 Topography, geology and soils

Geotechnical investigation of the study area was initially undertaken in 2005. More detailed investigations were conducted in 2007 including 130 test pit excavations and 50 boreholes along the preferred route. The following section of the report presents the findings of the geotechnical investigation and provides a summary of the physical geography of the study area, such as the topography, geology and soils.

3.3.2 Geotechnical investigations

Geotechnical investigations for concept design were conducted from June-August 2007. The work involved subsurface investigation at 180 locations. Boreholes were drilled to investigate deep alluvial soils and also to identify the presence of any potential soft soil and acid sulphate soils, and were excavated into rock to check the suitability for cut materials.

Inspection and mapping of cuttings along the existing highway were also conducted to gather information on adopted batter slopes and their condition.

3.3.3 Investigation results

The elevated and lowland terrain types were defined as 'undulating rises and low hills' (elevated areas) and 'alluvial plains, including floodplains and back swamps' (lowland areas).

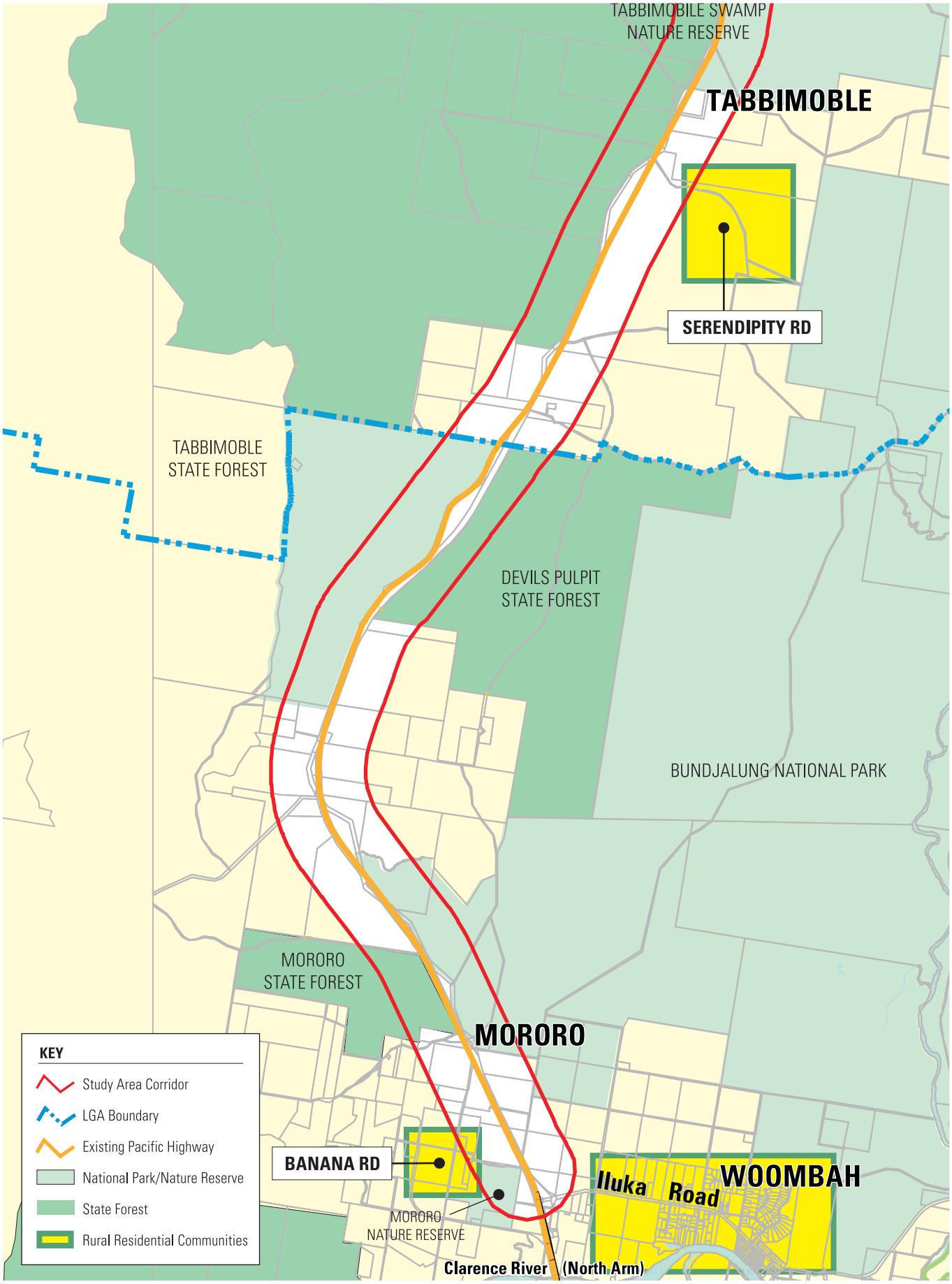

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Figure 3.1a

Rural Residential Communities

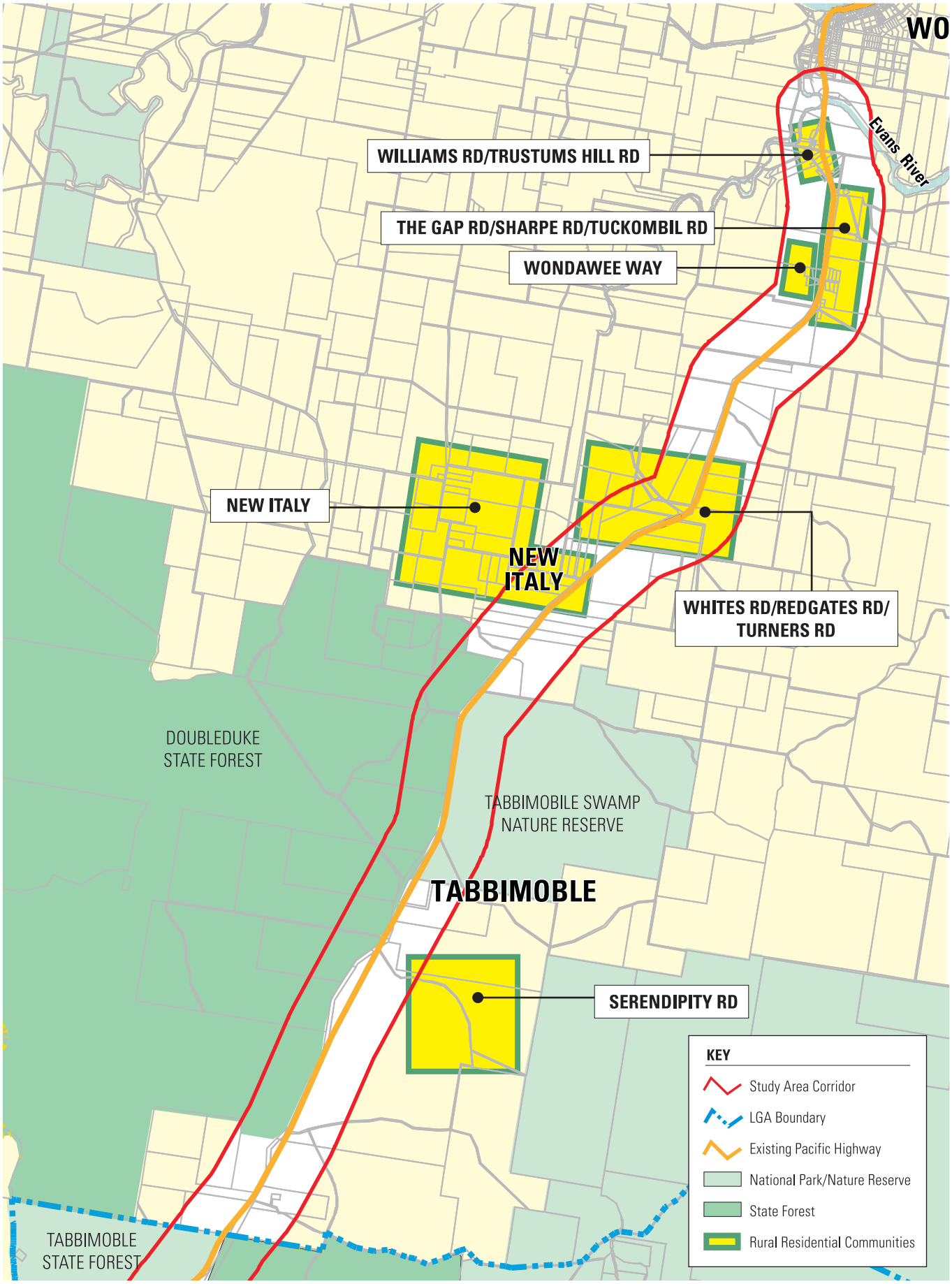

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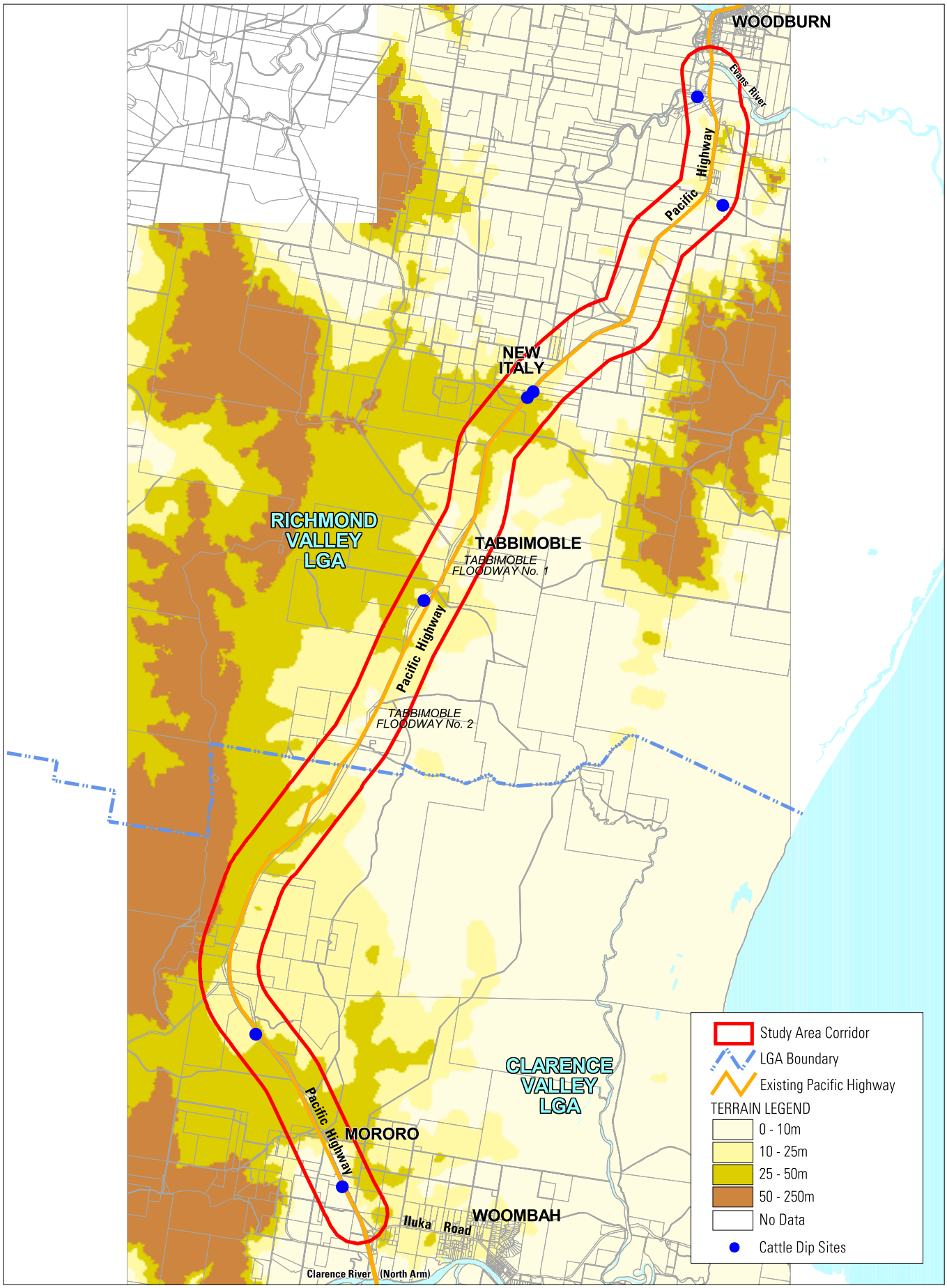
Figure 3.1b

Rural Residential Communities



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Source: Base data - Roads & Traffic Authority 2005
Topography - derived from LPI NSW (10m contours) by Connell Wagner P/L 2005

Figure 3.2

Topography Map

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3.3.4 Undulating rises and low hills

The higher ground through the study area is characterised by weathered soils underlain by bedrock of extremely weathered, low strength sandstone/siltstone. The terrain ranges between 5 m AHD and 40 m AHD, with slopes in the range from 2 to15%.

Soils were found to be stiff to hard clays or sandy clays, between 1 m and 6 m deep, overlying extremely weathered to medium strength sandstone and siltstone.

Potential acid sulphate soils were found in one test location at the southern end of the route and three test locations at the northern end of the route. Potential acid sulphate soils were not found in other locations. Further laboratory testing is underway to identify the extent of acid sulphate soils in the study area where excavations are required for road construction.

3.3.5 Alluvial plains including floodplains, back swamps and aeolian deposits

The alluvial plains are generally flat (slopes less than 3%), and are identified as being at elevations of:

- Reduced Level (RL) 4 m and RL8 m Australian Height Datum (AHD) (northern section. Richmond River, Tuckombil Canal floodplain).
- RL5m – RL10m AHD (Tabbimoble Floodways).
- RL25m AHD (Tabbimoble Creek).

Two main types of alluvial soils were encountered, although all exhibited deep soil profiles with shallow groundwater. Back swamp areas are typically soft, and during periods of high rainfall often become waterlogged and boggy, and are slow to drain.

In the southern half of the route, the alluvial soils comprise firm to very stiff clays, sand clays and dense sands, to typical depths of 12 to 19 m, overlying residual clays, siltstone and sandstone.

In the northern quarter of the route, the alluvial soils are medium dense sands, stiff clays and silts to depths of up to 7 m, overlying residual dense sands to up to 8 m depth, overlying sandstone and shale.

Preliminary results suggest no adverse soil conditions affecting the current preferred concept design which could have resulted in a change in selected cut and fill locations.

3.4 Hydrology and hydraulics

The Pacific Highway between Iluka Road and Woodburn crosses several floodplains and numerous waterways, and consequently this length of the highway experiences flood inundation from time to time. A detailed hydrologic and hydraulic analysis of the flooding behaviour and drainage patterns of the study area is ongoing at the time of preparing this report. The following discussion describes the known drainage characteristics of the study area.

For the purposes of the hydrologic modelling, the study area has been divided into the following portions (from south to north):

- Clarence River floodplain.
- Tabbimoble Creek and Floodways.
- Richmond River floodplain.

The southern section of the project crosses numerous small, ephemeral creeks within the Clarence River floodplain, also exhibiting a highly two-dimensional nature.

The Tabbimoble Creek and Floodway crossings also exhibit a two dimensional nature, flowing from west to east and discharging beneath the highway to a large, low-lying area behind the coastline.

The northern section of the project crosses the Richmond River floodplain, which consists of a relatively complex network of creeks and waterways (including Richmond River, Rocky Mouth Creek, Swampy Creek and Tuckombil Canal) and exhibits a highly two-dimensional nature (i.e. the network of streams extends upstream as well as across a wide catchment). Historically, the highway has been inundated for extended periods at the crossings in the area north of New Italy. This suggests that the downstream system (likely Rocky Mouth Creek or Richmond River) may have been at capacity, preventing local catchment runoff from escaping.

3.4.1 Hydrologic (flooding) analysis

Hydrologic (flooding) modelling was required to generate flood hydrographs for the hydraulic models and included the following:

- Development of XP-RAFTS hydrologic models for each existing crossing, using design rainfall parameters from Australian Rainfall and Runoff (AR&R) and existing catchment information.
- Verification of the hydrologic models to provide confidence in their ability to predict design event discharges. The models were verified using the Rational Method because of the absence of detailed historical observations and records.
- Calculation of peak design event discharge predictions for each crossing, for a range of design event magnitudes in accordance with AR&R.

3.4.2 Hydraulic analysis

Detailed hydraulic models have been prepared for pre- and post-development conditions. These models will be used to:

- Predict existing extents, depths and durations of flood inundation in the vicinity of the highway.
- Identify flood affected structures across the floodplains.
- Design upgraded creek and culvert crossings so that the highway can achieve the required flood immunity.
- Quantify any hydraulic impacts associated with the project – with particular attention to flood-affected properties.

Hydraulic modelling was undertaken using the 1d/2d MIKE FLOOD software package. The Richmond River, Tabbimoble and Clarence River floodplains were modelled in five MIKE FLOOD models in the following regions:

- North of New Italy.
- Tabbimoble Floodway Number 1.
- Tabbimoble Floodway's Numbers 2 and 3.
- Tabbimoble Creek and Overflow.
- Clarence River floodplain north of Iluka Road.

The preliminary results from the above regions are presented below.

North of New Italy

The Pacific Highway north of New Italy is affected by flooding from the Richmond River and local catchments. The local catchment flood levels are affected by the tailwater from Richmond River flood events.

Peak flood levels from Richmond River flood events were obtained from the "Woodburn to Ballina – Preferred Route/Concept Design – Hydrology/Hydraulics Report" (Brown Consulting

Pty Ltd, July 2007). Peak flood predictions at Rocky Mouth Creek from the above study are presented in Table 3.1 below.

Table 3.1 Richmond River Flood Event - Peak Flood Levels at Rocky Mouth Creek

ARI (years)	Peak Flood Level (m AHD)
1	2.54
5	3.38
20	4.09

The Pacific Highway north of New Italy has a pavement level of approximately 3.5 m AHD. It can be seen from Table 3.1 that a 20 year average recurrence interval (ARI) or higher Richmond River flood event will submerge the highway.

Peak flood level predictions from local catchment flooding are presented in Table 3.2 below.

Table 3.2 Local Catchment Flooding

ARI (years)	Peak Flood Level (m AHD)
20	3.4 – 3.8
100	3.5 – 3.9

It can be seen from Table 3.2 that flood waters from the 20 year and 100 year ARI local events are predicted to submerge the Pacific Highway by approximately 0.3–0.4 m for the 20 year and 100 year ARI design events respectively.

Clarence River floodplain

The Pacific Highway is affected by flooding from the Clarence River and local catchments. Peak flood levels from Clarence River flood events were obtained from the "Lower Clarence River Flood Study Review – Final report" (WBM, March 2004). Peak flood predictions from the above study in the vicinity of the Pacific Highway are presented in Table 3.3 below.

Table 3.3 Clarence River Flood Event – Peak Flood Levels

ARI (years)	Peak Flood Level (m AHD)
20	2.5 – 3
100	3 – 3.5

The Pacific Highway is predicted to be immune to 20 year and 100 year ARI Clarence River design flood events to the north of Iluka Road, however, some local flooding up to 0.2 m in depth is predicted in the vicinity of Banana Road for both the 20 year and 100 year ARI local catchment design flood events.

Tabbimoble Creek and Overflow

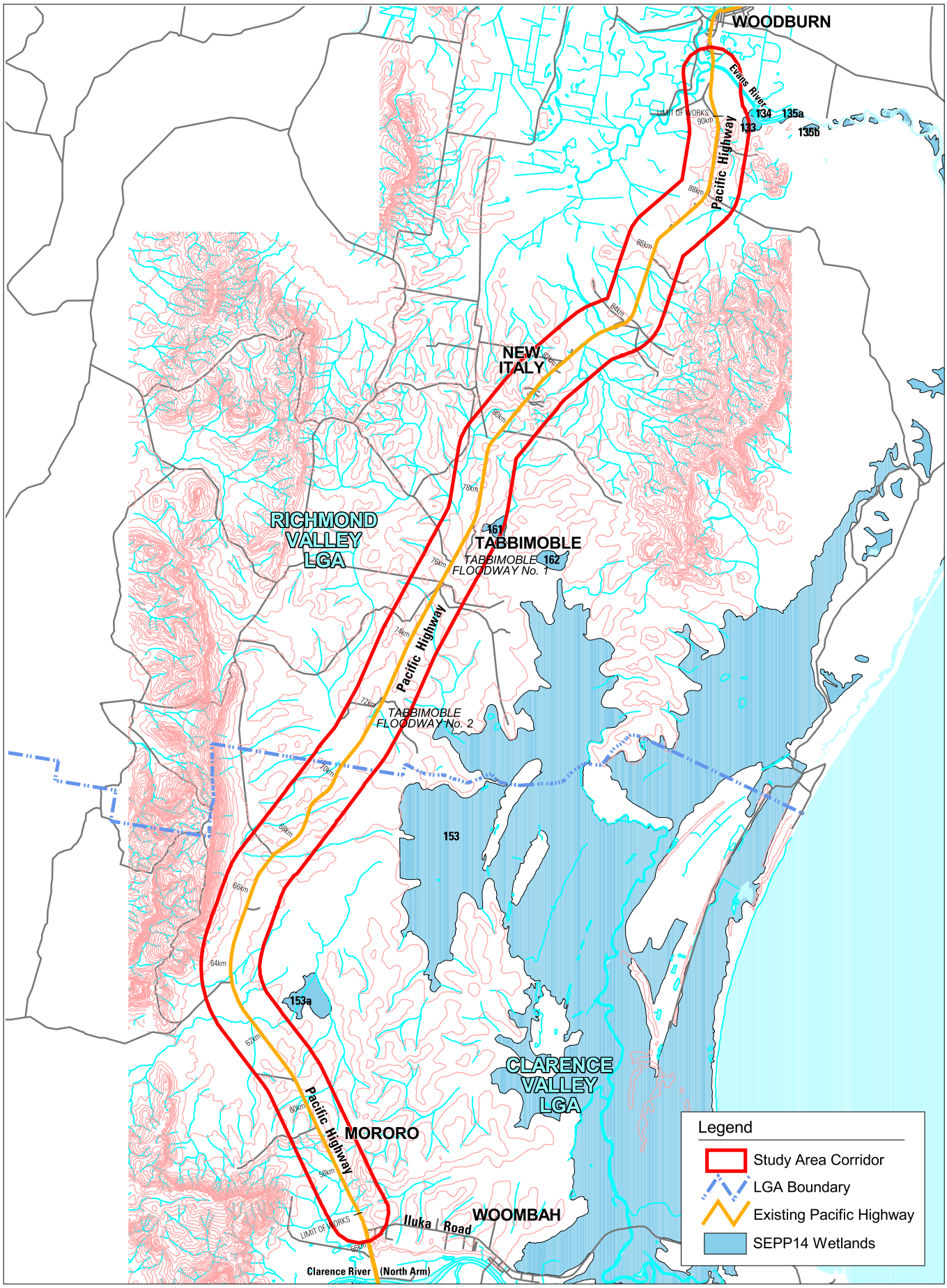
Preliminary calculations indicate that this section of the highway has 100 year ARI immunity in the vicinity of Tabbimoble Creek and Tabbimoble Overflow, however, some local flooding up to 0.2 m in depth is predicted in the vicinity of the rest area north of Jacky Bulbin Road for both the 20 year and 100 year ARI design flood events.

Tabbimoble Floodway's Numbers 2 and 3

Preliminary calculations indicate that this section of the highway has 100 year ARI immunity.

Tabbimoble Floodway Number 1

Preliminary calculations indicate that this section of the highway has 100 year ARI immunity.



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Source: Base data - Roads & Traffic Authority 2005
SEPP14 Wetlands - National Parks & Wildlife Service 2004

Figure 3.3

SEPP14 Wetlands

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3.5 Ecology

An initial ecological assessment was carried out on the flora and fauna of the study area in winter 2005. This included vegetation sampling, classification and mapping in order to ascertain the extent and types of flora and habitat. Surveys were conducted to ascertain the extent and type of fauna within the study area. In addition to visual surveys, call playback tests, traps and ultrasonic detection were used. Following the initial investigations, a targeted summer flora survey, a targeted frog survey and a survey of *Melaleuca irbyana* at New Italy were all conducted in February 2006.

The Iluka Road to Woodburn study area is characterised by extensive tracts of native vegetation exhibiting high biodiversity including a range of threatened flora and fauna species and endangered ecological communities (EECs). The findings of these surveys for flora and fauna are discussed below.

3.5.1 Vegetation

Five broad vegetation types occur in the study area:

- Dry Open Forest.
- Swamp Sclerophyll Forest.
- Floodplain Forest.
- Wet Heath/Sedgeland.
- Freshwater Swamp.

These five vegetation types cover 14 vegetation associations, four of which fall under the definition of an EEC listed under the *NSW Threatened Species Conservation Act 1995* (TSC Act). The four EECs concerned, which are illustrated in Figures 3.4a and b, are:

- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions.
- Subtropical coastal floodplain forest of the NSW North Coast bioregion.
- Freshwater wetlands on the coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

A substantial percentage of the survey corridor is vegetated with either Swamp Sclerophyll Forest or Subtropical Coastal Floodplain Forest. Nearly all the recorded threatened plant species and regionally significant plant species occur in these EECs.

The dominant vegetation types within the study area are Dry Open Forest, Swamp Sclerophyll Forest and Floodplain Woodland. These three vegetation types account for 47%, 15% and 14%, respectively, of the native vegetation within the study area and 10 of the 14 vegetation associations.

3.5.2 Threatened flora species

An assessment of the likelihood of threatened species occurring in the study area was based on:

- Department of Environment and Conservation's (DECC's) Atlas of NSW Wildlife for a 20 km radius search area.
- review of previous studies.
- review of the habitat preferences of threatened species resulting from the database search.
- interpretation of Comprehensive Regional Assessment Aerial Photograph Interpretation (CRAFTI) vegetation maps.

The vegetation surveys, including the targeted summer survey, were conducted in compliance with the 'precautionary principle' whereby the presence of suitable habitat was used as an indicator of the possible presence of a species in the study area. The assessment drew a distinction between those threatened species that were likely to occur in the study area (by virtue of presence of suitable habitat) and those that were unlikely to occur. Those species that are considered likely to occur are therefore assessed as though they have been recorded.

Eight species of flora listed as threatened under the TSC Act were recorded in the study area, as shown in Figures 3.5a and b. Three of these are endangered and five vulnerable as outlined in Table 3.4 below. Three of these species were also listed under the Commonwealth EPBC Act as vulnerable *(Desmodium acanthocladum, Prostanthera cineolifera and Prostanthera palustris).*

Table 3.4 Threatened species under the TSC Act recorded in the study area

Common Name	Botanical Name	Conservation Status	
Small-leaved Paperbark	*Melaleuca irbyana.*	NSW	Commonwealth
Fern	*Lindsaea incisa*	E	-
Sedge	*Cyperus aquatilis*	E	-
Orchid	*Oberonia titania*	E	-
Spiny Desmodium	*Desmodium acanthocladum*	V	V
Swamp Mint Brush	*Prostanthera palustris*	V	V
Maundia	*Maundia triglochinoides*	V	-
Cineolifera	*Prostanthera cineolifera*	V	V

Source: Connell Wagner, 2007.

The following 18 species, which are listed as threatened species under the TSC Act, are potentially present in the study area on the basis of species habitat requirements, but were not recorded during the field surveys. They are therefore considered, for the purpose of this report and in accordance with the 'precautionary principle', as being likely to occur in the study area.

Table 3.5 Threatened flora species likely to occur in the study area

Common Name	Botanical Name	Conservation Status	
		NSW	Commonwealth
	Drynaria rigidula	E	_
Square-stemmed Spike-rush	*Eleocharis tetraquetra*	E	_
Slaty Red Gum	*Eucalytpus glaucina*	V	V
Square-fruited Ironbark	*Eucalyptus tetrapleura*	V	V
Sweet Myrtle, Small-leaved Myrtle	*Gossia fragrantissima*	E	E
	Grammitis stenophylla	E	_
	Haloragis exaltata sp. Velutina	V	V
	Hibbertia marginata	V	V
	Lindsaea fraseri	E	_
	Melichrus sp. 'Gibberagee'	E	E
	Oldenlandia galioides	E	_
Knotweed	*Persicaria elatior*	V	V
Lesser Swamp Orchid	*Phaius australis*	E	E
Endangered Swamp Orchid	*Phaius tankervilliae*	E	E
	Phyllanthus microcladus	E	E
	Polygala linariifolia	E	
	Rutidosis heterogama	V	V

Source: Connell Wagner, 2007.

The endangered species *Melaleuca irbyana* (Small-leaved Paperbark) is considered to have the highest level of botanical constraint on the proposal. In NSW this species is restricted to the Grafton and Casino districts where it is known from approximately nine populations. The population in the study area is the most easterly recorded. The only other area where the species occurs is between Ipswich and Toowoomba west of Brisbane.

Melaleuca irbyana occurs south of the New Italy museum (see Figure 3.6) and extends for approximately 400 m on either side of the existing highway. The width of the populations varies from 50 to 150 m and is wider on the western side of the highway. The population contains approximately 800 individuals, comprising 250 trees greater than 3 m high and 550 saplings and suckers spread over about 1.5 ha. The condition of habitat is better on the western side of the highway. On the eastern side the habitat is dissected by driveways, fence lines, firebreaks and a power line easement.

The small ground fern *Lindsaea incisa*, also an endangered species under the TSC Act, is currently known from a total of only seven other locations in NSW. The population at the southern end of the corridor in Mororo State Forest, approximately 3 km north of the Iluka turn-off, is located about 40 m from the existing highway in swamp sclerophyll forest (protected ecological community). The duplication occurs to the east of the existing highway and therefore would not result in a direct impact on the species.

Cyperus aquatilis, which is also listed as endangered under the TSC Act, is a small sedge or grass-like plant with an annual life cycle. *Cyperus aquatilis* was recorded on the eastern and western sides of the Pacific Highway at Tabbimoble. A further targeted survey was carried out in late summer (February 2006) to determine how widespread the species is in the Tabbimoble area and to develop management options to conserve it in relation to the proposed highway upgrade, which are discussed in Section 7.3.4.

The other five recorded threatened species, *Desmodium acanthocladum, Maundia triglochinoides, Prostanthera cineolifera, Oberonia titania* and *Prostanthera palustris*, are unlikely to be impacted by the highway upgrade due to their location. The potential impact on these species and species listed as likely to be present but not recorded during the investigations, would be confirmed at the environmental assessment and detail design phases of the project.

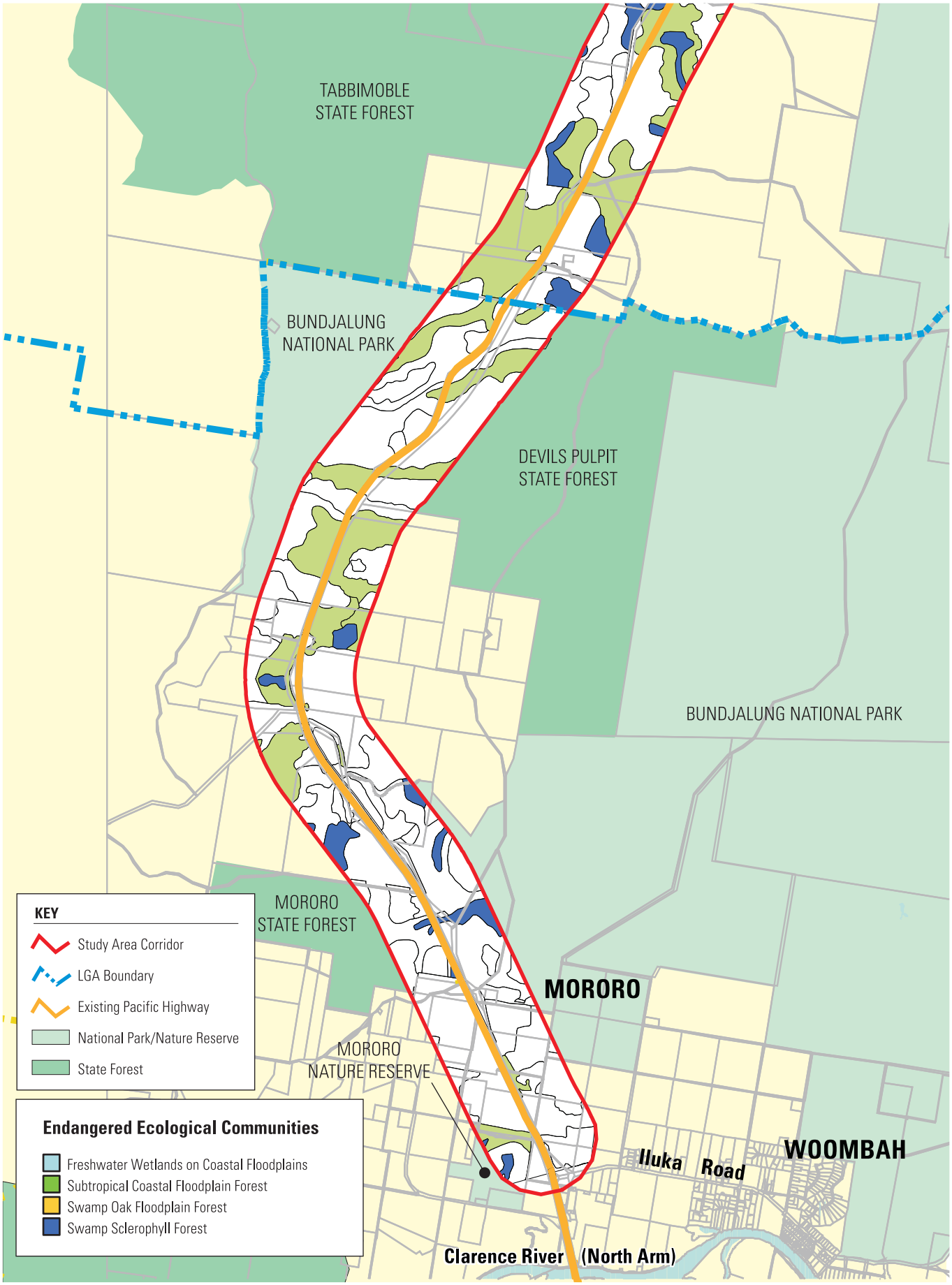

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Figure 3.4a

Endangered Ecological Communities

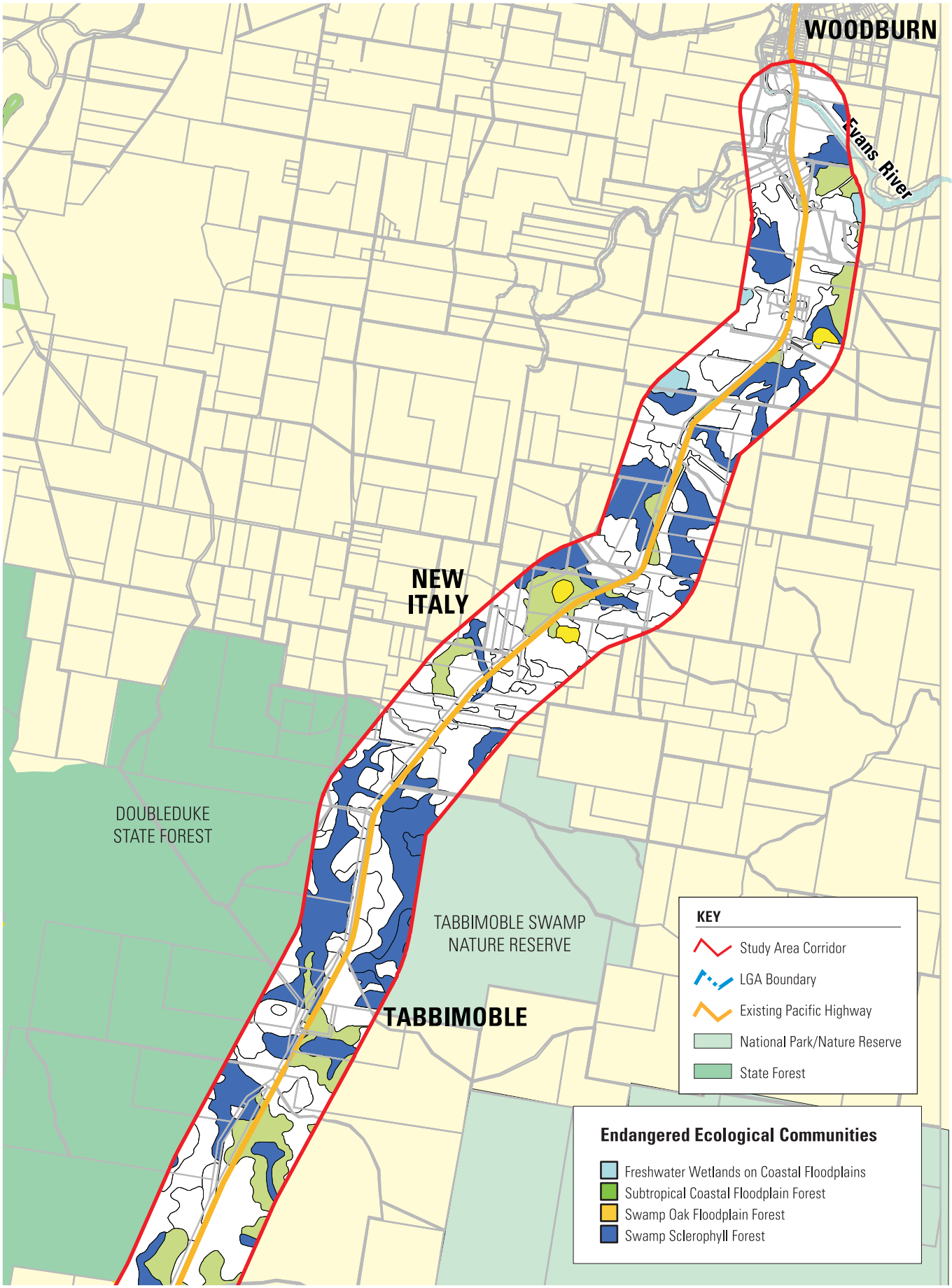

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Figure 3.4b

Endangered Ecological Communities

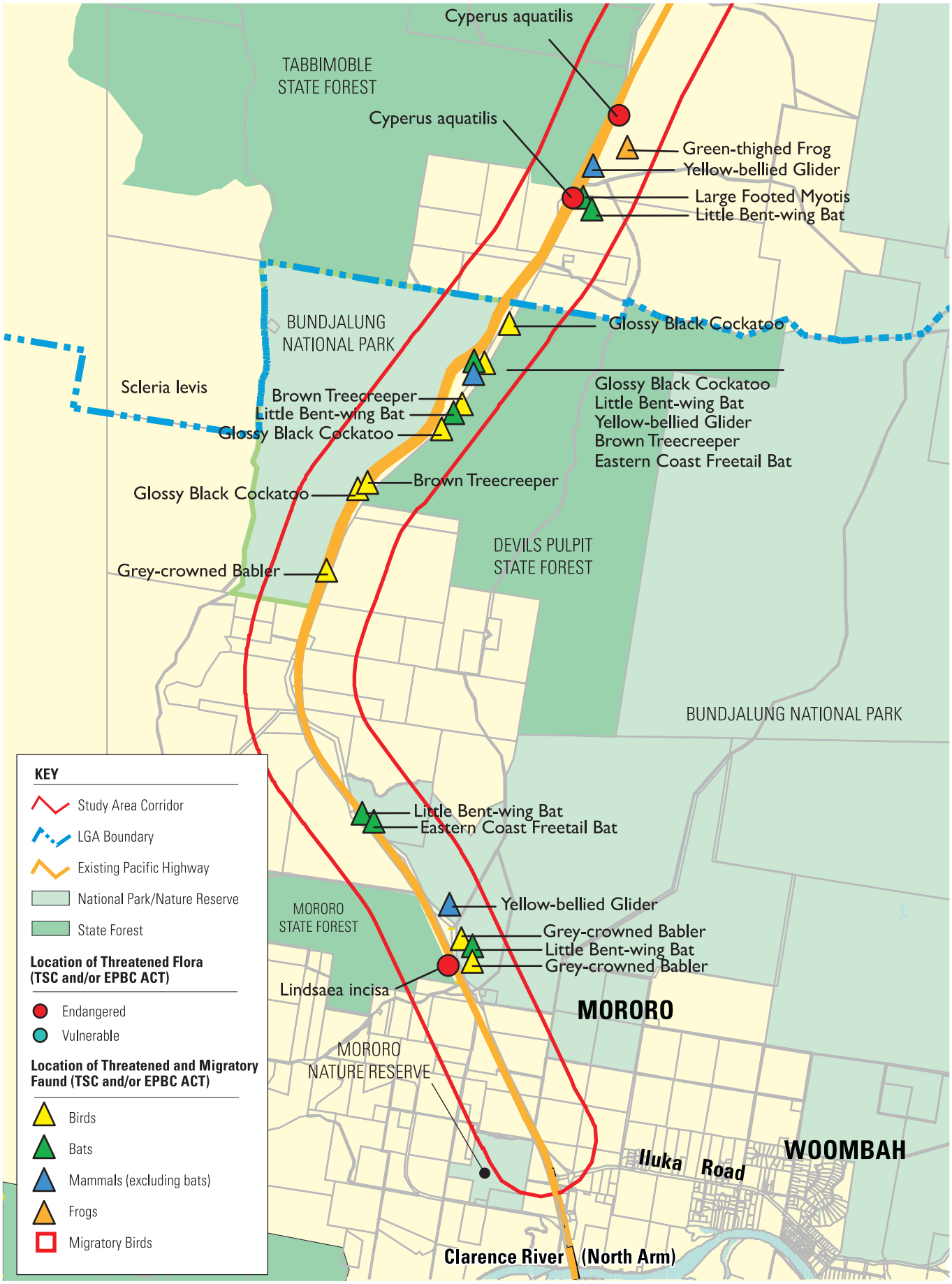

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Figure 3.5a

Locations of Threatened Flora and Fauna

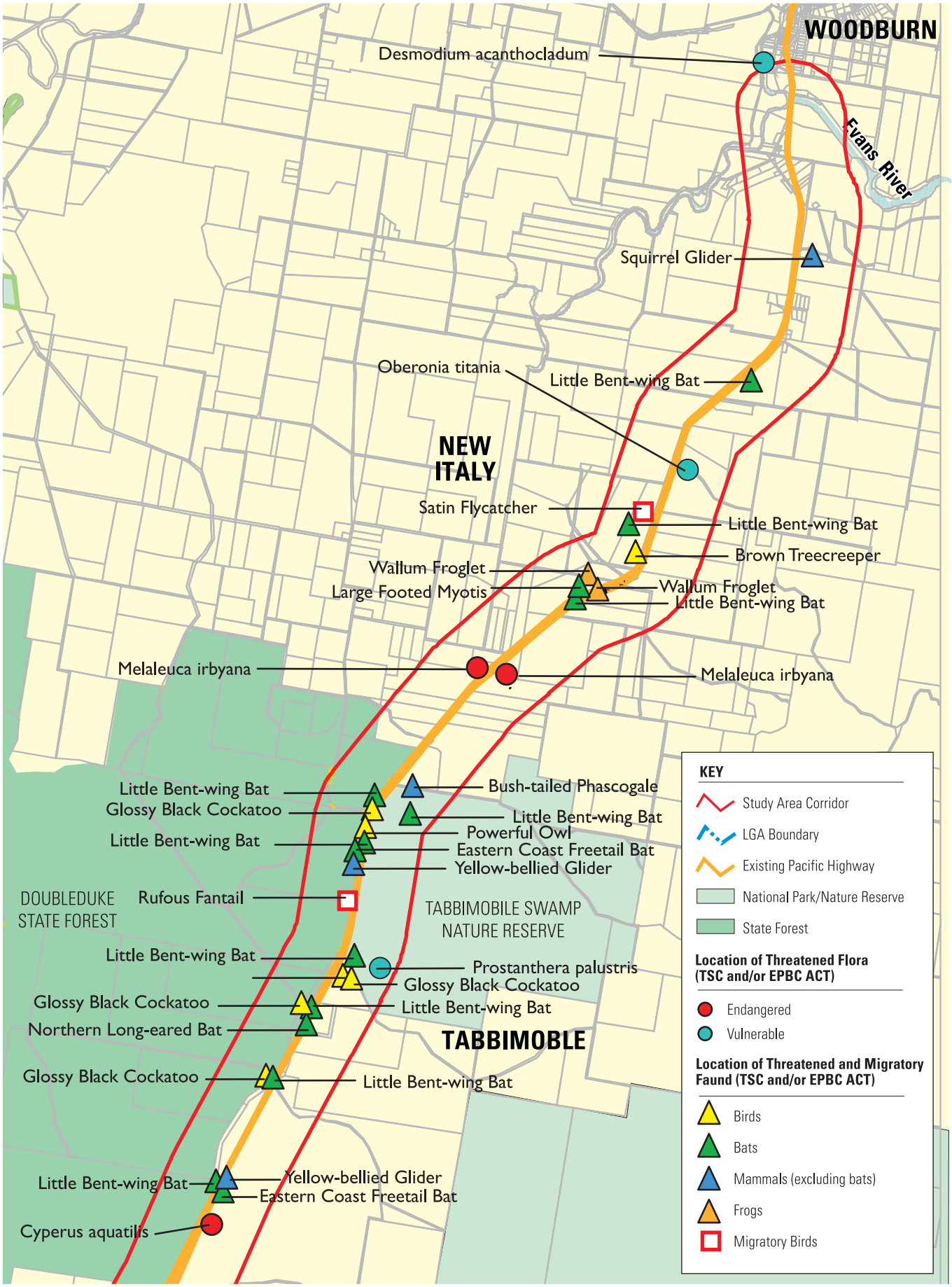

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Figure 3.5b

Locations of Threatened Flora and Fauna

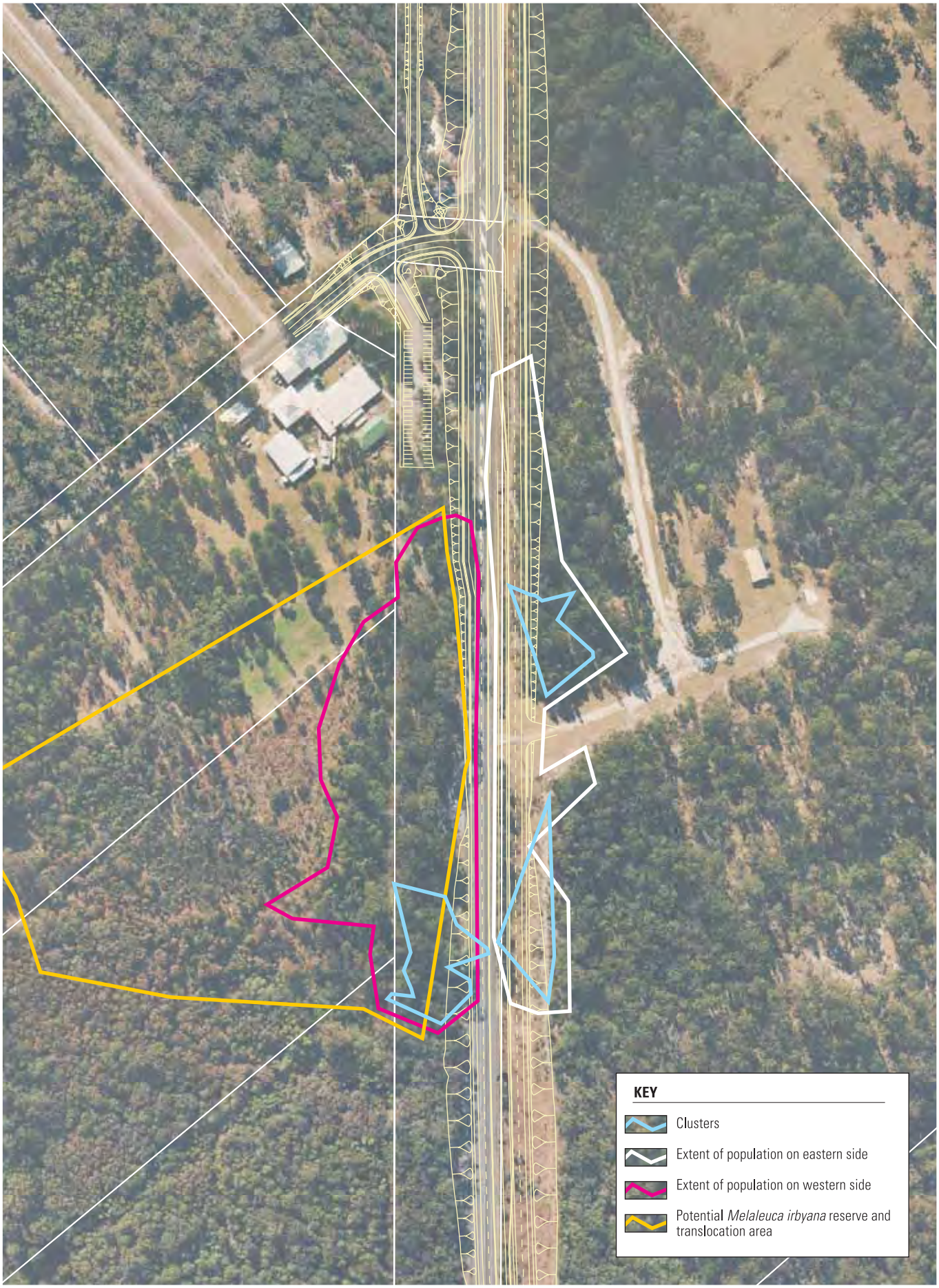

Figure 3.6

Location of *Melaleuca irbyana*

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Terrestrial fauna

Eighteen threatened fauna species listed under the TSC Act were recorded in the study area during field investigations undertaken for this assessment:

Table 3.6 Threatened fauna species and migratory species recorded in the study area

Common Name	Botanical Name	Conservation Status	
		NSW	Commonwealth
Wallum Froglet	*Crinia tinnula*	V	_
Green-thighed Frog	*Litoria brevipalmata*	V	_
Brown Treecreeper	*Cormobates picumnus*	V	_
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	_
Grey-crowned Babbler	*Pomatostomus temporalis*	V	_
Masked Owl	*Tyto novaehollandiae*	V	_
Powerful Owl	*Ninox strenua*	V	_
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	_
Squirrel Glider	*Petaurus norfolcensis*	V	_
Yellow-bellied Glider	*Petaurus australis*	V	_
East Coast Freetail Bat	*Mormopterus norfolkensis*	V	_
Grey-headed Flying-Fox	*Pteropus poliocephalus*	V	V
Hoary Wattled Bat	*Chalinolobus nigrogriseus*	V	_
Large-footed Myotis	*Myotis adversus*	V	_
Little Bent-wing Bat	*Miniopterus australis*	V	_
Eastern Bent-wing Bat	*Miniopterus Schreibersii oceanensis*	V	_
Eastern Long-eared Bat	*Nyctophilus bifax*	V	_
Eastern Cave Bat	*Vespadelus troughtoni*	V	_
Migratory species under the EPBC Act			
Satin Flycatcher		-	-
Rufous Fantail		-	-

Source: Connell Wagner, 2007.

The location of these species as noted during the investigations is depicted in Figures 3.5a and 3.5b. It is important to note that these locations represent a snapshot in time and do not preclude the presence of species in areas not shown, nor the future absence of species in areas where they have been recorded.

Interrogation of DECC's *Atlas of NSW Wildlife*, together with the presence of suitable habitat within the study area, indicates that additional threatened species are likely to occur. Species clearly exhibiting preferences for habitats not represented in the study area were eliminated from the target species list, thereby focusing field studies and impact assessments on the remaining threatened species. Threatened species for which there were no database records, but which were considered likely to occur (on the basis of habitat suitability) were also targeted. Threatened species that were found to be 'likely' to occur in the study area by virtue of habitat suitability were treated as if they had been recorded. These species are listed in Table 3.7.

Table 3.7 Threatened fauna species likely to occur in the study area

Common Name	Botanical Name	Conservation Status	
		NSW	Commonwealth
Wallum Sedge Frog	*Litoria olongburensis*	V	V
Stuttering Frog	*Mixophyes balbus*	E	V
Fleay's Barred Frog	*Mixophyes fleayi*	E	E
Giant Barred Frog	*Mixophyes iteratus*	E	E
White-crowned Snake	*Cacophis harriettae*	V	_
Pale Headed Snake	*Hoplocephalus bitorquatus*	V	_
Stephen's Banded Snake	*Hoplocephalus stephensii*	V	_
Red-tailed Black-Cockatoo	*Calyptorhynchus banksii*	V	_
Emu	*Dromaius novaehollandiae* (NSW North Coast Bioregion and Port Stephens LGA Population)	E2	_
Red Goshawk	*Erythrotriorchis radiatus*	E	V
Black-breasted Buzzard	*Hamirostra melanosternon*	V	_
Swift Parrot	*Lathamus discolor*	E	E
Square-tailed Kite	*Lophoictinia isura*	V	_
Hooded Robin Hooded Robin (southeastern subspecies)	*Melanodryas cucullata* *Melanodryas cucullata cucullata*	V	_
Osprey	*Pandion haliaetus*	V	_
Regent Honeyeater	*Xanthomyza phrygia*	E	E
Barking Owl	*Ninox connivens*	V	_
Masked Owl	*Tyto novaehollandiae*	V	_
Rufous Bettong	*Aepyprymnus rufescens*	V	_
Eastern Pygmy-possum	*Cercartetus nanus*	V	_
Spotted-tailed Quoll Spotted-tailed Quoll (SE Mainland Population)	*Dasyurus maculatus* *Dasyurus maculatus maculatus*	V _	_ E
Long-nosed Potoroo Long-nosed Potoroo (SE Mainland Population)	*Potorous tridactylus* *Potorous tridactylus tridactylus*	V _	_ V
Koala	*Phascolarctos cinereus*	V	_
Common Planigale	*Planigale maculata*	V	_
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V
Golden-tipped Bat	*Kerivoula papuensis*	V	_
Black Flying-Fox	*Pteropus alecto*	V	_
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	_
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	_
Common Blossom-bat	*Syconycteris australis*	V	_
Migratory species under EPBC Act likely to occur			
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	_	M
White-throated Needletail	*Hirundapus caudacutus*	_	M

Source: Connell Wagner, 2007.

Key Habitat and Fauna Corridors

The diverse range of habitat types is reflected in the high number and diversity of threatened fauna recorded throughout the study area. Threatened fauna species recorded include three cave-roosting bat species, three hollow-roosting bat species, three hollow-dependent mammal species, two species of frog, and seven bird (including four hollow-dependent) species.

Hollow-bearing trees provide essential nesting/roosting/shelter habitat for many of these species. Most of the hollow-bearing trees observed during the fauna surveys were located in the dominant habitat type (Dry Open Forest) which is distributed along the length of the highway corridor. Additional important habitat for some of these species includes culverts and bridges (providing roosts for cave-dwelling bats) and winter-flowering species (providing foraging resources for gliders). These habitats are also distributed throughout the length of the highway corridor.

Key habitats and corridors identified by the DECC as occurring within, or in the vicinity of, the study area include:

- Broadwater-Tabbimoble Regional Corridor, which links Bundjalung National Park and Tabbimoble Swamp Nature Reserve.
- Devils Pulpit Subregional Corridor, which links Bundjalung National Park and Tabbimoble Creek.
- Mororo–Bundjalung Regional Corridor, which links the Mororo Corridor and Bundjalung National Park.
- Bundjalung-Tabbimoble Regional Corridor, which serves as a link between Bundjalung National Park and the Pacific Highway.

3.5.3 Aquatic habitats

The study area contains several creeks and drainage lines, with intact native vegetation, providing shelter, foraging, breeding habitat for frogs including potential habitat for threatened frogs such as the Giant Barred Frog. These habitats are also used as foraging areas by various threatened bat species.

Culverts crossing the creeklines and drainage lines are also likely to be used as roost sites for cave-dwelling bats, including the threatened *Myotis adversus* (Large-footed Myotis) and *Miniopterus australis* (Little Bent-wing Bat), which were captured in traps located at culvert entrances.

Freshwater wetland habitat within the study area provides suitable habitat for a number of threatened species listed under the TSC Act, particularly threatened wetland birds and frogs.

A search of the BioNet database system (which includes records from the collections of the Australian Museum, NSW Department of Environment and Conservation and NSW Department of Primary Industries) was undertaken to identify threatened fish species recorded within 10 km of the study area. Within the general locality, the following four threatened fish species have been recorded:

- Olive Perchlet (*Ambassis agassizii*)
- Black Cod (*Epinephelus daemelii*)
- Oxleyan Pygmy Perch (*Nannoperca oxleyana*)
- Green Sawfish (*Pristis zijsron*)

An assessment of the likelihood of occurrence of threatened fish species was based on a preliminary assessment of aquatic habitats undertaken during the field surveys. From these surveys it was considered that these species would be unlikely to occur. This would be confirmed during the environmental assessment and detail design phases of the project.

3.5.4 Ecological sensitivity

The main aspects of ecological sensitivity associated with the proposed concept design have been identified as:

- the population of *Melaleuca irbyana* near New Italy.

- individual threatened plants distributed throughout the study area.
- locations with a high density of hollow-bearing trees.
- the EECs.
- forested habitats associated with threatened species records.
- culverts and bridges which are likely roosts for cave-dwelling bats.
- creeks and drainage lines.
- location of Wallum Froglet and Green-thighed Frog

Potential impacts of the proposed concept design on flora and fauna species and habitats are discussed in Section 7.3.4 and 7.3.5 of this report.

Figure 3.7

Key Habitats and Corridors

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3.6 Acoustic environment

3.6.1 Existing noise environment

For the purpose of establishing ambient noise levels, measurements were conducted at six reference locations along the study route from Tuesday 1 March 2005 to Tuesday 8 March 2005. The results, detailed in Table 3.8 below, show that daytime noise levels were 1-2dB(A) higher than night-time levels.

The small difference between day-time and night-time traffic noise levels reflects the fact that night-time traffic, although lower in terms of total number of vehicles, has a higher proportion of heavy vehicles, which generally emit higher noise levels than light vehicles.

Table 3.8 Façade road traffic noise levels

Noise Measurement Location (Refer Figures 3.12a and b)	Distance to Pacific Highway	Façade Road Traffic Noise Level	
		dB(A) (day)	dB(A) (night)
R1: 8 Old Pacific Highway Woombah	120m	59	58
R2: 6530 Pacific Highway Tabbimoble[1]	65m	62	61
R3: Lot 1/796808 Pacific Highway Tabbimoble[1]	45m	63	62
R4: 7680 Pacific Highway Tabbimoble	45m	65	64
R5: Lot 15/5861 Pacific Highway Tabbimoble	65m	64	62
R6: 32 Trustums Hill Road Woodburn	55m	62	61

Note 1: Measurements at locations R2 and R3 were in free-field (free of reflective objects). To account for noise reflection from the buildings, a façade correction of 2.5dB(A) was added to the measurement results.
Source: Connell Wagner, 2005.

Classified traffic counts were conducted on the Pacific Highway at the southern and northern ends of the study route during the noise monitoring period. Results of the traffic counts showed that:

- Traffic volumes throughout the study area were similar.
- The average daytime (15-hour) traffic volumes and proportions of heavy vehicles were in The order of 6,000 vehicles per day (vpd) and 20% respectively.
- The average night-time (9-hour) traffic volumes and proportions of heavy vehicles were in the order of 1,000vpd and 60% respectively.

This traffic information forms the baseline to which the measured noise levels relate. Predicted increases in traffic volume can then be translated into increased noise levels. Similarly, noise level can be predicted in relation to the distance from the highway. These matters are discussed in Section 7.9.

3.7 Indigenous heritage

3.7.1 Local Aboriginal Land Councils

The southern part of the study area between Iluka Road and Tabbimoble Creek lies within the territory administered by the Yaegl Local Aboriginal Land Council (LALC), and within the area of interest to the Ulgundahi Elders group.

The area north from Tabbimoble Creek to New Italy lies within the boundaries of the Bogal LALC, while the area from New Italy to the northern limit of the project area at Tuckombil Canal is shared by the Bogal, Jali and Ngulingah LALCs. This sharing arrangement has arisen due to the high spiritual and archaeological significance of the Evans Head/Goanna Headland locality to the Bundjalung people from a wide geographical area.

3.7.2 Native title claims

Searches of the National Native Title Register, Register of Native Title claims, Register of Indigenous Land Use Agreements and the Applications Summary were undertaken for the Richmond Valley and Clarence Valley LGAs on 4 May 2005 and 28 August 2007. Advice provided by the National Native Title Tribunal indicates that two entries relevant to the study area have been active throughout this period. Both have been accepted for Native Title registration and are currently in mediation.

The first of these (NC96/16) was lodged by the late Lawrence Wilson on behalf of the Bandjalang dialect group (the Bandjalang Aboriginal Corporation). It relates to five separate land parcels east and north-east of the existing highway reserve between Iluka Road and Woodburn. One of these land parcels (designated 'Area B') lies immediately east of the Pacific Highway reserve and forms Tabbimoble Nature Reserve.

The second entry (NC98/19) was also lodged by Lawrence Wilson on behalf of the Bandjalang dialect group. The application relates to a 3,315 km^2 area comprising all claimable land south from Broadwater Headland to Woody Bluff, inland to Nortons Gap and Busbys Flat. This application encompasses all of the Iluka Road to Woodburn study area.

The above native title claims generally do not affect the proposed Pacific Highway upgrade, as the claims do not apply to freehold lands, or to lands lawfully owned and occupied. On acquisition of any land required for the construction of the project however, the RTA would be required to extinguish the relevant native title claims (if any) prior to acquiring the land.

3.7.3 DECC Aboriginal Heritage Register

Fourteen Aboriginal sites have been registered to date on the DECC Aboriginal Heritage Information Management System within a 5 km radius of the study area. One of the DECC registered sites falls within the study area itself. This is a post-contact Aboriginal burial located south of The Gap Road, approximately 150 m east of the existing highway reserve.

3.7.4 Other Aboriginal heritage registers

Searches of the Commonwealth and National Heritage Lists, the NSW State Heritage Register, the RTA Heritage and Conservation Register and heritage schedules of the North Coast REP and Richmond Valley and Clarence Valley LEPs revealed no listed Aboriginal sites in or close to the study area. Nineteen Indigenous places in the Richmond Valley and Clarence Valley LGAs are registered on the National Estate database. The closest of these is located at Woombah, several kilometres east of the study area, and would not be affected by the proposal.

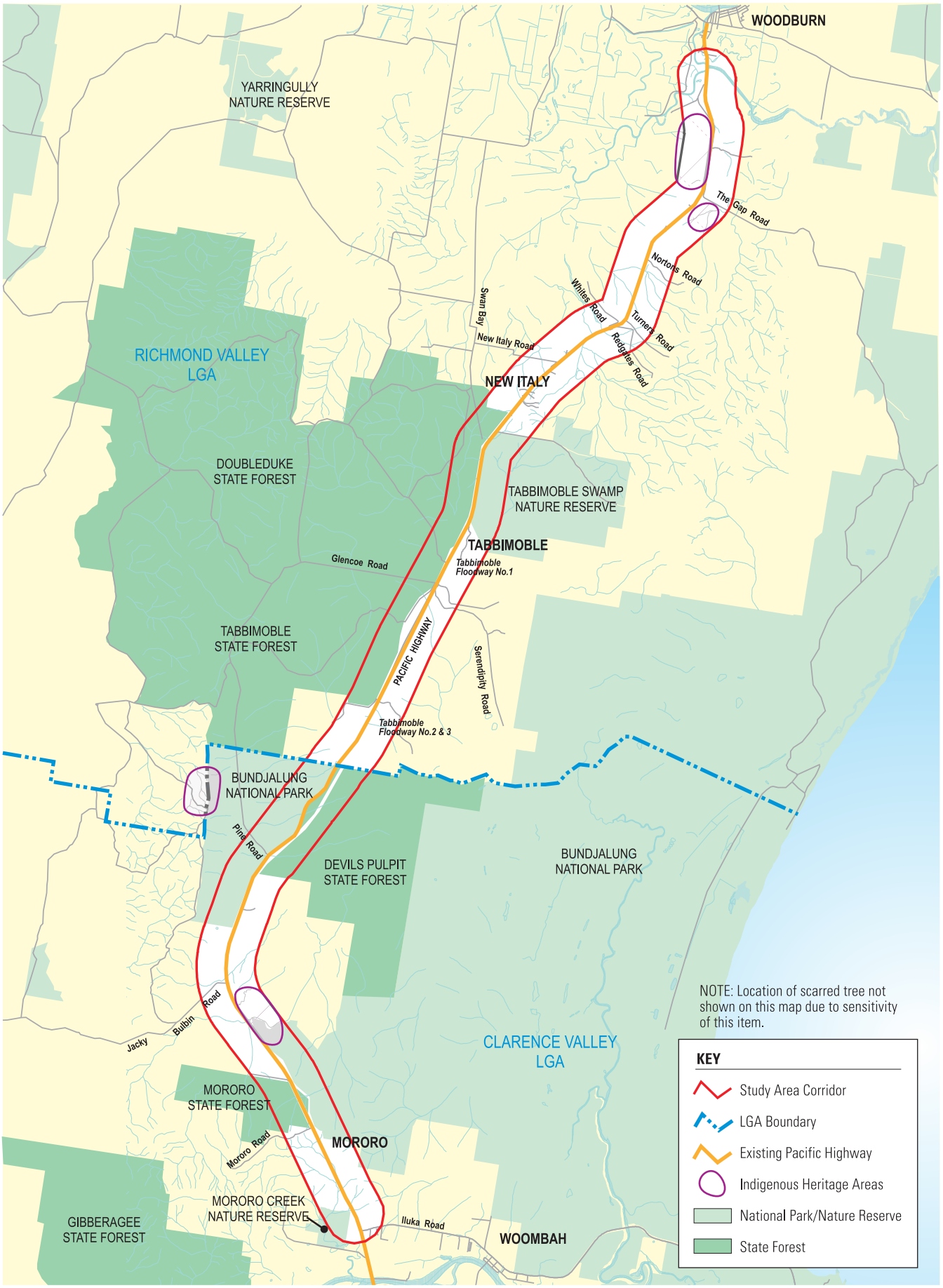

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Figure 3.8

Indigenous Heritage Areas

3.7.5 Unregistered Aboriginal sites

Field studies were conducted on 31 May, 1-3 June and 11 August 2005 to identify previously unrecorded sites. The section between Wondawee Way and Williams Road towards the northern end of the project was re-inspected on 9 August 2007, and broadened to include the area to be affected by a proposed interchange.

The field surveys were attended by representatives of the local indigenous communities and focused on landforms with high archaeological potential located within a 60 m wide strip centred on the existing highway. Four archaeological areas, comprising one low-density scatter of stone artefacts and three isolated artefact finds, were recorded during the field survey, in the general vicinity of the locations shown on Figure 3.8.

Owing to their limited size, level of disturbance and lack of further research potential, two of the isolated artefact finds (IR2W-1 and IR2W-3) were assessed as having low scientific significance in the local context. Aboriginal field representatives assisting with the survey advised that, if collected, these artefacts would be of educational value to the Aboriginal community.

The recorded artefact scatter (IR2W-2) and additional isolated stone artefact site (IR2W-4) were also small and disturbed. However, both sites have the potential to be larger and to contain subsurface potential archaeological deposits (PADs) on adjacent ridge crests. The scientific and cultural significance of these two sites could only be reliably assessed on the basis of the results of a sub-surface investigation of the associated PADs.

The survey included the finding of a scarred tree in the vicinity of New Italy which has been verified as being of high significance to local indigenous women. At the request of the site custodian, the precise location of the scarred tree has not been included in this report. However, the study team through its indigenous heritage consultant, has been able to verify that the tree is a sufficient distance from the existing highway to ensure that it would not be affected by any of the works required for the proposed Pacific Highway upgrade.

3.8 Non-Indigenous heritage

3.8.1 Listed heritage items

The area around the Richmond and Clarence Rivers was settled mainly during the mid-nineteenth century, by timber getters and dairy farmers, followed closely by sugar cane growers. Fishing has also long been a staple of the local economy, and accounts for the development of coastal towns such as Iluka.

The existing landscapes within the study area are largely the product of early timber harvesting and dairy farming. Land was extensively cleared of timber, and much of the existing forest cover is natural regrowth.

Searches of the Richmond River Local Environmental Plan 1992, the Maclean Local Environmental Plan and the NSW Heritage Office State Heritage Inventory for local and State significant heritage items have identified the following listed heritage items/places within the general project area (refer to Figure 3.9):

- New Italy Settlement.
- Vineyard Haven, New Italy.
- New Italy School site.

The RTA has also been consulted with regard to its corporate register under Section 170 of the *Heritage Act 1977*, and other internal heritage inventories. The RTA has advised that there are no items within the study area, on the Section 170 register or any other RTA inventory, that are likely to be affected by the proposed highway upgrade.

New Italy Settlement area

The New Italy Settlement landscape is of State significance as evidence of a settlement built through the tenacity, forbearance and technical skills (especially horticultural and architectural) of a group of settlers. Although few original structures or relics have survived, the New Italy Museum Complex, located at the junction of the Pacific Highway and Swan Bay New Italy Road, preserves a link to the archaeological and cultural heritage of the locality. (Refer to Figure 3.9). Items of heritage significance identified as part of the Museum Complex include:

- an obelisk of concrete and Italian marble (reputedly located on the site of the former mud brick house).
- a covered, above ground well.
- statuary and 'pioneer and his dog' monuments.
- a post and rail fence considered to be of original materials.
- more recent pavilion, restaurant, hall, display hall and Aboriginal art gallery buildings.

New Italy School site

Artefacts/items associated with the school site (located some 2 km north west of the museum complex) are considered part of the much larger New Italy landscape which contains wells, fruit plantings and archaeological evidence of churches, domestic buildings and artefacts, shops and cellars. The physical condition of the site is considered fair to good and the archaeological potential of the school site is high.

Vineyard Haven, New Italy Settlement

'Vineyard Haven' is listed as an item of State heritage significance under the *NSW Heritage Act, 1977*. Vineyard Haven occupies the property originally taken up by the French Palis Brothers, and then the Italian Giovanni Guarischi, and contributes to the State significant New Italy Settlement Landscape. It contains remnants of the landscape encountered by the settlers and evidence of their domestic and work practices. These relics and archaeological items include a dam site, a timber lined well, a mound, vines, vine contours on the landscape, former water trenches and other archaeological evidence of settlement.

This property is situated on the corner of Swan Bay New Italy Road and Forest Road, approximately 1.5 km to the west of the Pacific Highway (refer Figure 3.9).

3.8.2 Other heritage items

A heritage study was commissioned by the Richmond Valley Council and was commenced in January 2004 (*Richmond Valley Council A Community- based heritage study*, February 2007). The study was adopted by Council on 20 March 2007 and is currently on public exhibition. The study assessed over 470 items within the local government area and the report gave recommendations for listing or for further study to be undertaken of items.

The New Italy Settlement identified within the NSW Heritage Register indicates only three portions of land that make up the item (the Museum Complex, Vineyard Haven, and the School site). However, the Register notes that the sites listed should be considered as part of a broader landscape (including archaeological evidence of wells, cellars, a church and fruit and pine tree plantings) and the curtilage of the site should be expanded to include other areas of the landscape as it is the only known settlement of its type in NSW.

The *Richmond Valley Council Heritage Study* has nominated an area for the listing of New Italy Settlement Landscape for state heritage listing based on a map drawn by a pioneer settler around 1920 (refer Figure 3.9).

The following heritage items were recommended to be placed on Richmond Valley's Local Environmental Plan:

- New Italy Cyprus Road Well
- New Italy Memorial
- New Italy Museum Complex
- New Italy Roder's Well
- New Italy Vine Haven

However, while these items have been recommended for listing, they have not as yet been listed on any Local Environmental Plan or the State Heritage register.

During the preliminary heritage assessment, no other 'relics' (within the meaning of that term as defined in Section 4 of the *Heritage Act 1977*) were identified in the vicinity of the existing Pacific Highway. However, a more detailed search for and assessment of 'relics' of settlement will be undertaken during the environmental impact assessment phase of the project.

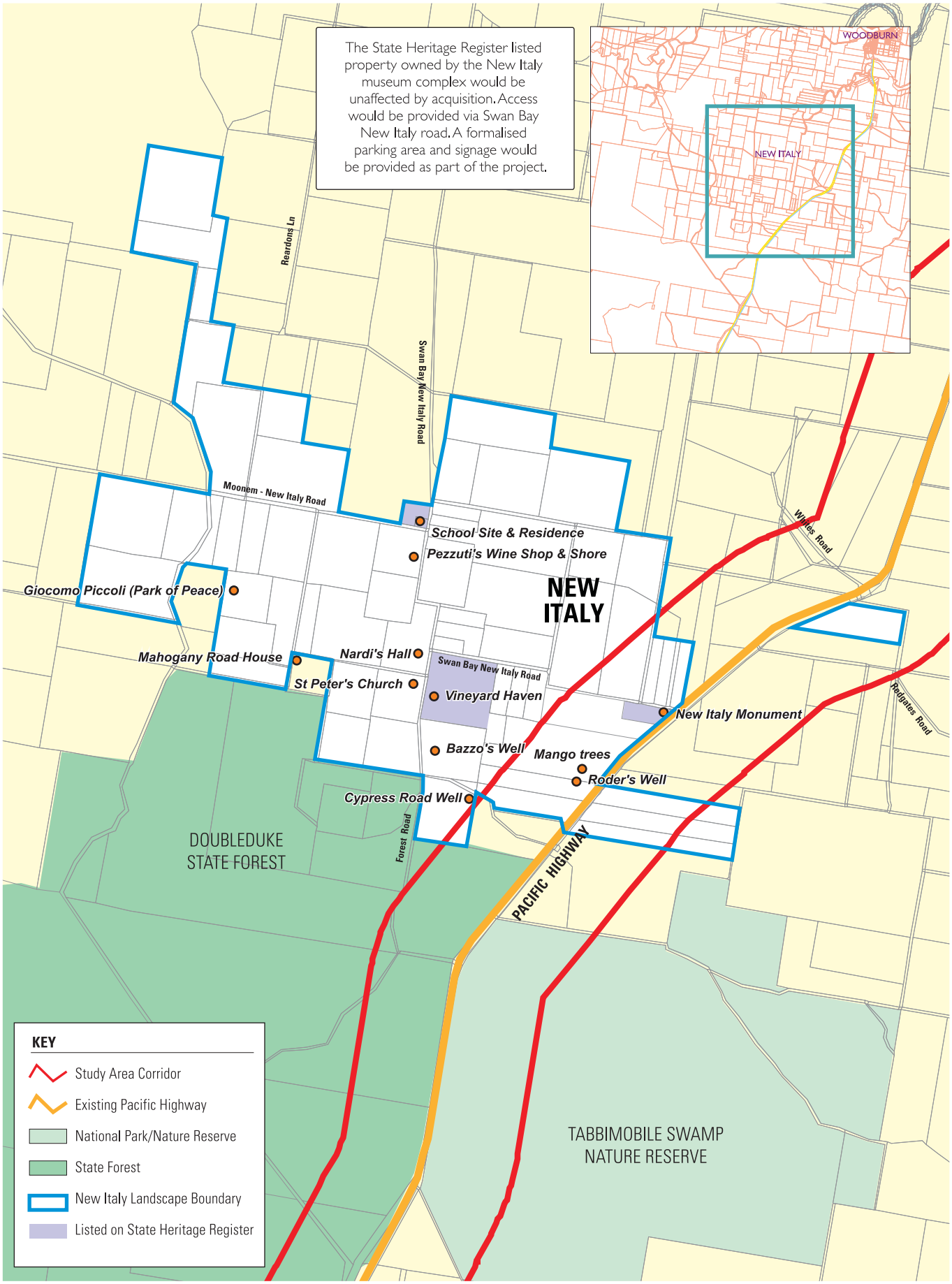

Figure 3.9

Non-Indigenous Heritage

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4. Project need, objectives and design principles

This section outlines the RTA's Pacific Highway project objectives and provides an overview of the design guidelines were used in the development of the project.

4.1 Need for the project

The need to upgrade the Pacific Highway between Iluka Road and Woodburn has been evaluated in the context of the overall Pacific Highway. The highway is a major inter-state transport infrastructure facility that not only forms the primary Sydney-Brisbane transport link, but also serves a significant and growing coastal residential and recreational population.

The project is required to meet the NSW and Commonwealth Governments' overall objective of fully upgrading the Pacific Highway to a four-lane divided highway standard. It will provide additional capacity in an area with continued traffic growth, and will join other completed and planned projects to form a continuous high-standard road, better able to meet the demands placed on it.

The project is also an essential component of the wider regional network, and the need for it is based on a number of issues, including:

- Road safety – including the need to reduce the number and severity of road traffic accidents through safer design.
- Population growth, urban expansion, commercial development, tourism and employment growth on the NSW north coast and in southern Queensland.
- Freight transport demand and service patterns.

It is expected that traffic volumes on the Pacific Highway will continue to increase due to:

- Population increases in the North Coast region.
- Traffic diverted from other routes as the Pacific Highway is improved.
- Traffic generated by improved travel times and reduced travel costs.

4.1.1 Pacific Highway Upgrade Program objectives

The RTA's overall objectives for the Pacific Highway Upgrade Program are to:

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

4.1.2 Highway design standards

The design of the Iluka Road to Woodburn upgrade of the Pacific Highway is being carried out according to Upgrading the Pacific Highway – Upgrading Program Beyond 2006: Design Guidelines (2006), prepared by the RTA's Pacific Highway Office. The project also seeks to comply with Austroads standards (various dates) and the RTA's Road Design Guide (1989). Key standards applying to this project are summarised below in Table 4.1.

Table 4.1 Pacific Highway Upgrade Standards Class A

Feature	Class A dual carriageway	Intersecting and other roads
Design speed	Horizontal 110 km/h. Vertical 100-110 km/h.	80 and 60 km/h dependent on function.
Cross section	Dual carriageway. Verge: typical 10 m. Shoulder: typical 2.5 m. Traffic lanes: minimum 2 x 3.5 m. Offside shoulder: minimum 0.5 m. Central median reserve minimum 11m. Offside shoulder: minimum 0.5 m. Minimum: 2 x 3.5 m traffic lanes. Shoulder: typical 2.5 m. Verge: typical 10 m.	Two lane single carriageway with typically 3.5 m lanes and shoulder width dependent on road function.
Flood immunity	One carriageway positioned above the 1 in 100 year flood level (desirable) or the 1 in 20 year flood level (minimum) across the flood plain.	No change to existing conditions.
Intersections	At-grade 'seagull' type T-intersections at key local roads. Grade separated "dumbbell" interchange at key location.	At grade T-intersections with some turning lanes. Connecting to dumbbell interchange
Access	Left-in, left out for most existing access roads and private properties not serviced by 'seagull' type T-intersection (Class A). Some accesses may have u-turns and right hand-in layouts.	Unrestricted.
Minimum radius	1000m	
Overhead clearances	5.3 m.	Varies dependent on function. Typically 5.3m
Fill/batter	1 vertical : 3 horizontal to 1 vertical : 2 horizontal	1 vertical : 3 horizontal to 1 vertical : 2 horizontal
Cuttings	1 vertical : 2 horizontal	1 vertical : 2 horizontal

Source: RTA, various publications.

5. Community involvement

5.1 Approach to community involvement

The approach to consultation has been to actively involve the community in each phase of the project.

The process that the RTA has adopted for the development of the Iluka Road to Woodburn preferred concept design is depicted in Figure 5.1. It highlights the stages of the project where formal input has been sought from the community and stakeholders and how this has imputed into the development of the preferred concept design. The RTA has maintained an 'open door approach' whereby feedback has been welcomed at any stage of the project and such contributions have also aided the development of the preferred concept design.

The key activities undertaken which were designed to keep stakeholders informed and able to provide input into the project, consisted of:

- Information releases: including updates, display advertising and via a project specific internet site. This activity commenced in November 2004, with information updated throughout the route investigation and concept design phases. A community update was released as part of the concept design display in March 2006. Other progress updates have been released on three occasions October 2005, December 2005 and February 2007.
- Community Information Sessions (CIS): which are open structured community forum sessions providing a range of opportunities for exchange of information, where study team members provide information and answer questions. The CISs included presentations, display material and community input. There have been three to date, in December 2004, March 2005 and March 2006. The first CIS, (December 14 2004, at Woodburn) was to introduce the community to the project and the second (8 March 2005, at New Italy) to discuss route option planning and the third (April 6 2006, at Woodburn) to discuss the published Concept Design Report. Further CISs will be held at strategic stages during the project planning, design and approval process.
- Property visits: involving one-on-one visits to members of the community at their properties.
- Feedback opportunities: providing stakeholders with a range of means to obtain information or make submissions, such as a telephone information line with direct contact to the RTA Project Manager and the project Community Liaison Co-ordinator, project website and email address, and project mail address. These have also been available since November 2004.
- Aboriginal focus meeting: held in June 2007. In accordance with DECC '*Interim Community Consultation Requirements for Applicants*', persons with a registered interest as well as members from the Local Aboriginal Land Councils were invited to attend. Items of indigenous heritage were discussed at the meeting and a bus tour of the route was held.

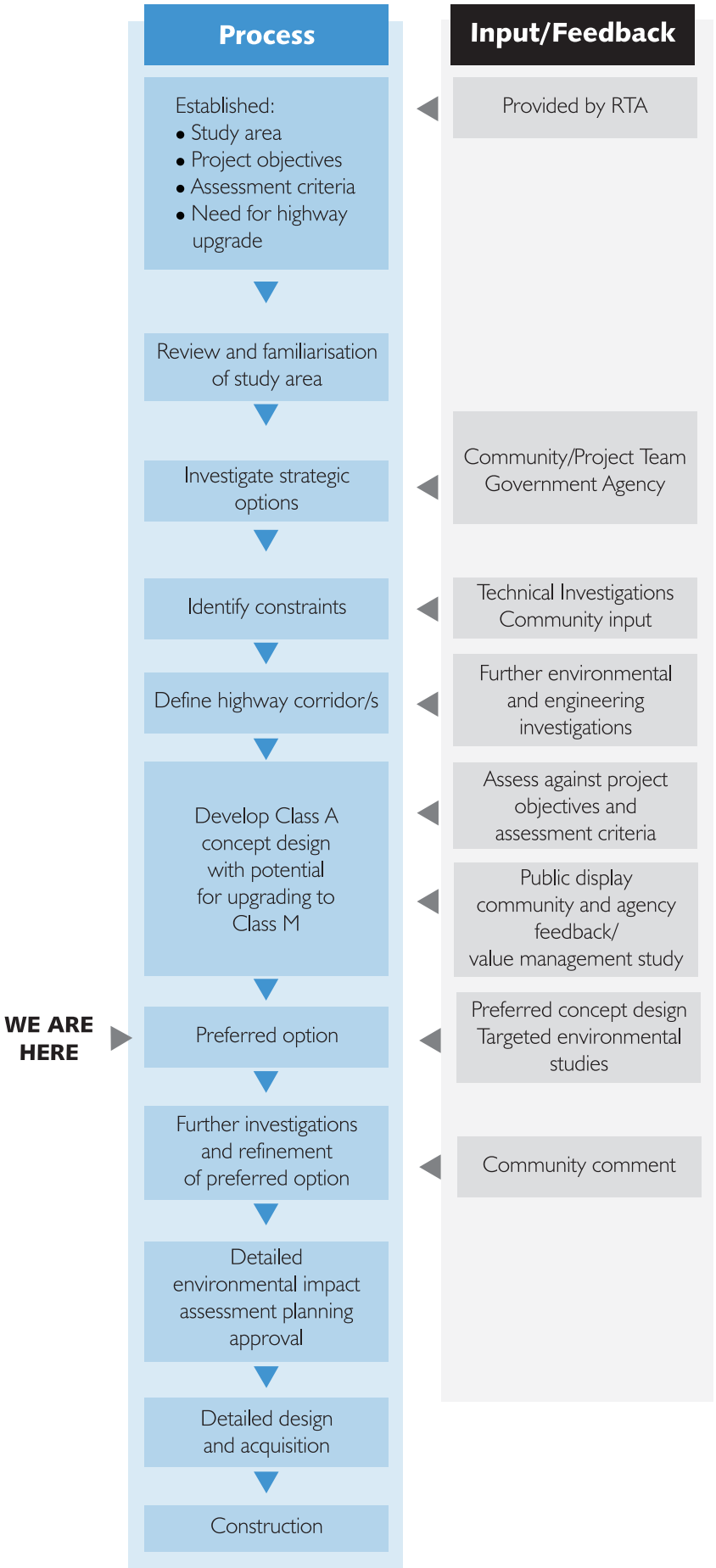

Figure 5.1

Methodology for Development and Assessment of Route

5.1.1 Concept design display

The concept design was on display from 30 March to 28 April 2006. The advertised display locations were:

- RTA Woodburn Community Information Centre.
- New Italy Museum Complex.
- Clarence Valley Council.
- RTA Pacific Highway Office.

Posters were also displayed at:

- Richmond Valley Council (Evans Head office).
- Ballina Motor Registry.

The RTA Woodburn Community Information Centre was staffed with study team members from 7-8 April 2006. Advertisements were placed in newspapers to notify the Concept Design Display.

5.1.2 Submissions to the concept design

The Concept Design Display was a key phase in the development of the project and in the consultation process where specific issues on the concept design were identified. Submissions were invited on the Concept Design Report and a total of 69 were received in direct response to the Concept Design Report and a further 25 general responses were submitted. The issues raised through these submissions are summarised in the Concept Design Submissions Report (2008) and were further considered at the Value Engineering Workshop held in July 2007.

The following is a summary of the key issues identified to date and communicated to the project team by the community:

- Impacts to private property and impacts on property values.
- Access to and from private property, access onto the highway, location of u-turn bays, emergency services access, and accessibility to Woodburn and other centres of population.
- Safety, conflict between local and through traffic, school bus safety and impacts of increasing truck traffic.
- Provision and location of intersections and highway interchanges.
- Protection of items of indigenous and non-indigenous heritage.
- Impacts of the project on New Italy museum, café and driver reviver.
- Timing of construction
- Road noise and noise mitigation.
- Flooding and flood mitigation.
- Environmental impacts, including air quality, water quality, and biodiversity conservation.
- Impacts on land use (eg. agriculture).

5.1.3 Stakeholder consultation

The RTA has also met with interest groups, stakeholders and government agencies to discuss the concept design. These groups include:

- Emergency service providers.
- Clarence Valley Council.
- Richmond Valley Council.
- Department of Primary Industries.
- Department of Environment and Climate Change.
- Department of Natural Resources.

- Bus companies.
- Cane growers.
- Historical groups.

As with the community consultation, the feedback from these groups has been incorporated, where appropriate, into the preferred concept design.

5.2 Amendments to the concept design that form the preferred concept design

A number of refinements were made to the concept design following the public display in April 2006. Where possible, these refinements incorporate suggestions made by landholders, the community and other stakeholders. In addition to this the design has undergone a value engineering study and review to ensure it is consistent with the objectives and deign criterion developed specifically for the entire Pacific Highway Upgrade Program.

Design changes that have occurred since the publication of the concept design report in March 2006 are discussed in Chapter 6.

6. Preferred concept design

This section provides an overview to the development of the Iluka Road to Woodburn project to meet a Class A standard. It outlines construction issues affecting the design development and presents an overall preferred concept with these issues and requirements in consideration. It also provides a preliminary indication of a possible design layout for a Class M scenario.

6.1 Approach to preferred concept design development

At an early stage in the Iluka Road to Woodburn project it was identified that a limited study area would meet the objectives of the highway upgrade. With other Pacific Highway upgrade projects, several options were able to be investigated to identify the best solution for road users, communities and the environment while meeting the functional project objectives. In the case of the Iluka Road to Woodburn upgrade however, the existing road passes through no built-up areas. The surrounding areas provide limited scope for reasonable improvement in alignment without detrimental effect to private property and the environment and an alternative route would not necessarily have delivered any substantial travel time savings. As such, the approach to the concept design development was to duplicate the existing highway adjacent to the existing highway where possible. The development of the preferred concept design to date has comprised the key stages as detailed below.

6.2 Class A and Class M

The Iluka Road to Woodburn Pacific Highway upgrade preferred concept design comprises a Class A road that is capable of being upgraded in the future to a Class M road. These are defined as:

- Arterial road style (referred to as Class A) — two lanes in each direction (median width to accommodate future upgrading to three lanes in each direction), 100 km per hour posted speed, limited access condition roadway with at grade intersections. This may include intersections where right turn movements are permissible. Under a Class A scenario, local traffic and through traffic would continue to share the highway.

- Motorway style (referred to as Class M) — two lanes in each direction (median width to accommodate future upgrading to three lanes in each direction), 110 km per hour posted speed, controlled access condition roadway with grade-separated interchange access, and a continuous alternative route. If warranted by future traffic growth, the Class M upgrade may include widening within the median to six lanes (three in each direction).

The proposed upgrade of the Pacific Highway between Iluka Road and Woodburn is being approached as a Class A upgrade. However, in carrying out the investigations for the project, the study team has also considered how the proposed concept design might be upgraded to Class M, and what this would entail in terms of the wider road footprint and associated property impacts.

It is not possible to anticipate when the Iluka Road to Woodburn section of the Pacific Highway might be upgraded to Class M. However, planning is important at this stage of the project so that in the event of a possible future Class M upgrade it can be achieved with minimal disruption to property owners and highway operation. The planning and design for the Class A concept seeks to minimise the need for further reconstruction of large sections of new highway, should the Class M strategy be implemented, thus, without further disruption or uncertainty for private landowners.

6.3 Overview of existing conditions and proposed improvements

Substantial lengths of the Pacific Highway between Iluka Road and Woodburn are suitable for reconstruction to a 110 km/h design speed dual carriageway. This potentially facilitates straightforward duplication of the highway on its current alignment, either to the east or west of the existing carriageway. However, there remain a number of locations where the existing alignment is of a relatively poor standard and duplication would not be feasible. These locations are shown in Figure 6.1.

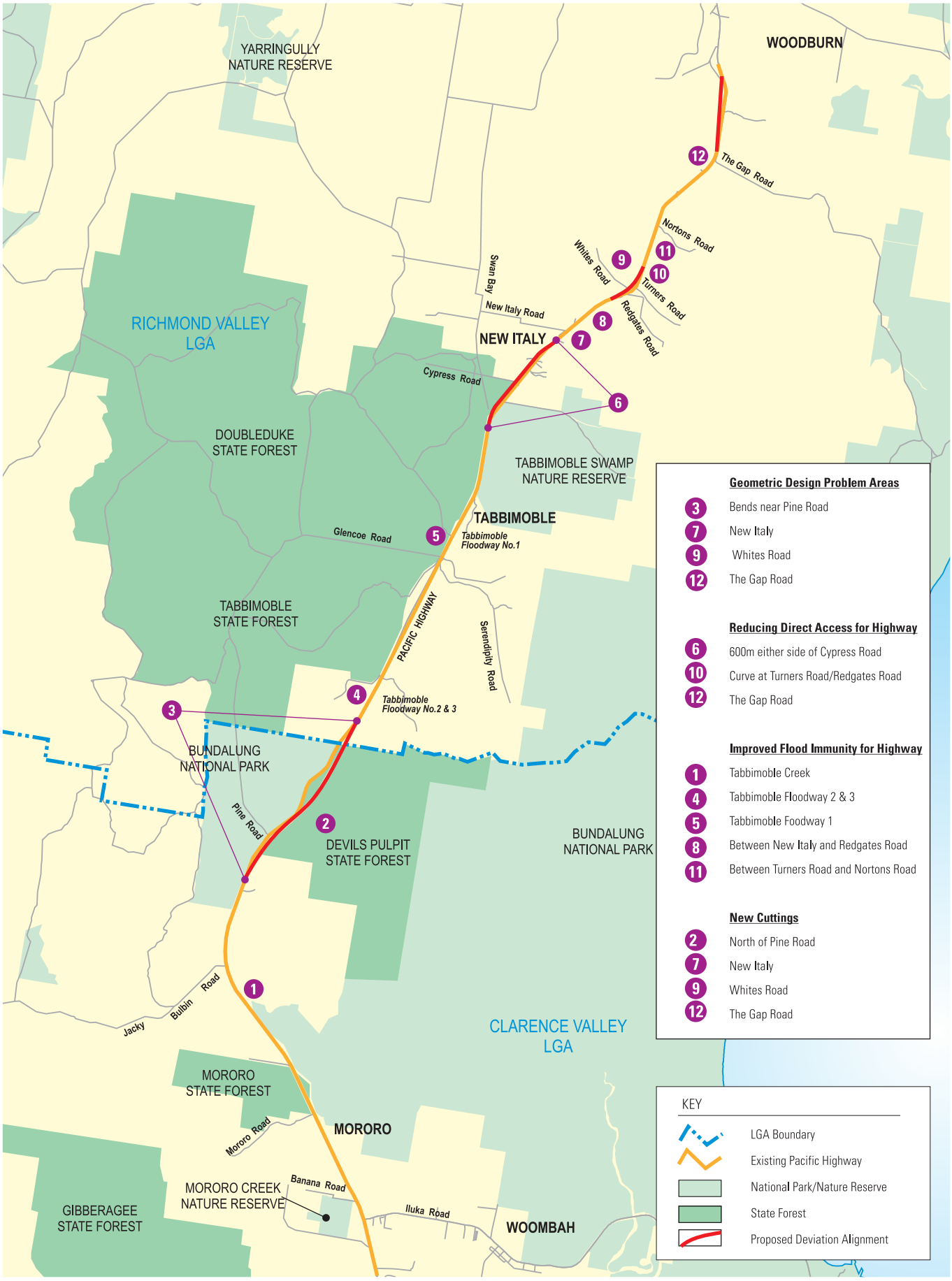

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Figure 6.1

Existing Pacific Highway Opportunities for Improvement

6.4 Description of the preferred concept design

Given the considerations outlined in this chapter, the issues raised by the community and government stakeholders, and the constraints identified through the detailed studies documented in Chapter 3, a proposed concept design has been developed that responds to the issues and constraints. The main features of the proposed concept design are listed below:

The proposed concept design is presented in Figure 6.2a to 6.2i.

6.4.1 Typical cross-section

The typical cross-section (see Figure 6.4) of the proposed concept design consists of the following:

- Typical 10 m verge.
- Typical 2.5 m shoulder (typical).
- Minimum 2 x 3.5 m traffic lanes.
- Minimum 0.5 m offside shoulder.
- Minimum 11 m central median reserve.
- Minimum 0.5 m offside shoulder.
- Minimum 2 x 3.5 m traffic lanes.
- Typical 2.5 m shoulder (typical).
- Typical 10 m verge.

Additionally, a road reserve has been identified to enable future parallel service roads to be provided on either side or both sides of the carriageway under a Class M scenario (also illustrated in Figure 6.4).

6.5 Summary of changes since publication of concept design in March 2006.

Following consultation and display of the Concept Design Report, the following changes were made to the concept design:

6.5.1 Strategic changes

Strategic changes have occurred following publication of the Concept Design in March 2006 in order to address access and public transportation issues.

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined u-turn, crossover facilities located at an average of 3 km at:
  - CH 58.000.
  - CH 61.800.
  - CH 65.000.
  - CH 68.500.
  - CH 70.800.
  - CH 73.600.
  - CH 77.300.
  - CH 81.300.
  - CH 81.300 with u-turn north to south only.
  - CH 87.450.
- Bus stops added to egress side of selected side roads.

6.5.2 Specific Changes

Specific design changes have occurred following publication of the Concept Design in March 2006 in order to address a number of issues. These are summarised as follows (from south to north):

- Iluka Road access to be designed to connect final dual carriageway under Wells Crossing to Iluka Road Project, as a result Banana Road would connect to the Iluka Road Interchange via a new slip road.
- U-turn located at CH 59.400 just north of Mororo Road.
- Rest area just north of Mororo Road to be retained under Class A only.
- Southbound rest area to be shifted 30m north to reduce environmental impact.
- Jacky Bulbin Road seagull to include u-turn.
- Offline section realigned to conform with revised cadastral information.
- Median right turn added at CH 65.650 into private access.
- Merge Taper added at Serendipity Road.
- Median right turn added at CH 80.400 into Cypress Road.
- Cut at New Italy reduced to decrease impact on area, including *Melaleuca irbyana*.
- Road realigned between Cypress Road and New Italy Road to reduce land acquisition and impact of mango trees. Retaining wall added to eliminate batter adjacent to mango trees and well.
- Access to four properties 300 to 600 m north of Cypress Road to be combined to one egress only.
- Parking area to be formalised at New Italy to enable parking for 60 vehicles.
- Median right turn added with u-turn facility at Whites Road.
- Bend at Gap Road realigned to 1000 m to reduce impact on western side.
- Cut at New Italy reduced to decrease footprint and impact on area.
- U-turn located at CH 85.800 Nortons Road.
- Parallel service road from Wondawee Way to Trustums Hill Road added.
- Major design change at northern tie in due to excessive material requirements for the Woodburn to Ballina project. Full dumbbell interchange to be incorporated into design with future north facing ramps.

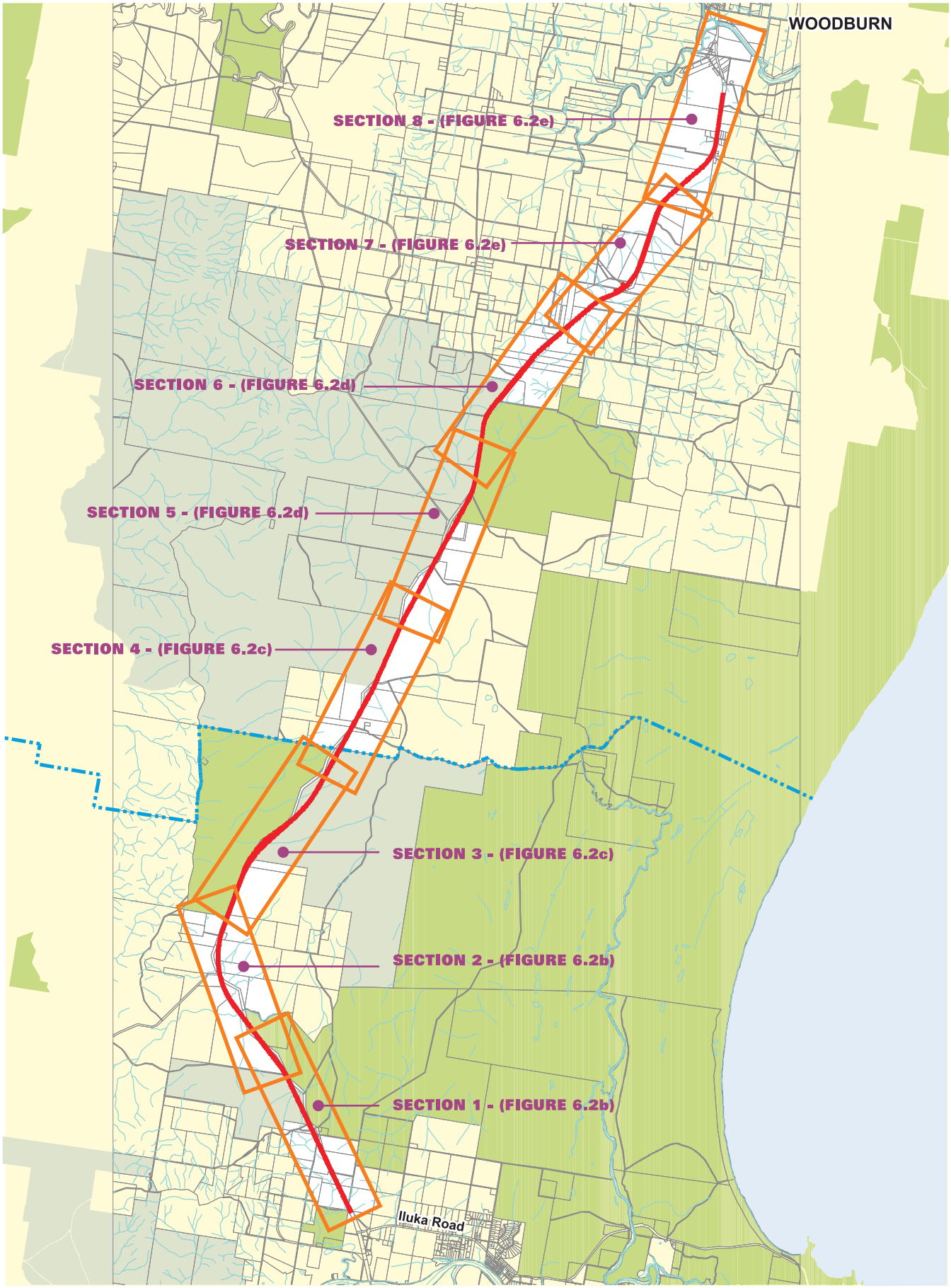

Figure 6.2a

Preferred Concept Design Sections Map - Arterial (class A)

6.6 Concept design Iluka Road to Woodburn Class A

6.6.1 Section 1 – Iluka Road to Mororo State Forest (Figure 6.2b)

At the southern end of the study area, the project will connect to the upgraded Pacific Highway being developed concurrently by the RTA for the Wells Crossing to Iluka Road project. This adjoining project includes a proposed grade-separated interchange (ie flyover) at Iluka Road, and associated on and off ramps enabling u-turns to be made in both directions. The proposed concept design will connect to the interchange, with the existing highway becoming the southbound lanes, and two new northbound lanes being constructed on the western side. Just north of Banana Road the proposed carriageway switches sides to the eastern side with the existing road forming the northbound carriageway.

Banana Road would connect to the grade separated interchange via a two way extended north facing ramp.

A double u-turn bay incorporating a maintenance cross-over is located between Banana Road and Mororo Road.

Mororo Road would have left-in, left-out access onto the highway's northbound carriageway with access to the south via a u-turn bay directly opposite enabling refuge within the median for u-turn movement. Access into Mororo Road from the north would be via the u-turn bay 1 km to the south.

A bus stopping bay would be located at Mororo Road

It is envisaged that the existing rest area to the north of Mororo Road will remain under a Class A arrangement, but may not be suitable for Class M.

A new southbound only rest area would be provided 800 m north of Mororo Road. This would be served by dedicated slip roads. This rest area would be designed to accommodate overnight parking for B-doubles as well as all other types of heavy and light vehicles.

The location for the rest areas meets the RTA rest area strategy, which requires a typical spacing of 50 km between major rest areas along the Pacific Highway. The proposed locations would also ensure that the rest areas are not in close proximity to any residences or other noise-sensitive land uses.

At the curve north of Mororo Road, the new carriageway would switch sides, with the existing highway becoming the southbound carriageway, and two new lanes being constructed on the western side.

Summary of Changes since publication of Concept Design in March 2006.

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined facilities.
- Bus stops added to egress side of side roads.
- Iluka Road access and to be designed to connect final dual carriageway with short northbound slip (1:15 taper). As a result of this, Banana Road to be left in left out.
- Rest area just north of Mororo Road to be retained under Class A only.
- Southbound rest area to be shifted 30m north to reduce environmental impact.
- Combined u-turn, crossover facilities located halfway between Mororo Road and Banana Road.
- U-turn located at CH 59.400 just north of Mororo Road.

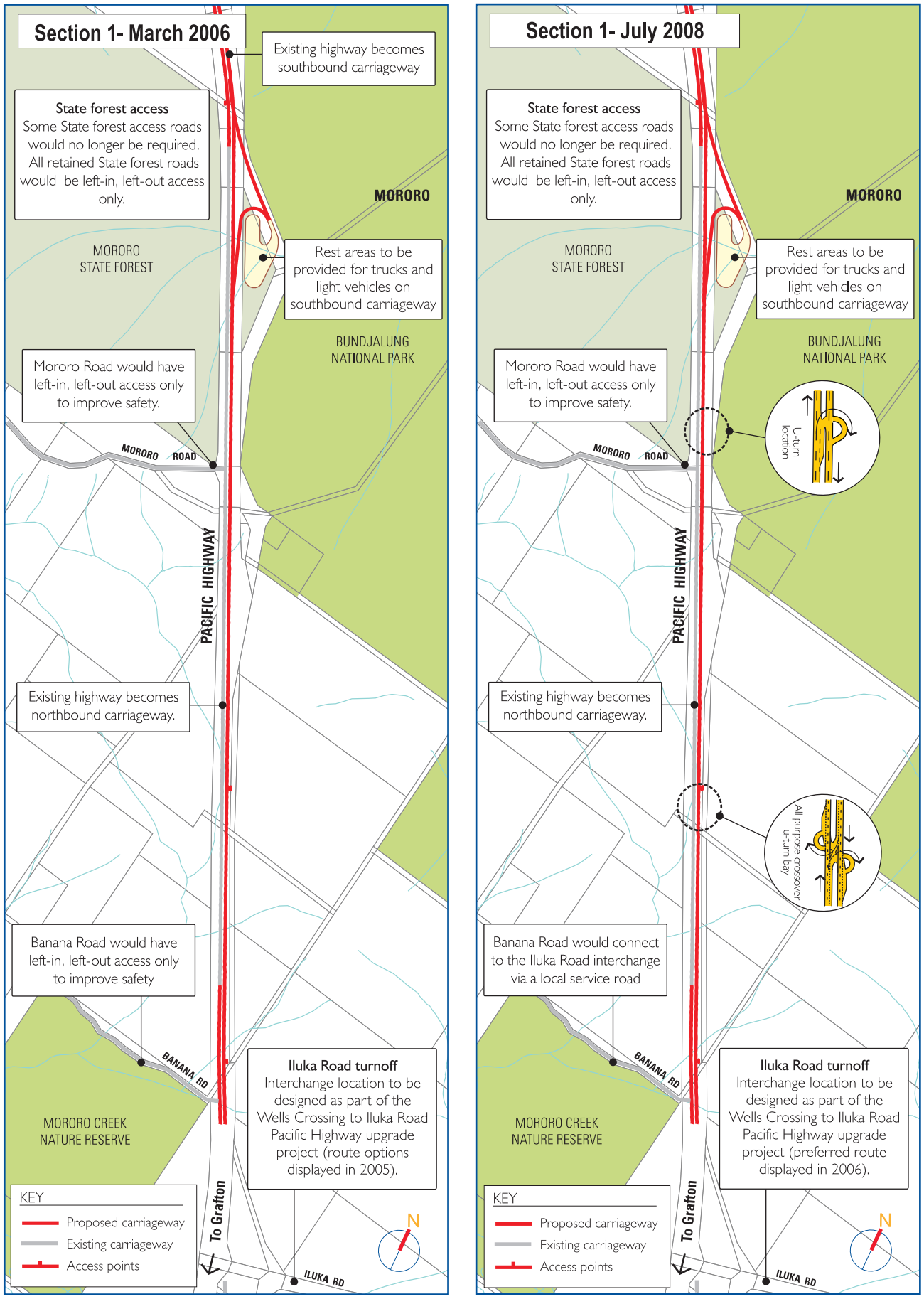

Figure 6.2b

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Preferred Concept Design Arterial (class A) compared to March 2006 Concept Design

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6.6.2 Section 2 – Mororo State Forest to Bee Keepers (Figure 6.2c)

The duplication of the existing highway continues to the west of the existing from Mororo State Forest for approximately 4 km. A 'Seagull' type T-intersection is proposed at Jacky Bulbin Road

A double u-turn bay incorporating a maintenance cross-over is located 1.8 km south of Jacky Bulbin Road.

Jacky Bulbin Road is located on the floodplain of Tabbimoble Creek, where existing highway levels are likely to require raising to achieve the desired flood immunity level. Some fill is therefore likely to be required.

A bus stopping bay would be located at Jacky Bulbin Road and Old Pacific Highway opposite.

Approximately 1 km north of Jacky Bulbin Road, the new lanes would again switch sides, with the existing highway becoming the northbound lanes and two new lanes being constructed on the eastern side.

A double u-turn bay incorporating a maintenance cross-over is located 100m south of the Bee Keepers rest area.

The Bee Keepers rest area would be removed as a full rest area is to be provided north of Mororo Road.

Summary of Changes since publication of Concept Design in March 2006.

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined facilities.
- Bus stops added to egress side of side roads.
- Combined u-turn, crossover facilities located near Mororo State Forest.
- Jacky Bulbin Road seagull to include u-turn.
- Combined u-turn, crossover facilities located near Bundjalung National Park.

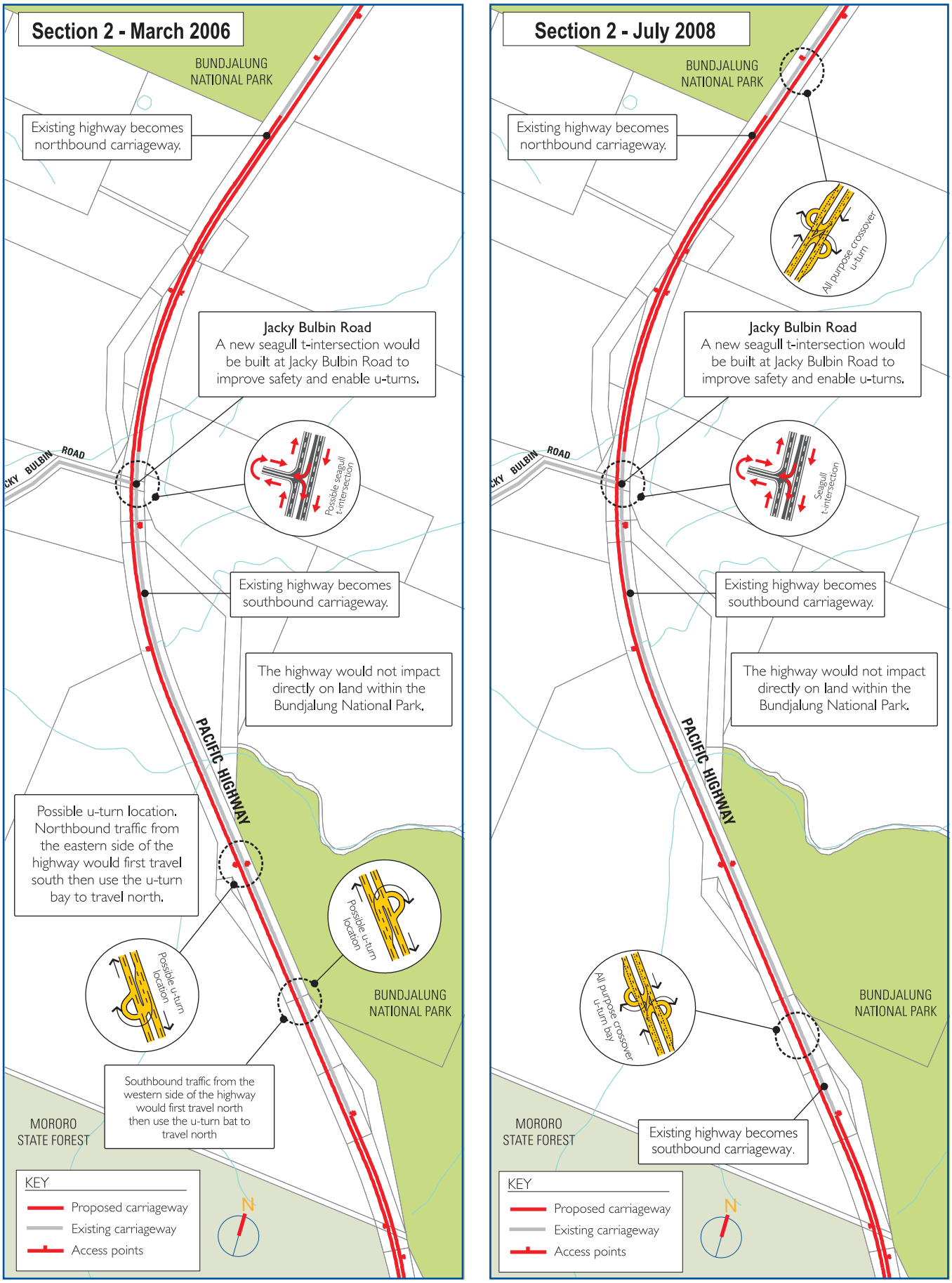

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Figure 6.2c

Preferred Concept Design Arterial (class A) compared to March 2006 Concept Design

6.6.3 Section 3 –Bee Keepers to Khans Track (Devils Pulpit State Forest) (Figure 6.2d)

Pine Road, which provides access to Bundjalung National Park, would be limited to left-in, left-out turn movements only.

A u-turn bay is proposed to be located approximately 1.2 km south of Pine Road, to permit northbound traffic to gain access to private properties on the eastern side of the highway.

There are five consecutive horizontal curves in the existing alignment North of Pine Road that cannot accommodate a 110 km/h design, and which also vary vertically. The proposed preferred concept therefore incorporates two sections of deviation. A 2 km deviation is proposed at Pine Road. The proposed southbound carriageway would be on a Class M alignment and the northbound makes use of the existing carriageway where possible. Under a Class M arrangement, a new northbound carriageway could be constructed adjacent to the proposed southbound carriageway and the original highway would revert to a service road.

A 3 km deviation is also proposed at Devils Pulpit State Forest. This highway would be realigned in this area to provide a new four lane highway within this corridor. In anticipation of a future deviation, the RTA had previously acquired a 3 km corridor of land through the Devils Pulpit State Forest to the east of the Pine Road bends.

The reserved corridor ends at the southern end of the Tabbimoble Straight, and provides an opportunity to gain substantial quantities of fill material.

A double u-turn bay incorporating a maintenance cross-over is located 1.5 km north of Pine Road within the new deviation.

Khans Track would be relocated alongside the highway boundary within the state forest with some current accessed relocated further north or south.

A northbound rest area would be located between the existing alignment and proposed off-line section 2.5 km north of Pine Road. This rest area would be designed to accommodate overnight parking for B-doubles as well as all other types of heavy and light vehicles.

The location for the rest areas meets the objectives of the RTA's rest area strategy, which require a typical spacing of 50 km between major rest areas along the Pacific Highway. The proposed locations would also ensure that the rest areas are not in close proximity to any residences or other noise-sensitive land uses.

Summary of Changes since publication of Concept Design in March 2006.

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined facilities.
- Median right turn added at CH 65.650 into private access.
- Combined u-turn, crossover facilities located 1 km north of Pine Road.
- Offline section realigned to conform with revised cadastral information.

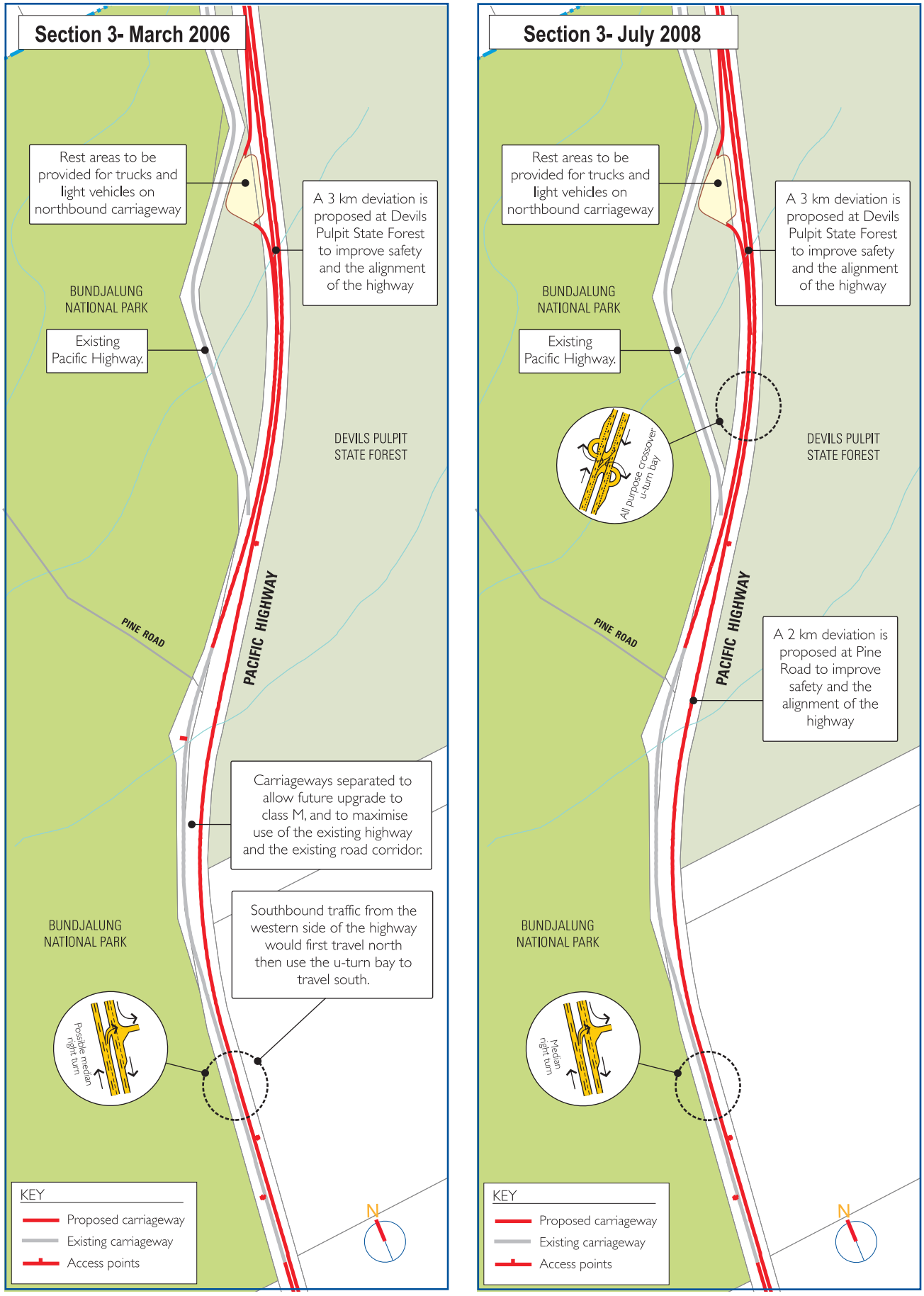

Figure 6.2d

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Preferred Concept Design Arterial (class A) compared to March 2006 Concept Design

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6.6.4 Section 4 –Khans Track (Devils Pulpit) to McFaydon Road (Figure 6.2e)

To the north of Tabbimoble Floodway No. 2, the new highway lanes switch again to the western side and the existing highway would become the southbound lanes. This configuration would continue for the length of the Tabbimoble Straight.

A double u-turn bay incorporating a maintenance cross-over is located 1.7 km north of Tabbimoble Floodway No. 2.

Summary of Changes since publication of Concept Design in March 2006.

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined facilities.
- Offline section realigned to conform with revised cadastral information.
- Combined u-turn, crossover facilities located 500 m south of Tabbimoble Floodway No. 3. Combined u-turn, crossover facilities located 1.7 km north of Tabbimoble Floodway No.2.

6.6.5 Section 5 –McFaydon Road to Tabbimoble Floodway 1 (Figure 6.2f)

A 'Seagull' type T-intersection is proposed at Serendipity Road, which would be realigned so that it intersects with the highway approximately 150 m south of the existing intersection (back to its original location). The existing intersection is currently a four-way junction, with Glencoe Road (a forest access road) making up the fourth arm of the intersection on the western side. Glencoe road would become left-in, left-out only.

A bus stopping bay would be located at Serendipity Road.

A double u-turn bay incorporating a maintenance cross-over is located 1 km north of Tabbimoble Floodway No. 1.

Summary of Changes since publication of Concept Design in March 2006.

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined facilities.
- Bus stops added to egress side of side roads.
- Combined u-turn, crossover facilities located 1 km north of Tabbimoble Floodway No. 1.

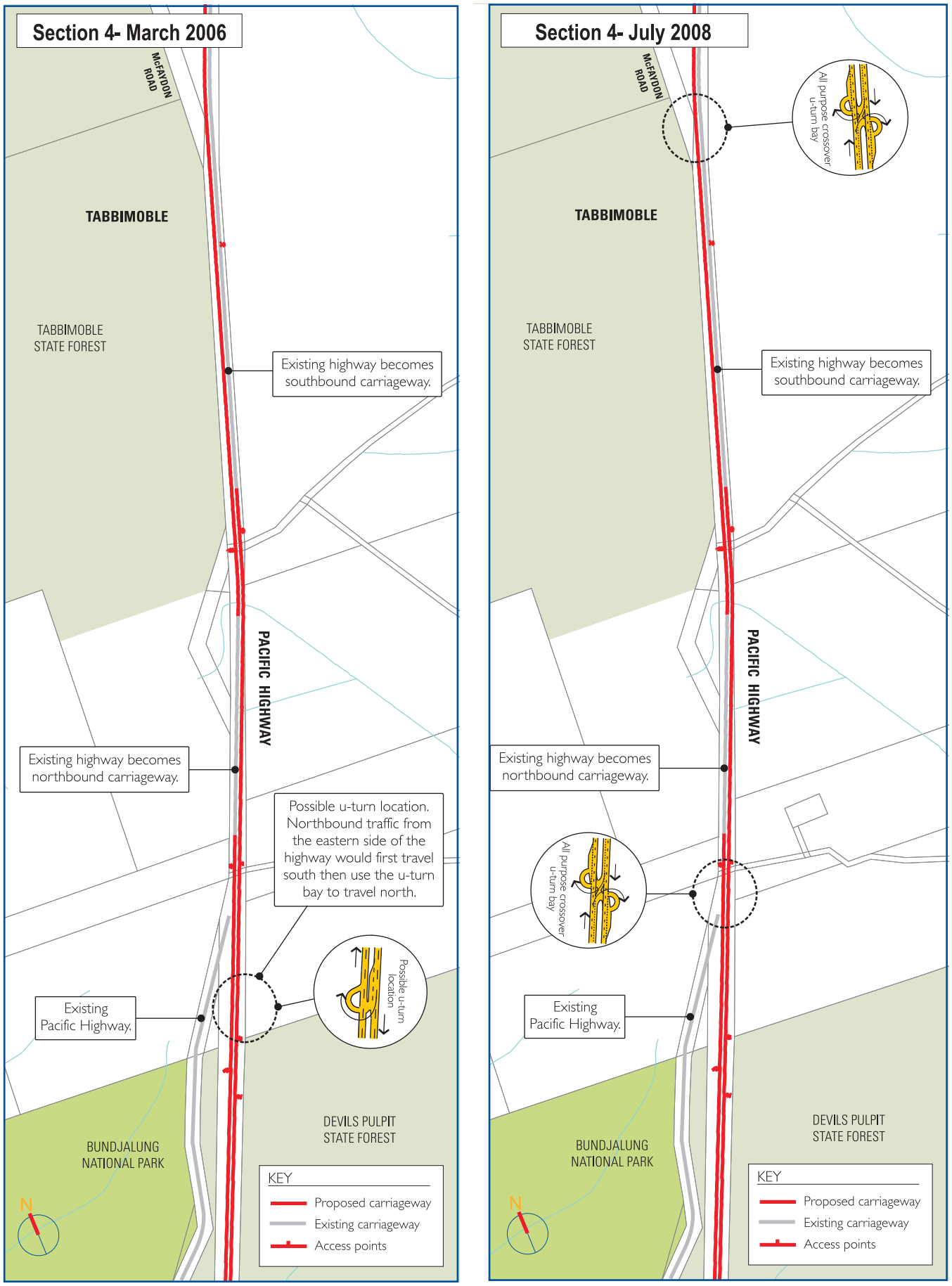

Figure 6.2e

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Preferred Concept Design Arterial (class A) compared to March 2006 Concept Design

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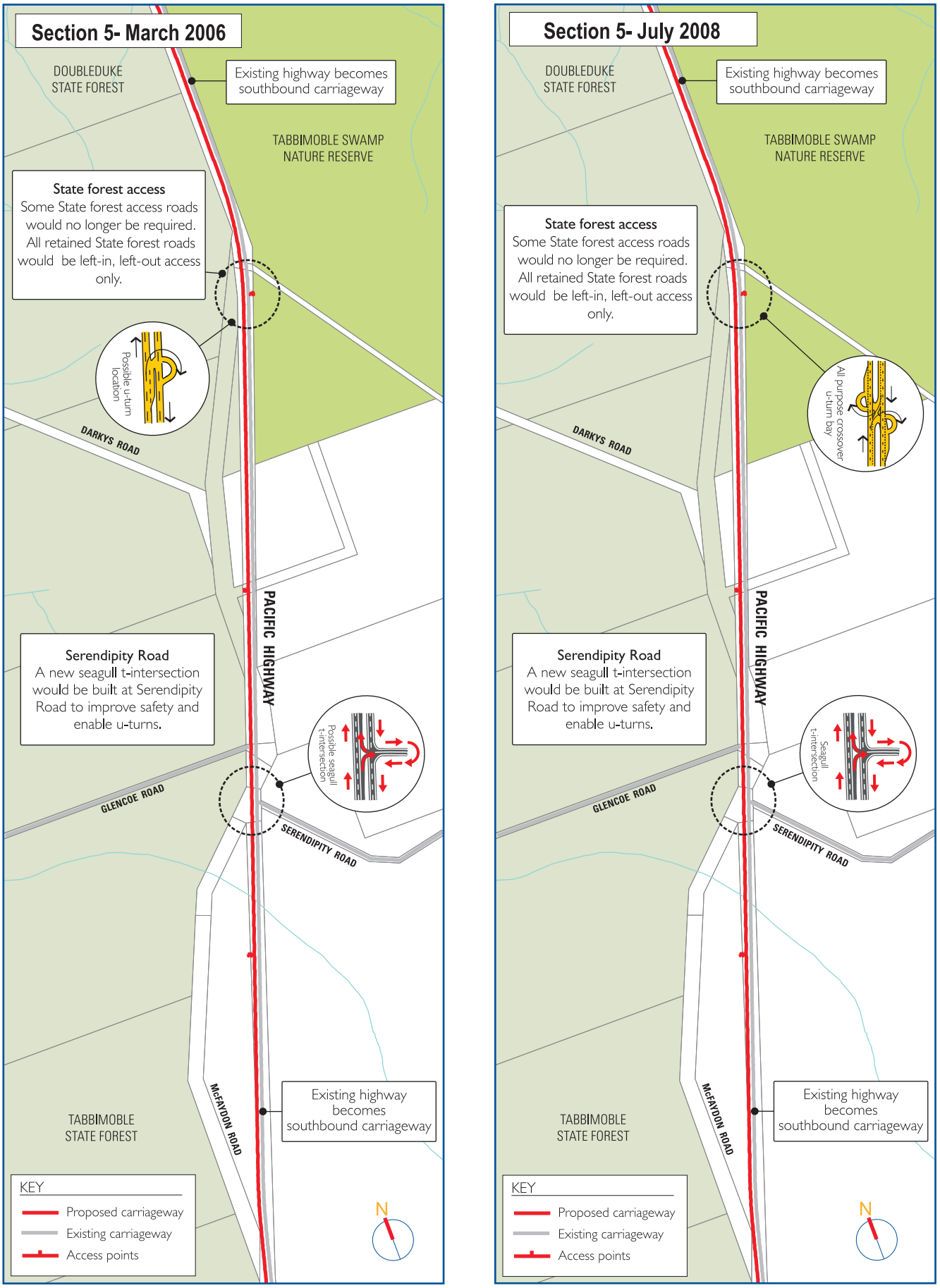

Figure 6.2f

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Preferred Concept Design Arterial (class A) compared to March 2006 Concept Design

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6.6.6 Section 6 – (North of Tabbimoble Floodway 1 to Oakey Flat (Figure 6.2g)

Between Doubleduke State Forest and Tabbimoble Swamp Nature Reserve the Highway is to be duplicated on the western side. This is to avoid impact on the Nature Reserve.

In the Cypress Road area, the preferred concept requires both carriageways of the Highway to be located adjacent to the existing highway on its western side. The proposed new construction would render a 1.4 km section of the existing highway redundant. This section of road would be utilised as a local access road servicing four private properties and the Tabbimoble Swamp Nature Reserve via Minyumai Road, but requiring only a single left-in, left-out access that would be located approximately 200 m north of Cypress Road.

A bus stopping bay would be located at the entrance to the new service road at Tick Gates.

Cypress Road may be accessed from the north by a u-turn facility and right turn lane within the median. This u-turn facility also enables residents south of the tick gates to head north after travelling south.
Cypress Road adjoins a straight section of existing highway that has an acceptable gradient, however, new construction of a dual carriageway to the existing alignment for 1.1 km is required because of:

- The need to avoid encroachment into Tabbimoble Swamp Nature Reserve.
- The need to avoid undesirable reverse curves in the new road alignment (ie S-shaped curves).
- The need to realign with the existing highway at New Italy, which is tightly constrained by land use and heritage issues, on both sides of the highway.

Since the publication of the Concept Design Report, the bend in the Cypress Road area (to the north of the tick gates) has been refined as part of the preferred concept design, resulting in a slight shift to the east of in order to utilise the existing road corridor more effectively and reduce impact to well and mango trees on the western side of the Highway.

A double u-turn bay incorporating a maintenance cross-over is located halfway between Swan Bay New Italy Road and Cypress Road.

Approaching New Italy, the preferred concept design again adopts the existing highway as the northbound carriageway and duplicates on the eastern side. Adjacent to the Swan Bay New Italy Road intersection which is currently situated on a crest with poor visibility to the south, the formation would be cut deeper, improving sight distances and gaining further fill materials.

The existing Swan Bay New Italy Road intersection is one of the busier intersections in the study area and has poor visibility to the south. The current intersection is close to the adjacent New Italy Museum Complex buildings, and duplication of the existing traffic lanes would not facilitate an improved intersection with better visibility. It has been identified that four new traffic lanes would need to be constructed in a deeper cutting on a new vertical alignment, (though similar horizontal alignment as the existing roadway). A ‘Seagull’ type intersection is proposed to be be constructed to provide safe movements to and from the Pacific Highway. The design for the new intersection includes an improved vertical alignment, flattening the highway gradient to the north and south of the Swan Bay New Italy Road turnoff, to improve visibility in both directions and maximise safety.

A bus stopping bay would be located at Swan Bay New Italy Road.

Summary of Changes since publication of Concept Design in March 2006.

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined facilities.
- Bus stops added to egress side of side roads.
- A southbound to northbound u-turn bay is located at Cypress Road.

Combined u-turn, crossover facilities located halfway between Swan Bay New Italy Road and Cypress Road.

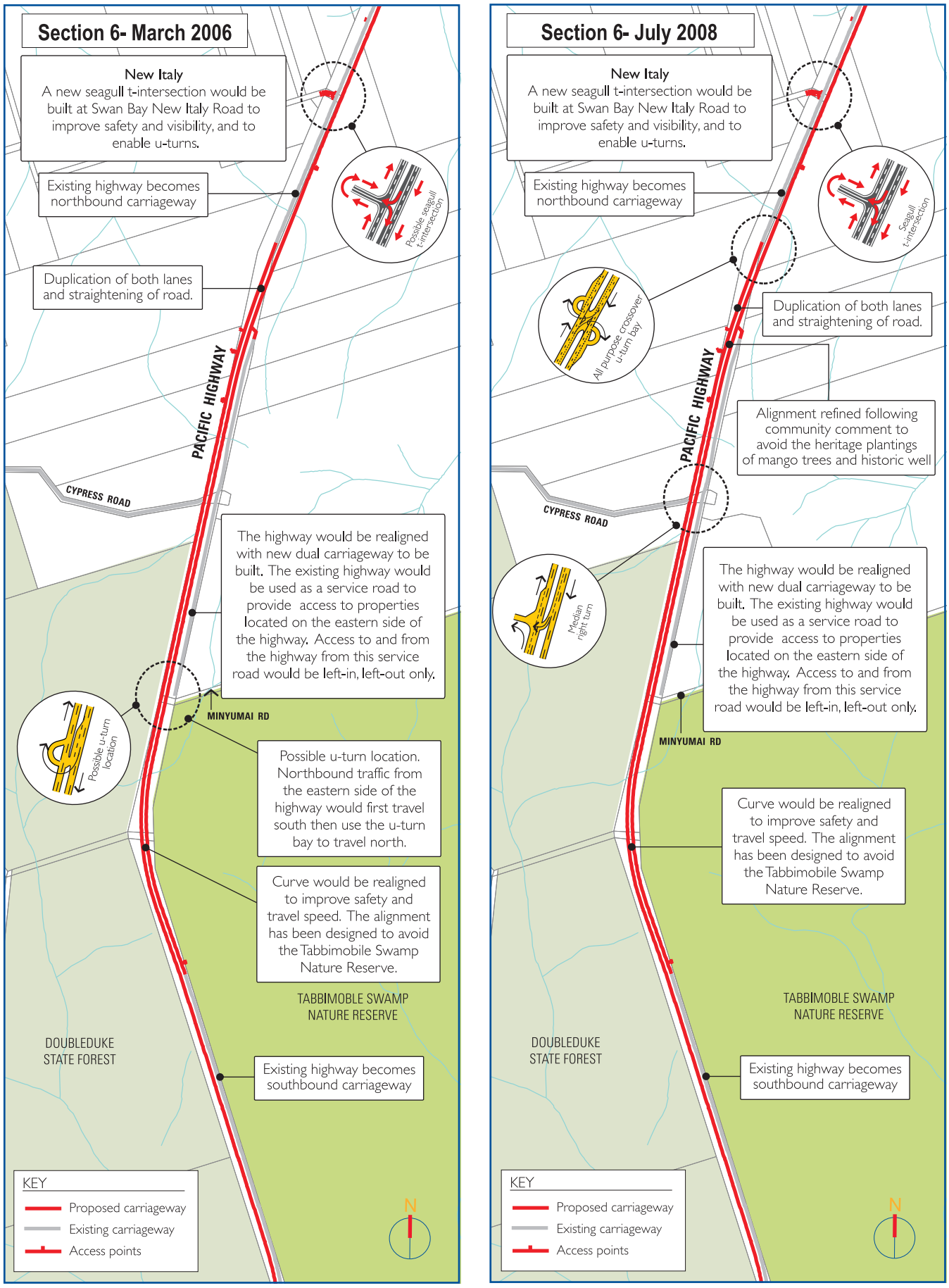


Figure 6.2g

Preferred Concept Design Arterial (class A) compared to March 2006 Concept Design

6.6.7 Section 7 – Oakey Creek to Nortons Road (Figure 6.2h)

From New Italy to Whites Road the new alignment switches sides, with the existing highway becoming the southbound carriageway. Between New Italy and Whites Road at Oakey Creek, the highway reaches its lowest point, with the existing road surface being at an elevation of less than 2 m AHD. Therefore, this length of road (approximately 1.25 km) would require additional fill material to achieve the desired flood immunity of a 1:20 flood event on at least one carriageway. Some additional culverts or upgrading of the existing structures may be required.

The existing curve adjacent to Whites Road has too small a radius for the required design speed of 110 km/h (see Figure 6.2e). A 1.1 km length of new four-lane road would therefore be required to increase the curve radius and meet the RTA's design standards. The new section of road would be located up to a maximum 100 m west of the existing two-lane highway. It is also anticipated that it can be constructed in a cutting, reducing the level of the road significantly, thus reducing the visual and acoustic impact on the surrounding area. It is anticipated that the redundant piece of existing highway would then be used to provide local access for Redgates Road and Turners Road.

Whites Road would be left-in left-out plus a right turn lane into it contained within the median. A u-turn facility would be located at Whites Road would enable residents from Redgates Road and Turners Road to head north.

Bus stopping bays would be located at both accesses.

Between the Whites Road bend and Nortons Road, the existing highway would become the southbound lanes, with new construction on the western side to create the northbound lanes (see Figure 6.2e).

The section between Whites Road and Nortons Road is low-lying, and would require fill material to improve flood immunity.

Two u-turn bays are proposed north of the Whites Road bend, to enable safe turn movements from each of the north and southbound carriageways. Nortons Road would become left-in, left-out only.

A northbound to southbound u-turn bay incorporating a maintenance cross-over is located Just north of Turners Road.

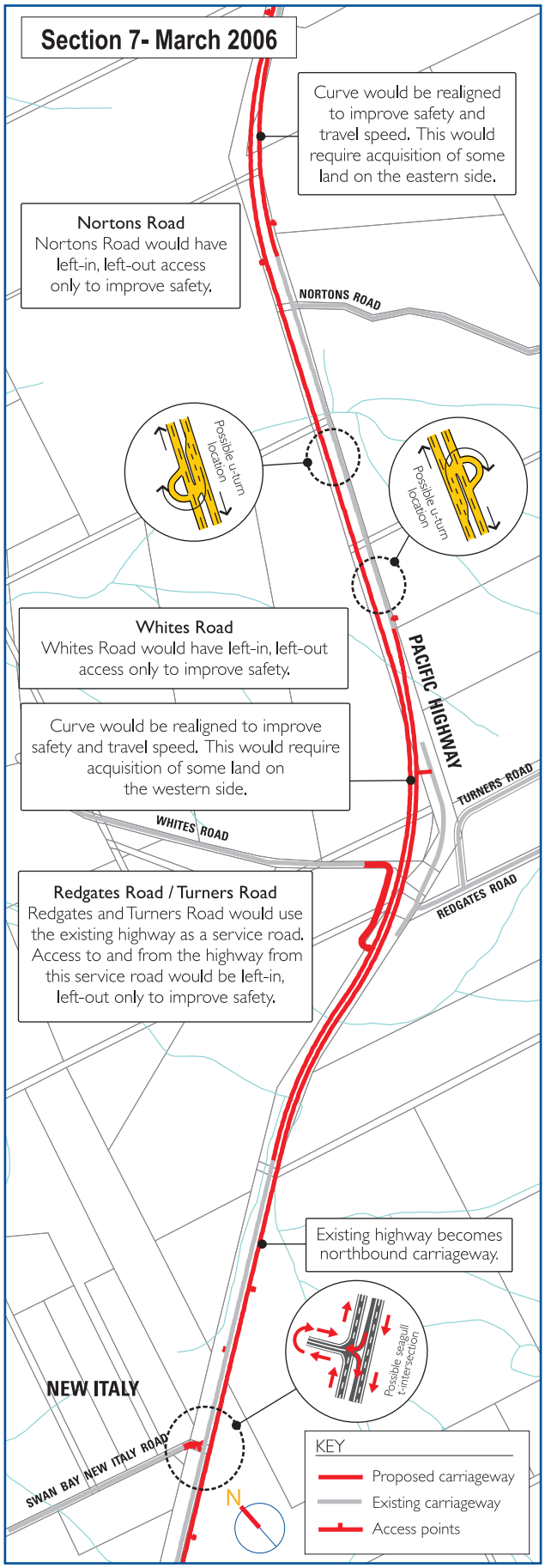
A southbound to northbound u-turn bay is located at Nortons Road.

The median has additional width on this section to enable the existing Pacific Highway/proposed southbound carriageway to be converted to a service road and a new southbound carriageway to be constructed in the median under a future Class M arrangement. Building the northbound carriageway in its ultimate Class M position allows the carriageway to continue to be used when converting from Class A to M in the future.

A bus stopping bay would be located at Nortons Road.

Summary of Changes since publication of Concept Design in March 2006.

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined facilities.
- Bus stops added to egress side of side roads.
- U-turn bay incorporating a maintenance cross-over is located just north of Turners Road.
- U-turn bay is located at Nortons Road.



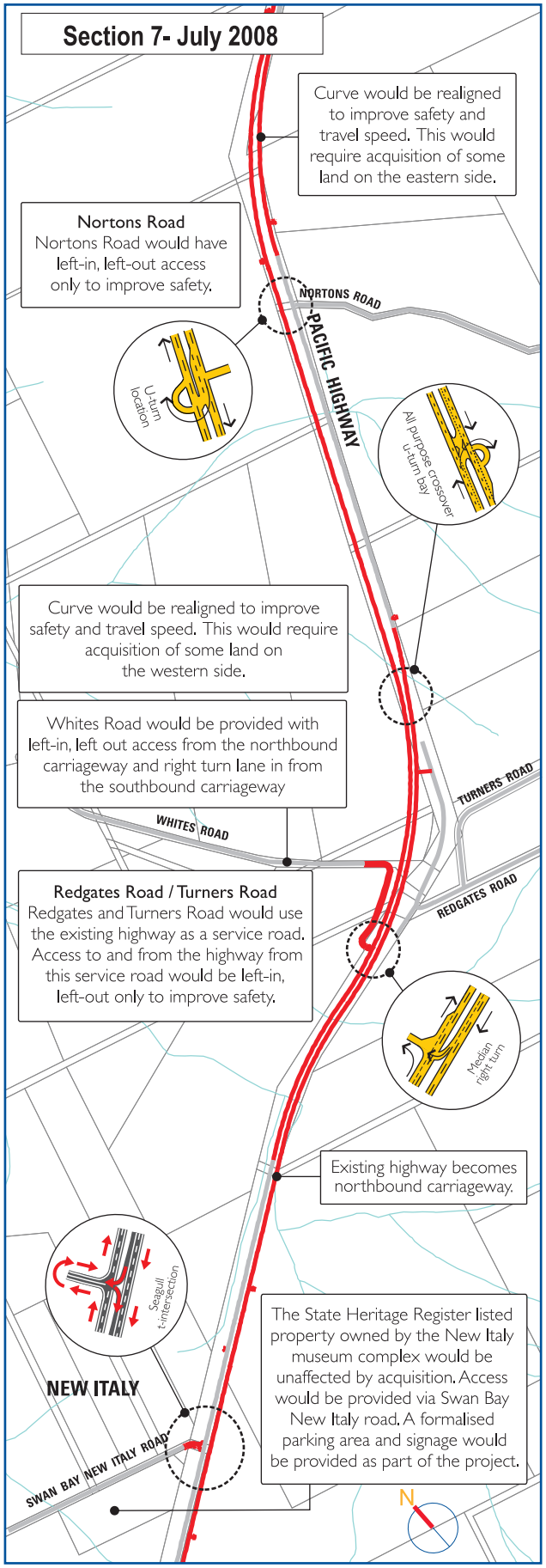


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Figure 6.2h

Preferred Concept Design Arterial (class A) compared to March 2006 Concept Design

6.6.8 Section 8 – North of Nortons Road to Trustums Hill Road (Figure 6.2i)

Between Nortons Road and The Gap Road, the proposed concept design has a new northbound carriageway on the western side with the existing road forming the southbound carriageway.

A further double u-turn bay incorporating a maintenance cross-over is located 600m south of The Gap Road

Between The Gap Road and Trustums Hill Road the preferred concept design has changed substantially between following publication of the Concept Design Report in March 2006 and subsequent community feedback.
Within the concept design published in March 2006, a possible location for grade separated interchange was indicated north of Trustums Hill Road as part of the Woodburn to Ballina project, however following concerns regarding access to Woodburn and opportunity to reduce net cut and fill balance of materials for both schemes, the grade separated interchange has been located further south between The Gap Road and Trustums Hill Road. This would also provide a connection between Woodburn, Trustums Hill, Wondawee Way and The Gap Road without traversing the Pacific Highway Upgrade. At this stage the interchange is envisaged to be a dumbbell type double roundabout connected by a two lane bridge over the highway with south facing ramps. North facing ramps could be provided when warranted by traffic demand.

Tuckombil Road would remain as a local access road, but the existing intersection at The Gap Road would be closed. Access from The Gap Road to the Pacific Highway would be via the interchange.

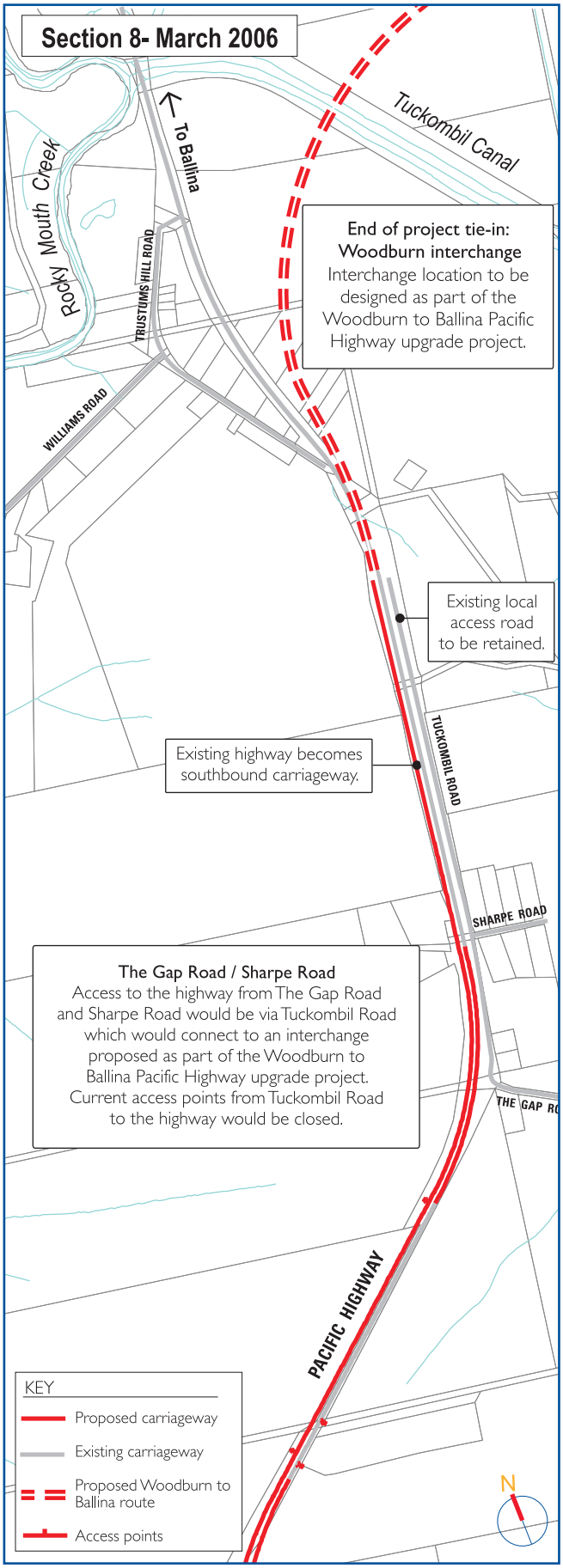
The existing access from the highway into the northern end of Tuckombil Road would also be closed, with traffic diverted to the connection referred to above.

Following consultation after the publication of the Concept Design Report in March 2006, changes made at Wondawee Way and the curve at The Gap Road seek to minimise the impact on properties on the western side of the highway without compromising the design standards of the mainline carriageway.

The project terminates approximately 700m south of the Tuckombil Canal.

Summary of Changes since publication of Concept Design in March 2006.

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined facilities.
- U-turn bay incorporating a maintenance cross-over is located south of The Gap Road.
- Highway shifted west to incorporate grade separated interchange with direct links to Woodburn, The Gap Road and new connection to Wondawee Way.



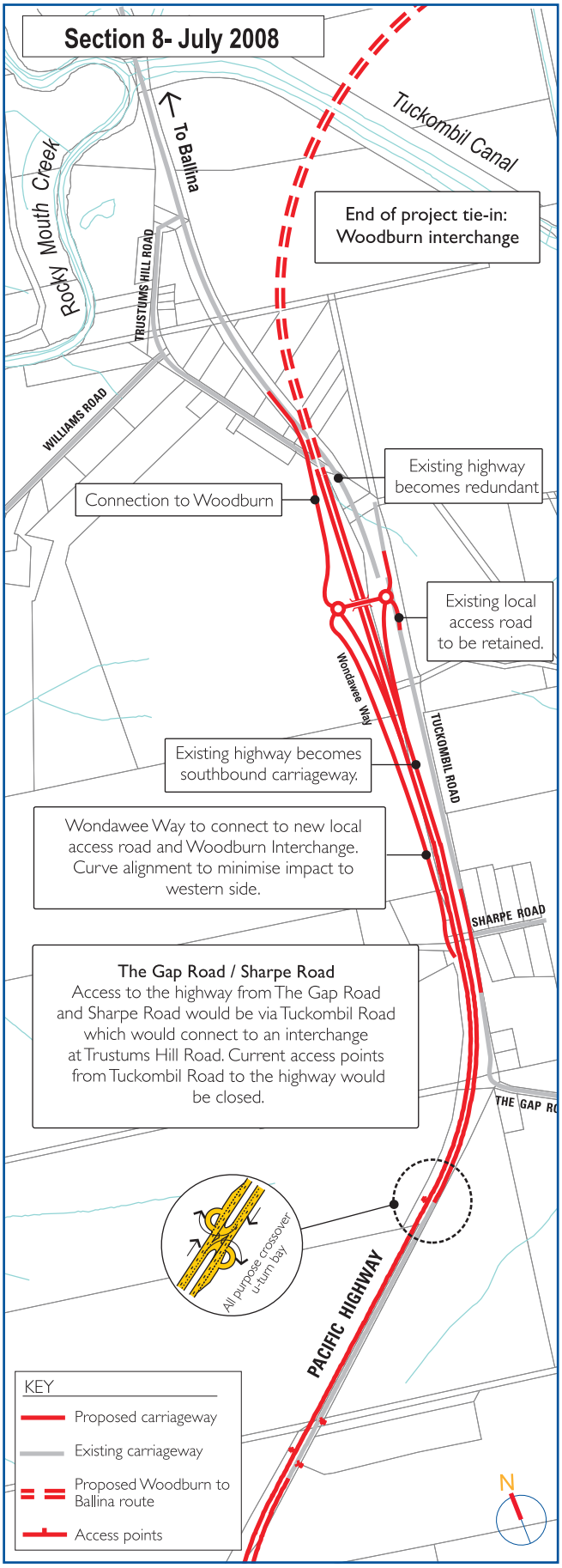


Figure 6.2i

0 250 500m
SCALE

Preferred Concept Design Arterial (class A) compared to March 2006 Concept Design

ILUKA TO WOODBURN\1235.09.GE\06.08.07\RC

6.7 Key design features Iluka Road to Woodburn project Class A

6.7.1 Access strategy

Analysis of local access needs and patterns

A key stage in the planning process has been an assessment of access needs for all private and public properties, and development of a strategy to ensure that access needs are safely met without compromising other important highway design standards.

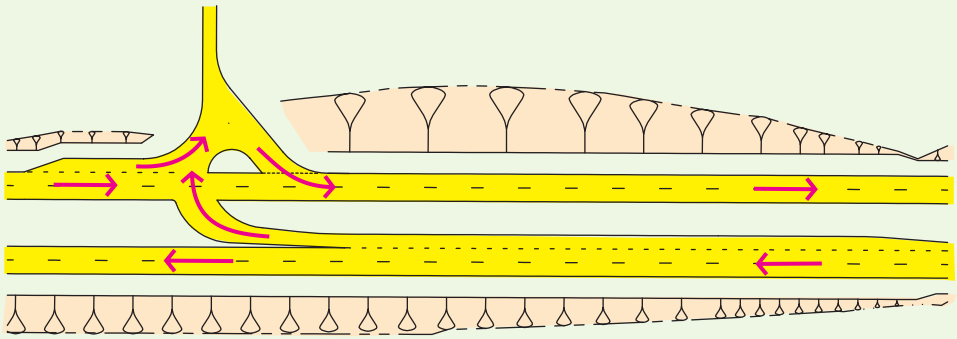
Accesses and u-turn facilities

Access onto and off the upgraded highway for private properties and minor local roads would be achieved through provision of left-in and left-out turning facilities, coupled with strategically placed u-turn facilities (see Figure 6.3). For reasons of safety, right-hand turns would not be permitted onto the highway from private properties and some local roads. Motorists wishing to turn right onto the highway from minor roads and private properties would be required to first turn left, and then travel to the nearest u-turn facility before continuing their journey in the desired direction. It is anticipated that the delay and the extra distance travelled would be off-set by overall reduced journey times, reduced delays and improved safety through eliminating right-turn movements. A summary of Access and u-turn facilities is listed in Table 6.1.

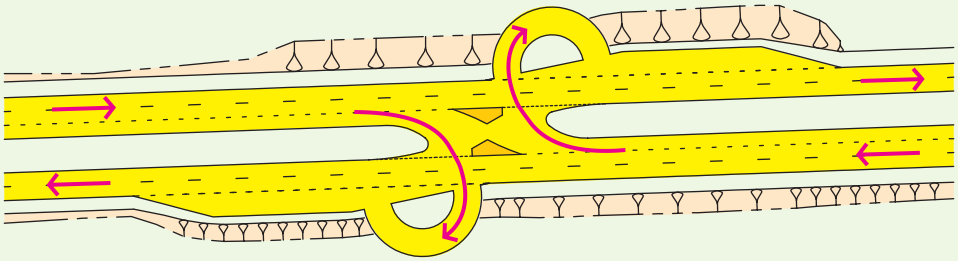
Table 6.1 At-grade intersections with public roads and u-turn facilities

Chainage	Road	Side/direction	Treatment
56980	Banana Road*	West	Left in & Left out
58170	N/A	Bi-directional	Combined u-turn & Crossover
59340	Mororo Road	West	Left in & Left out
59400	Nr Mororo Road	North to South	All purposed u-turn
61800	N/A	Bi-directional	Combined u-turn & Crossover
63500	Old Pacific Highway	East	Left in & Left Out
63680	Jacky Bulbin Road	West	Full Seagull intersection
65000	N/A	Bi-directional	Combined u-turn & Crossover
65650	N/A	North to South	All purpose u-turn
67200	Pine Road	West	Left in & Left Out
68500	N/A	Bi-directional	Combined u-turn & Crossover
70800	N/A	Bi-directional	Combined u-turn & Crossover
73600	N/A	Bi-directional	Combined u-turn & Crossover
75280	Serendipity Road	East	Full Seagull intersection
75500	Glencoe Road	West	Left in & Left Out
77300	N/A	Bi-directional	Combined u-turn & Crossover
85100	Cypress Road	West	Combined u-turn & right turn, with Left in & Left out to side road
81010	Service Road	East	Left in & Left out
81400	N/A	Bi-directional	Combined u-turn & Crossover
82130	New Italy – Swan Bay Road	West	Full Seagull intersection
83770	Whites Road	West	Combined u-turn & right turn, with Left in & Left out to side road
84370	Turners and Redgates Road	East	Left in & Left out
84620	N/A	North to South	Combined u-turn & Crossover
85740	N/A	South to North	All purpose u-turn
85810	Nortons Road	East	Left in & Left out
87560	N/A	Bi-directional	Combined u-turn & Crossover

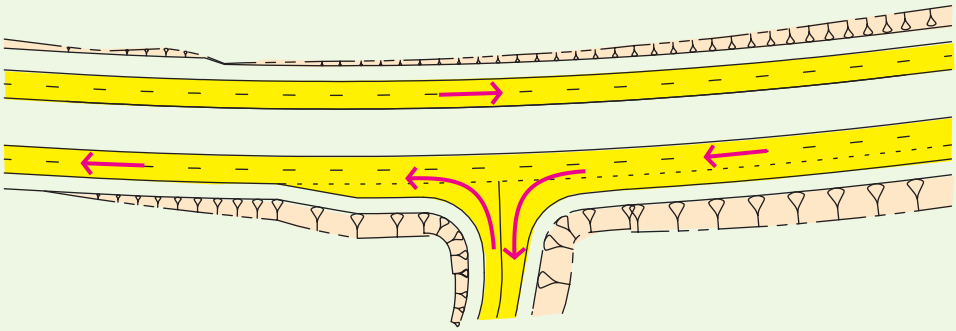
*Note: To be connected to interchange at Iluka Road under Wells Crossing to Iluka Road scheme



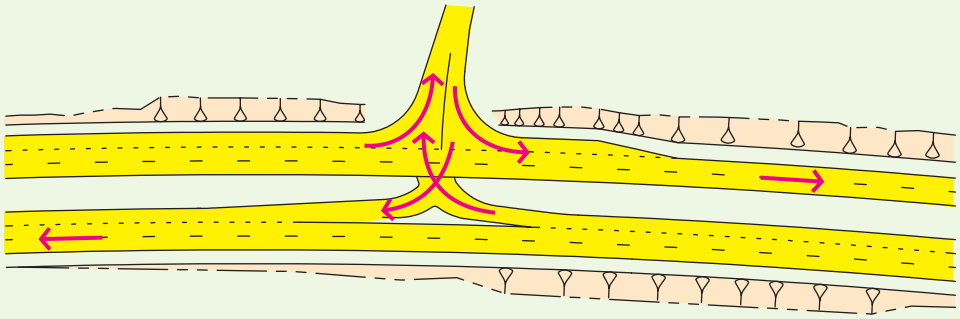
Left in - left out with median right-turn



All purpose cross over/u-turn bay



Left-in left-out



Seagull T-intersection

Figure 6.3

Typical Intersections

The maximum distance from a side road or private property entrance to the nearest u-turn bay would be on average 3 km, though typically the diversion would be much less than this. Some traffic may therefore need to travel this distance to the north before making a u-turn to travel south, or vice versa. The u-turn bays would be designed to cater for all vehicles using the highway including B-Double semi-trailers, buses and cane haulage vehicles.

Three intersections have been identified as requiring direct access onto the highway in each direction. The higher standard of intersection is considered justified by the relatively higher numbers of turning movements. 'Seagull' type T-intersections with protected turning lanes are proposed in these cases which are Jacky Bulbin Road, Serendipity Road and Swan Bay New Italy Road. Intersection layouts are illustrated schematically in Figure 6.3.

The traffic volumes on these side roads do not require the provision of grade-separated interchanges (flyover type).

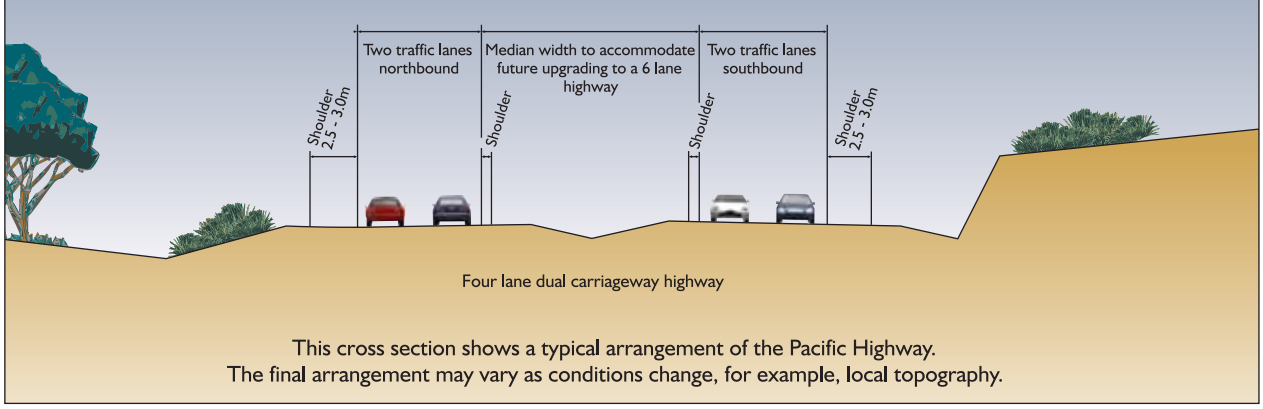
There are four locations where direct access points to the highway can be rationalised by using parallel service roads, either newly constructed or created through the use of residual sections of the existing highway, where new sections of four-lane highway are proposed. The sites include:

- 600 m either side of Cypress Road.
- The curve at Turners/Redgates Road.
- The Gap Road.
- Wondawee Way.

Interchanges

Within the concept design published in March 2006, a grade separated interchange was located north of Trustums Hill Road as part of the Woodburn to Ballina project. Following concerns regarding access to Woodburn and an opportunity to reduce net cut and fill balance of materials for both schemes, the grade separated interchange has been located further south between The Gap Road and Trustums Hill Road. At this stage the interchange is envisaged to be a dumbbell type double roundabout connected by a two lane bridge over the highway with south facing ramps only. North facing ramps will be constructed when traffic levels warrant it in the future.

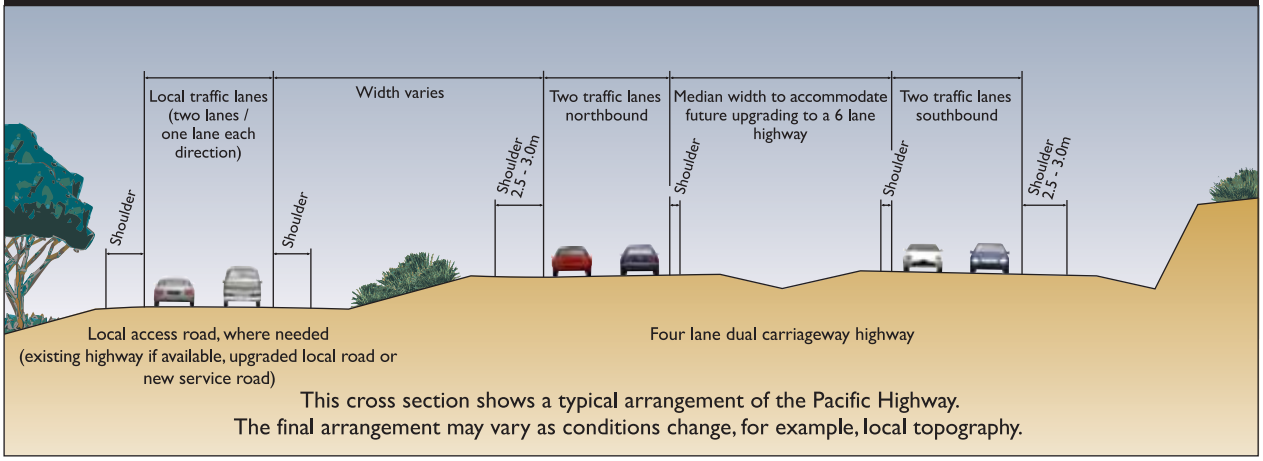
TYPICAL CROSS SECTION SHOWING AN UPGRADE, DUAL CARRIAGEWAY HIGHWAY



This cross section shows a typical arrangement of the Pacific Highway.
The final arrangement may vary as conditions change, for example, local topography.

A new carriageway is to be constructed along side the existing highway for much of this project. Which side of the existing highway the new carriageway will be built on may vary from location to location depending on environmental, engineering or other constraints.

TYPICAL CROSS SECTION SHOWING THE NEW MOTORWAY WITH A LOCAL ACCESS ROAD RUNNING PARALLEL



This cross section shows a typical arrangement of the Pacific Highway.
The final arrangement may vary as conditions change, for example, local topography.

A new carriageway is to be constructed along side the existing highway for much of this project. Which side of the existing highway the new carriageway will be built on may vary from location to location depending on environmental, engineering or other constraints.

Figure 6.4

Typical Cross Sections

6.7.2 Bridges

The preferred concept design contains a number of structures either adjacent to existing structures (duplication) or stand alone on the project. These will typically be precast prestressed RTA deck planks and range between 39 m to 155 m with a width of 11.0 m comprised as follows;

- 3.0 m nearside shoulder
- 2 x 3.5 m traffic lanes
- 1.0 m offside shoulder

With exception to this is a structure proposed as part of the dumbbell interchange between The Gap Road and Woodburn. This is likely to comprise of two 3.5m traffic lanes and 2.0 m shoulders, thus, no change in overall width to above. The position of the central stanchion in the median below will enable the mainline to be widened under a future 6 lane arrangement. A summary of structures is listed in Table 6.2 below.

Table 6.2 Proposed structures

Chainage	Description	Type	No. of Spans	Length	Width
62600	Duplication to Bridge over Tabbimoble Creek	Precast Prestressed RTA deck Planks	9	155	11
63850	Duplication to Bridge over Tabbimoble Overflow	Precast Prestressed RTA deck Planks	3	53	11
71450	Duplication to Bridge over Tabbimoble Floodway 3	Precast Prestressed RTA deck Planks	4	66	11
71840	Duplication to Bridge over Tabbimoble Floodway 2	Precast Prestressed RTA deck Planks	3	42	11
76300	Duplication to Bridge over Tabbimoble Floodway 1	Precast Prestressed RTA deck Planks	5	80	11
89540	South Woodburn Interchange	TBC	2	90	11

6.7.3 Pavements

Although full pavement designs have not been conducted to date, It has been assumed that the design of the mainline may form that of a Plain Concrete Pavement with rationalisation of existing pavements where the Class A dual carriageway utilises the existing road and is to be relocated under a Class M scenario. This occurs at two locations, Pine Road and Nortons Road.

Service roads will be typically two coat seals over base materials with exception to the link to Woodburn and interchange and off ramps. This is likely to be constructed from heavier duty asphalt as opposed to two coat seal.

6.7.4 Rest areas

Major rest areas are proposed with appropriate facilities on both sides of the highway. For northbound traffic a major rest area is proposed approximately 2 km north of Pine Road, on the western side of the proposed highway deviation adjoining Devils Pulpit State Forest. For southbound traffic a major rest area is proposed approximately 1 km north of Mororo Road on the eastern side of the highway.

The proposed major rest areas would ensure meet the objectives of the RTA rest area strategy, which requires a typical spacing of 50 km between major rest areas. The existing parking facility at New Italy rest area and driver reviver would remain, but would be reduced in size. This would be addressed by formalising and marking the car park area to ensure more efficient use of the limited space. Approximately 50 car parking spaces would be provided. The remainder of the existing lay-bys and stopping areas are located at sporadic intervals, and vary widely in size

and in terms of the facilities offered. The Mororo Road rest area would be retained under the current Class A arterial standard road. The rest of the existing stopping areas will not be retained within the proposed concept design.

6.7.5 Emergency stopping bays

In addition to the emergency shoulders, the concept design includes emergency stopping bays at an average of 3 km intervals throughout the scheme. For emergency purposes only, these stopping bays will provide safe emergency stopping off the shoulder. They are located at all purposed u-turn bays and indicated in Figure 6.3.

6.7.6 Improving flood immunity

The RTA's Pacific Highway design standards require that, if feasible, at least one carriageway should be constructed at or above the 1-in-100 year flood level. If this is not feasible, the design standards require a minimum flood immunity of the 1-in-20 year flood level. The following key locations have been identified (see Figure 6.1) as being flood-prone and requiring road levels to be raised:

- Tabbimoble Creek.
- Tabbimoble Floodways 2 and 3.
- Tabbimoble Floodway 1.
- New Italy to Redgates Road.
- Turners Road to Nortons Road.

6.8 Staging of works

It is likely that the project will be staged, in the development of the initial upgrade to allow for appropriate consideration of funding, road user safety and construction constraints.
Staging possibilities includes the following:

- Construction of the 2 km deviation in the Pine Road area to improve the safety and alignment of the highway.
- Construction of the 3 km deviation in the Devils Pulpit area to improve the safety and alignment of the highway.
- Construction of the interchange at Trustums Hill as part of the Woodburn to Ballina Upgrade project in order to provide a source of fill material.

6.9 Construction issues and road user management

6.9.1 Earthworks, cut and fill

Earthworks are a construction issue for this project, with the cut and fill balance comprising a substantial part of project costs. Large sections of the proposed concept design are flood prone, where the upgraded highway would have to be constructed on embankment at a slightly higher level than the existing carriageway. A majority of suitable fill material would be gained from proposed new cuttings and from the short deviation sections of the project, thus reducing the amount of imported material required.

The preferred concept design incorporates substantial cutting at the following locations, to achieve a suitable road profile and, of equal importance, to reduce the amount of imported fill material required:

- Devils Pulpit deviation.
- Whites Road.
- New Italy.
- Between Wondawee Way and Trustums Hill Road.

Further refinement of the design has resulted in opportunity to provide win material for projects to the north and south which are experiencing deficits. In particular, the Woodburn to Ballina

project has a 1 km section south of the Tuckombil Canal and opportunities arose not only to reduce the material required on that scheme, but to enable that material to be sourced locally to prevent haulage through Woodburn from further afield. This resulted in the relocation of the grade separated intersection proposed under the Woodburn to Ballina Project to the south of Trustums Hill Road within this project.

6.9.2 Contaminated soils

A Phase 1 preliminary contamination assessment was conducted by GHD Pty Ltd in April 2007 to identify potential contaminant sources along the alignment and assess the risk associated due to the proposed upgrading of the highway. It indicated that in general, no significant or gross potential sources of industrial contamination were identified along the proposed route such as service stations or major industrial facilities. A number of potential sources of contamination were identified in the vicinity of the proposed route and included.

- Seven Cattle Dip sites located outside the works zone
- Heavy timber industries located east of the highway at Tabbimoble Floodways 2 and 3.
- Disused quarry east of Tuckombil Road
- Former Mororo landfill off Lewis Lane
- Electricity sub-station at Tuckombil Road

6.10 Class M design layout

The Iluka Road to Woodburn project would be initially constructed to a Class A arterial standard. The proposed design discussed to this point relates to a Class A upgrade. In addition to the development of a Class A proposal, the RTA is also planning for a possible future upgrade to a 'Class M' or motorway standard road. Class M refers to a motorway-standard road, where access is restricted to grade-separated (flyover-type) interchanges, and there is no direct access on or off the highway to local roads or private property.

A Class M road would have 110 km/h posted speed and controlled access, with local traffic diverted to a parallel service road that would run the length of the project which would have two lanes and with a posted speed limit of less than 100 km/h.

A Class M upgrade would provide two lanes in each direction but with the capability of being upgraded to three lanes in each direction when warranted.

The Class M scenario has not been subject to any detailed design beyond a conceptual, schematic layout as depicted in Figures 6.5a to 6.5e. This schematic layout indicates the likely potential extent of land acquisition that would be required in order to implement the ultimate Class M scheme. This 'footprint' for the Class M layout has been adopted to provide planning certainty and allow for acquisition. The intention behind this strategy is that, should the Class M strategy be implemented at some future time, no further land would be required in addition to that identified on the maps in Figures 6.5a to 6.5e.

The Class M strategy includes a possible grade-separated interchange at New Italy, when warranted. An interchange at New Italy would further improve safety at this location, and would also continue to support and promote the cultural heritage values and economic viability of the New Italy Museum complex. Grade separated interchanges are currently proposed at Iluka Road, and south of Trustums Hill Road as part of the adjoining Wells Crossing to Iluka Road and Woodburn to Ballina projects, respectively. A Class M scheme would require construction of a 33 km parallel local service road to provide access to communities between these two interchange locations.

All of the u-turn facilities, left-in and left-out turn facilities, and T-intersections proposed under the Class A concept design would be removed under a Class M scheme. The combined cross-over facilities incorporating emergency u-turn bays would also remain but be converted for emergency and maintenance use only.

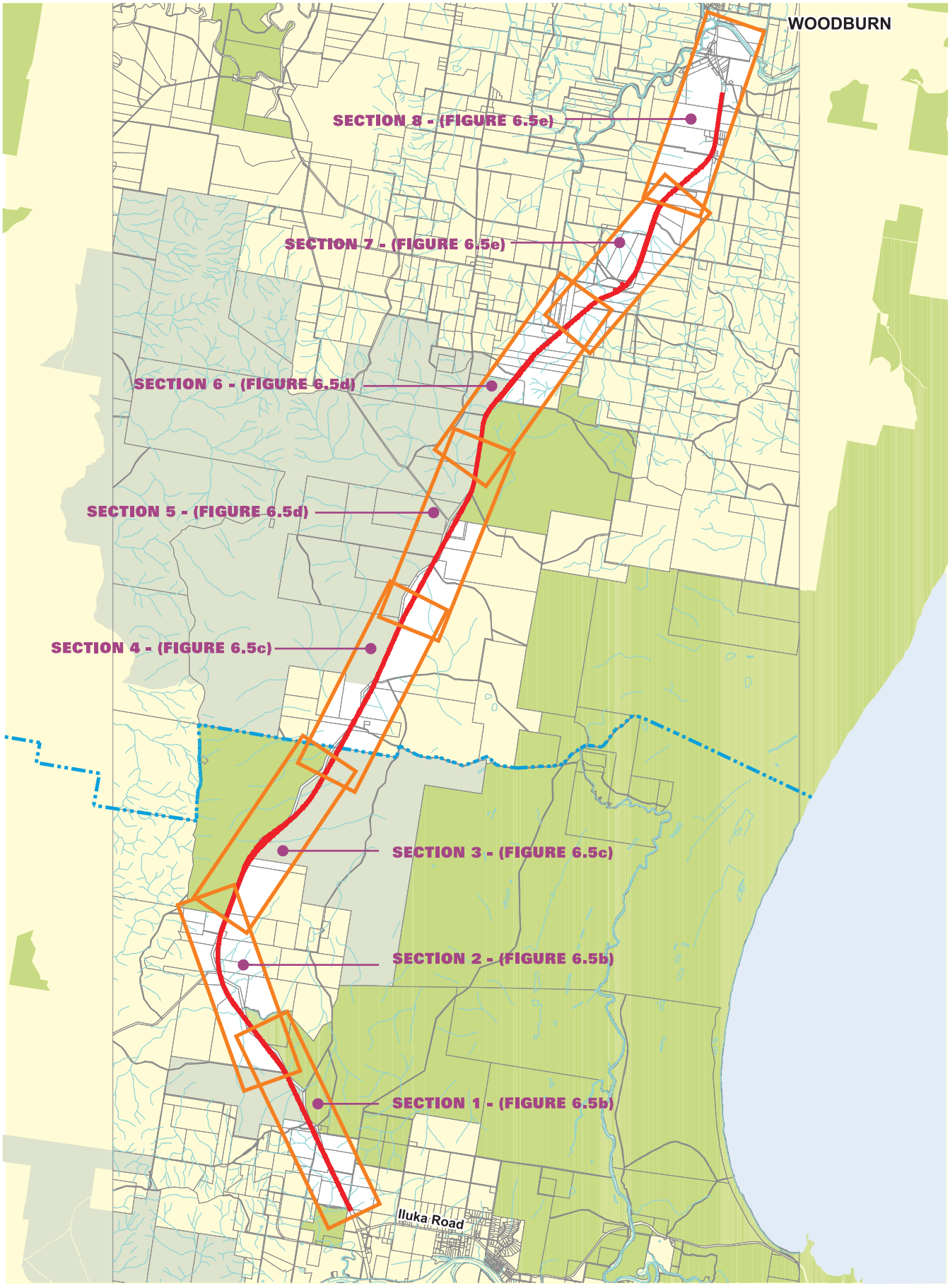


Figure 6.5a

Preferred Concept Design Sections Map - Proposed Motorway (class M)

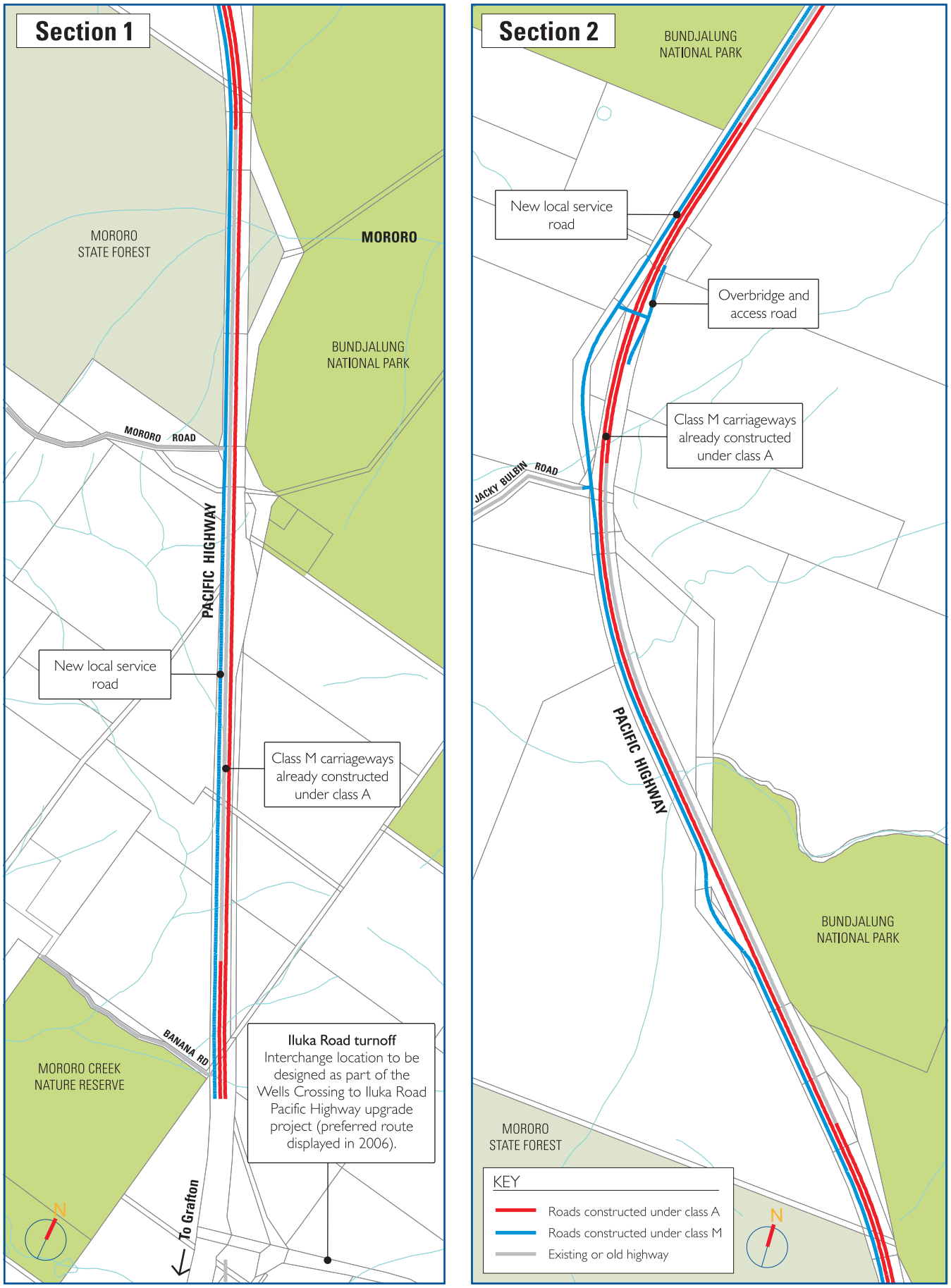


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Figure 6.5b

Preferred Concept Design - Proposed Motorway (class M)

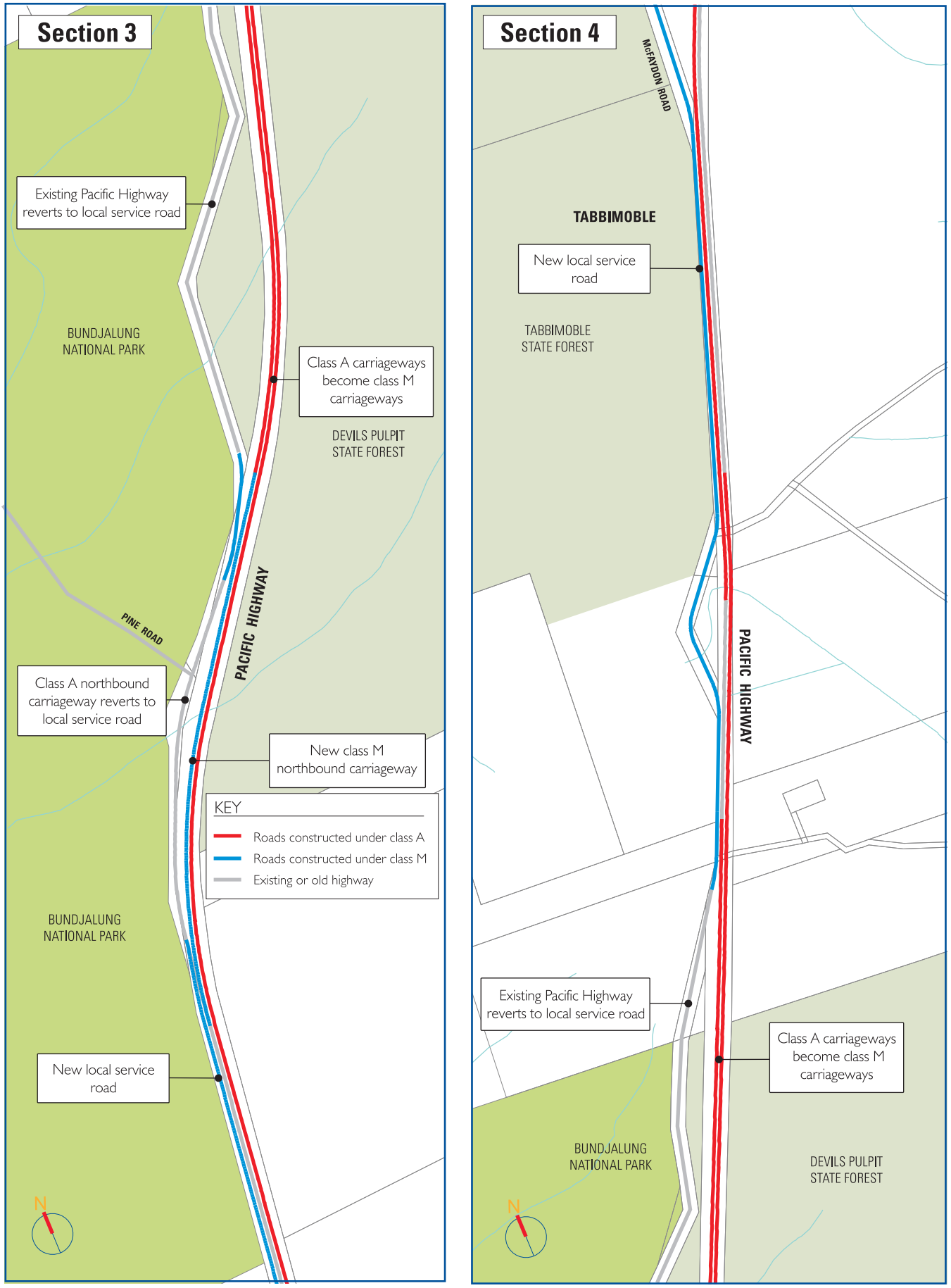

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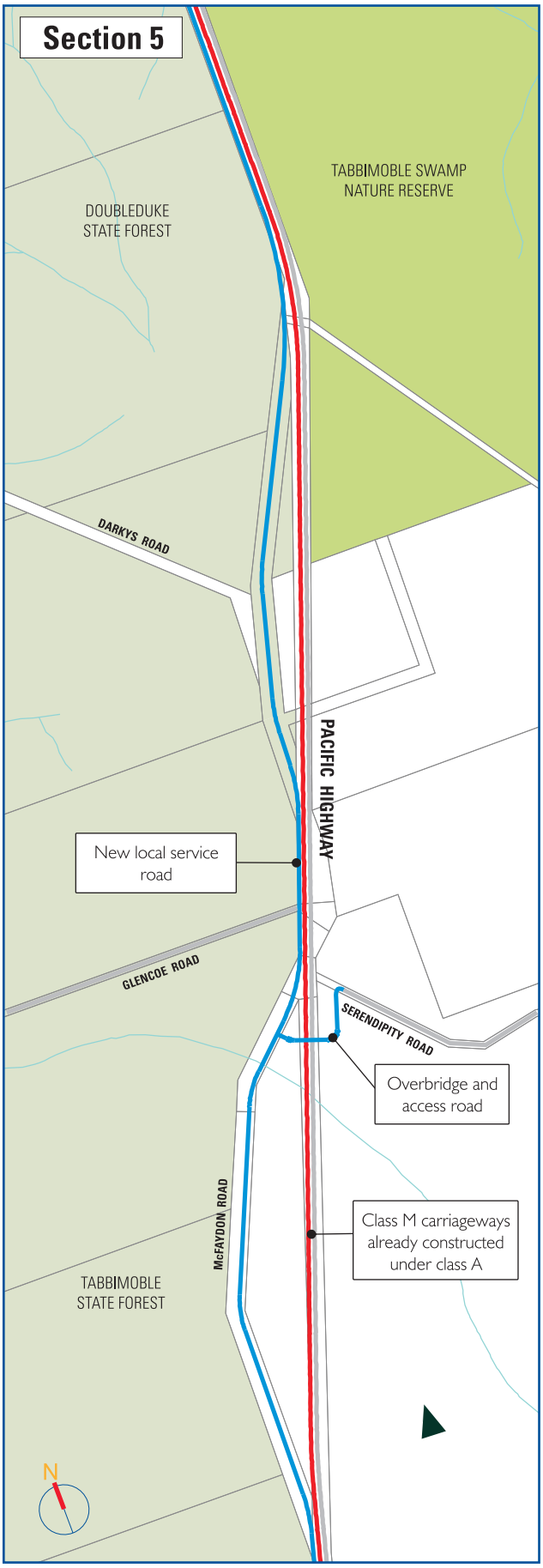
Figure 6.5c

Preferred Concept Design - Proposed Motorway (class M)



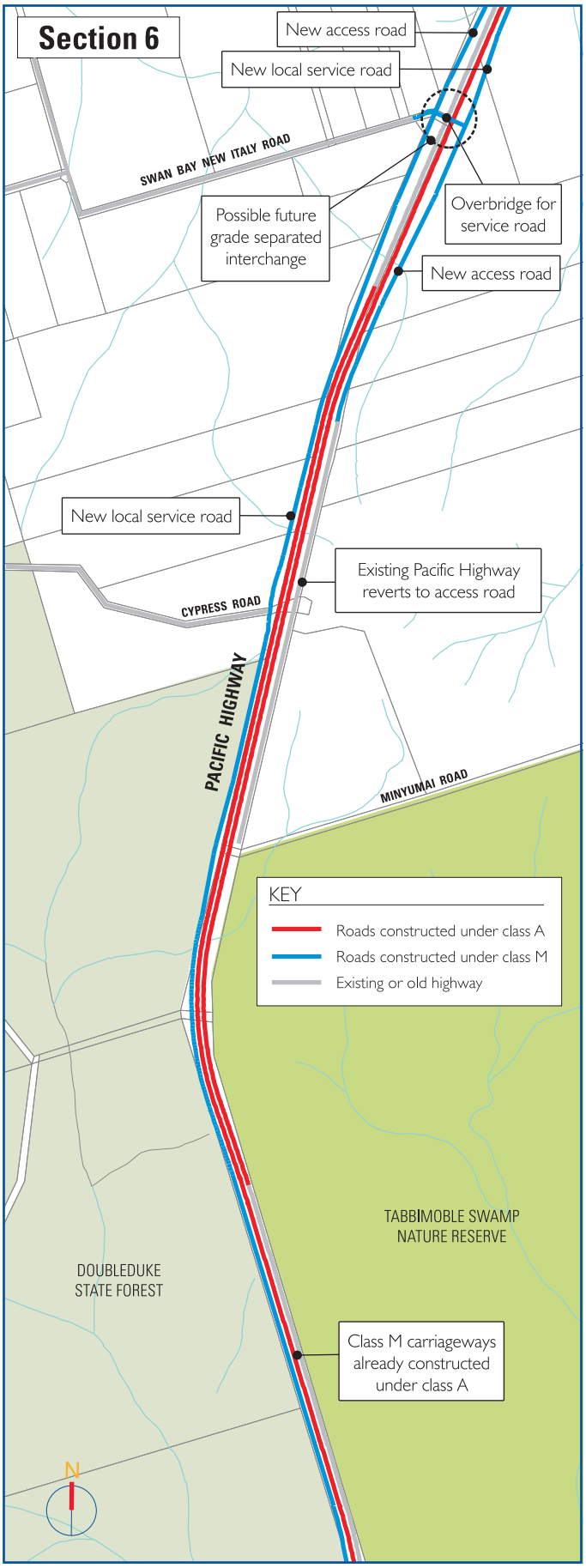


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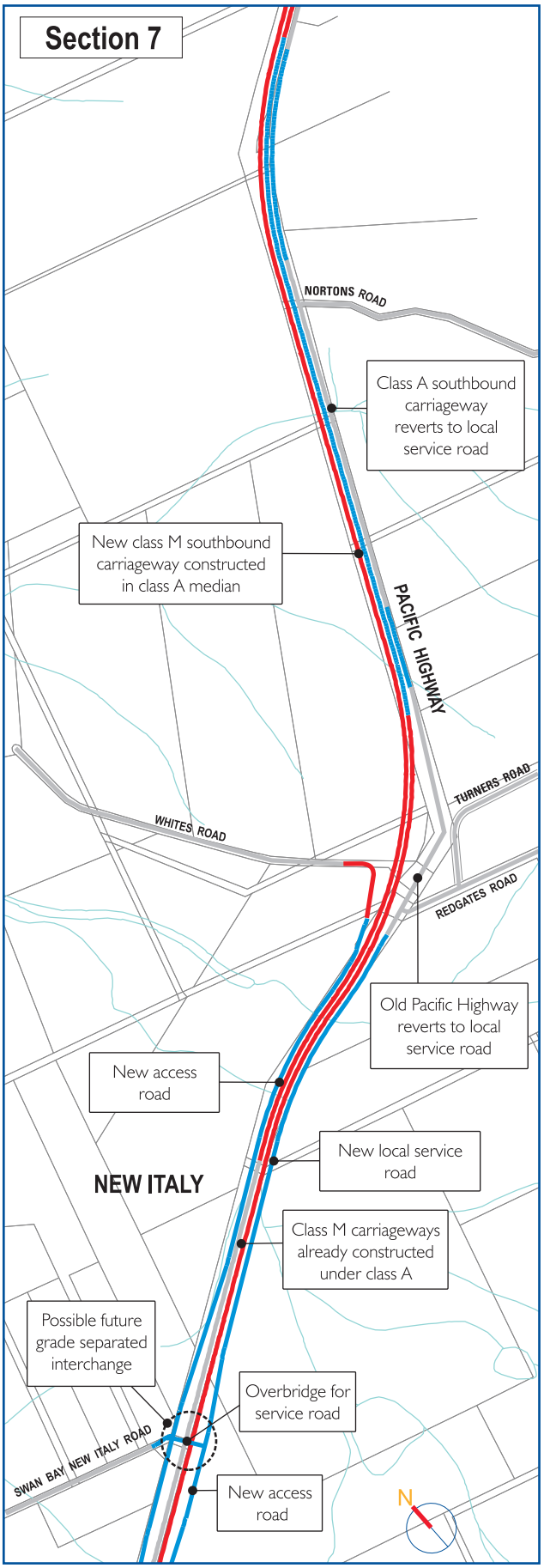
Figure 6.5d

Preferred Concept Design - Proposed Motorway (class M)



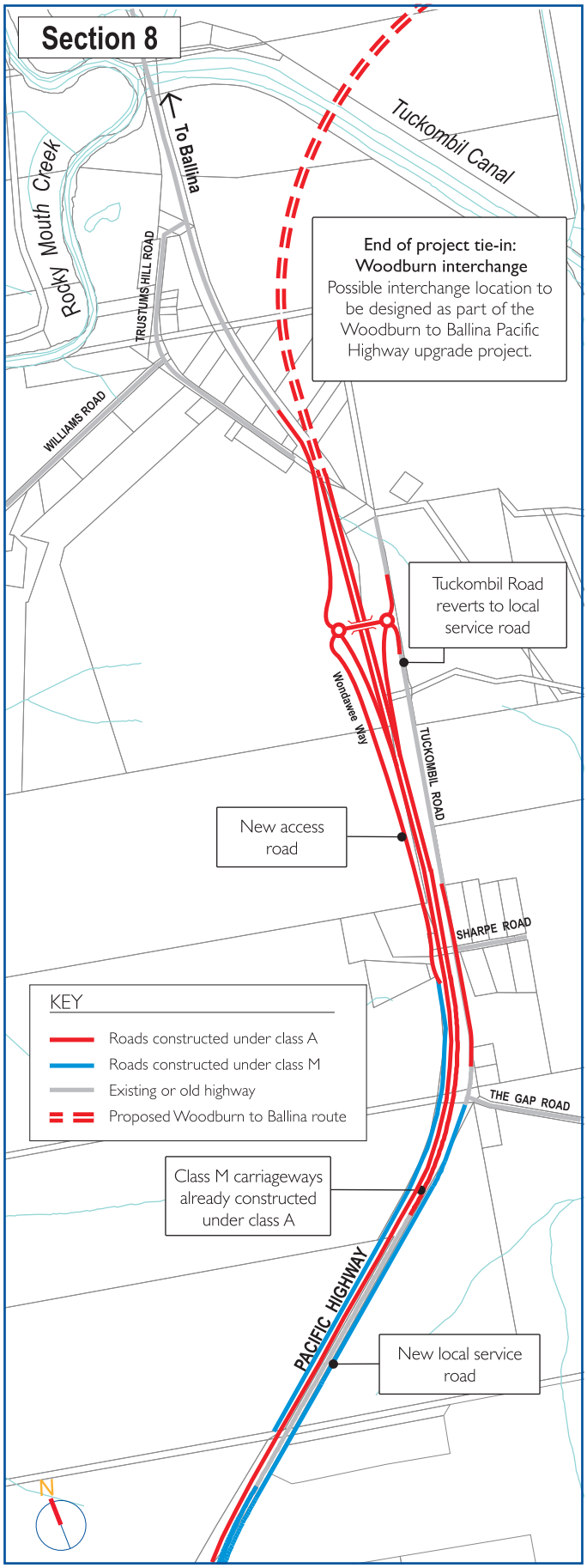


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Figure 6.5e

Preferred Concept Design - Proposed Motorway (class M)

7. Evaluation of the preferred concept design

The proposed preferred concept design detailed in Section 6 has been the subject of evaluation against the Pacific Highway Upgrade Program project objectives and assessment criteria as well as the issues and constraints identified in this report. The key issues and overall results of the evaluation are discussed below.

7.1 Key issues

Key issues arising from the preferred concept design are as follows:

- Impacts on threatened flora species.
- Fauna habitat fragmentation and loss of key habitat.
- Impacts on items of heritage significance.
- Impacts on items of Aboriginal significance.
- Impacts on and acquisition of private property.
- Access arrangements.

Appropriate mitigation measures and management strategies would be developed during the environmental assessment, project approval and detail design phases to further address these issues. These issues are discussed further in Section 7.3.

7.2 Pacific Highway Upgrade Program Objectives

The proposed concept design has been evaluated against the Pacific Highway Upgrade Program and project objectives detailed in Chapter 4, as per below in Table 7.1. The objectives and assessment criteria were considered throughout the route development process in order to ensure that the proposed concept design satisfies the requirements of the overall Pacific Highway Upgrade Program, and the project-specific objectives developed in consultation with the local community and government agencies.

Table 7.1 Evaluation of the proposed concept design against the objectives and assessment criteria

Pacific Highway Upgrade Program Objectives	Assessment criteria – a*chieved in preferred concept design (Y/N)*	Y/N
Significantly reduce road crashes and serious injuries	Improvement in road safety	
	▪ Comply with design and engineering safety standards.	Y
	▪ Retain existing rest areas.	N/A*
	▪ Optimise number of direct access points onto highway.	Y
	▪ Optimise number of at-grade intersections.	Y
	▪ Provide emergency stopping bays.	Y
	Design to bypass sections of road with poor existing horizontal alignment	
	▪ Replace existing sections of sub-standard highway with new road that meets current RTA design standards.	Y
	Design to make allowance for future upgrade to Class M	
	▪ Identify locations for potential future interchanges, service roads, etc.	Y
	Identify property acquisition requirements for Class M corridor, including service roads	
	▪ Total Class M corridor requirements identified.	Y
	Provision of rest areas and truck parking bays at intervals as required by RTA design guidelines	
	▪ Retain or relocate existing rest areas and truck parking bays – in accordance RTA design guidelines.	Y
** Existing rest areas will be replaced with new high-standard rest areas catering for all road users, with one rest area for each direction of travel. Mororo Road Rest area may remain.*		

Pacific Highway Upgrade Program objectives	Assessment criteria – *achieved in preferred concept design (Y/N)*	Y/N
Reduce travel times and delay	Minimise length of upgraded highway and travel times	
	▪ Minimise route option length.	Y
	▪ Minimise travel time.	Y
	▪ Minimise vehicle operating costs.	Y
	Improve the reliability of travel times on the highway	
	▪ Achieve appropriate Level of Service.	Y
	▪ Ensure capacity to accommodate seasonal traffic variations.	Y
	Ensure upgrade is flood-proof for minimum 1:20 year flood and up to 1:100 if possible	
	▪ Design for 1:100 year flood (subject to hydrology and hydraulics report).	Y
	Minimise disruption to traffic during construction	
	▪ Optimise length of highway under construction at one time.	Y
	▪ Maximise off-line construction where possible within corridor.	Y
	▪ Minimise cross-over points for new second carriageway.	Y
	▪ Utilise available RTA-owned 'controlled access road' land adjacent Devils Pulpit State Forest.	Y
	▪ Design to current RTA design standards within available RTA corridor/land assets.	Y
	Deliver travel benefits as soon as possible	
	▪ Ability to stage project works.	Y
	Optimise highway alignment and geometry	
	▪ Enable trucks and B-doubles to travel safely at maximum legal speed limit.	Y
Develop route that involves the community and considers their interest	Achieve community acceptance of the selected route	
	▪ Maintain community support for preferred option.	Y
	▪ Minimise severance across highway corridor.	Y
	▪ Minimise impacts on areas of cultural or archaeological significance.	Y
	▪ Minimise impact to native flora and fauna.	Y
	▪ Minimise businesses affected by potential acquisition.	Y
	▪ Minimise length of highway in visually sensitive (or medium-high visual quality) areas.	Y
	▪ Minimise number of properties that will experience noise that could require mitigation.	Y
	Improve/maintain existing traffic and access	
	▪ Improve local traffic circulation, safety, separation from highway traffic.	Y
	▪ Improve vehicle, cyclist and pedestrian facilities.	Y
	▪ Maintain/improve availability of safe access across the highway corridor for all residents.	Y
	▪ Direct access points and intersections onto the highway will be formalised to Class A standard.	Y
	▪ Traffic surveys and forecasts for future performance at key intersections indicate that the performance of intersections would be good with the proposed upgrade.	Y
A route that supports economic development	Minimise property impacts	
	▪ Retain private property access on and off the highway.	Y
	▪ Minimise property acquisition and displacement impacts.	Y
	▪ Minimise number of sensitive land uses that may be subject to construction dust and other air quality impacts.	Y
	▪ Minimise impacts of altered flood flows.	Y
	Maintain access to and from the highway for businesses and producers	
	▪ Minimise distance from local producers to nearest highway access or interchange.	Y
	▪ Optimise highway to meet RTA flood requirements.	Y
	▪ Maintain access to Bundjalung National Park.	Y
	Provide access to New Italy for north and south-bound traffic on highway	
	▪ Minimise direct property impacts.	Y
	▪ Retain Driver Reviver facility.	Y
	Minimise impacts on high quality agricultural land and existing agricultural enterprises and resources	
	▪ Minimise number of properties with greater than 10% of land acquired by the preferred option.	Y
	▪ Minimise number of agricultural enterprises that will experience reduction in primary production.	Y
	▪ Minimise length of route encroaching on State Forests.	Y
* *Existing rest areas will be replaced with new high-standard rest areas catering for all road users, with one rest area for each direction of travel. Mororo Road Rest area may remain.*		

Pacific Highway Upgrade Program objectives	Assessment criteria – a*chieved in preferred concept design (Y/N)*	Y/N
Manage the upgrading in accordance with ecologically sustainable development principles	Conserve biological diversity and ecological integrity	
	▪ Minimise impact on threatened species and habitats.	Y
	▪ Minimise impact on endangered ecological communities (EEC).	Y
	▪ Mitigate against risk identified for loss of, or disturbance to flora and fauna, including threatened species during construction and operation.	Y
	Eliminate the threat of serious or irreversible environmental damage	
	▪ Minimise the area of high and moderate conservation value land affected.	Y
	▪ Develop a comprehensive Environmental Management Plan (for the construction phase).	Y
	▪ Minimise use of energy and non-renewable resources.	Y
	▪ Maintain or improve water movement across the highway corridor.	Y
	▪ Minimise disturbance of potential acid sulphate soils.	Y
	▪ Minimise potential for elevated total suspended solids levels in watercourses from construction.	Y
	▪ Minimise the risk of water quality impacts in small creeks draining to sensitive SEPP 14 wetlands.	Y
	Eliminate encroachment or direct impact on National Parks and wildlife estate	
	▪ National Parks and wildlife estate lands preserved with no encroachment.	Y
	Improve air quality and reduce greenhouse emissions	
	▪ Minimise travel distance, travel time and delays.	Y
	▪ Ensure atmospheric carbon monoxide concentrations would be well below Department of Environment and Conservation criteria.	Y
Provide best value for money	Design to make allowance for future upgrade to Class M	
	▪ Locations identified for potential future interchanges, service roads.	Y
	▪ Total Class M corridor requirements identified.	Y
	Minimise impacts on existing utility infrastructure	
	▪ Minimise cost of public utility adjustments.	Y
	▪ Maximise use of existing road infrastructure.	Y
	Maximise economic benefits to offset costs	
	▪ Minimise construction cost.	Y
	▪ Minimise operation cost.	Y
	▪ Deliver earlier economic benefits.	Y
	▪ Maximise benefit/cost ratio for the preferred option.	Y
	▪ Optimise benefit/cost ratio of construction staging options.	Y
	▪ Maximise compatibility of the preferred option with broader long term land use and development strategies.	Y

Source: Connell Wagner, 2006.

7.3 Evaluation against biophysical constraints

7.3.1 Topography geology and soils

Topography

There are no significant topographic issues in the development of the proposed concept design. The existing Pacific Highway traverses low hills, undulating rises, broad valleys and alluvial plains, none of which would be classified as 'steep'.

Geological, geotechnical and soils

Within the undulating rises and low hills, moderate cuts and fills would be required. This may have the advantage of producing more suitable construction materials and hence reduce the requirement for expensive imported materials.

Field mapping at the Cypress Road straight indicates that excavation into highly weathered bedrock would be required in cut areas. Excavation into this rock may require specialist machinery or equipment and treatment to exposed batters such as geotextile reinforcement.

Borehole investigation (BH2 and BH3) at Whites Road indicates that cut materials would comprise loose to medium sand underlain by very stiff to hard clay. Testing identified that

potential acid sulphate soil is present in this area; therefore an acid sulphate soils management plan is required for any excavation in this zone.

The main concerns across lowland areas will be deeper compressible alluvial soils associated with creek flood plains. Shallow water tables, low bearing capacity and potential acid sulphate soil sub-grades may present constructability issues. Shallow water tables may be encountered across the Tabbimoble floodways.

Structures

Piled foundations, bored or driven, are expected to be the most appropriate foundation type for structures on deep alluvial soils.

Piled foundations, bored or driven, or shallow pad footings are expected to be suitable foundation types on the higher ground and undulating lands.

Fill embankments

Fill batters where possible would need to be constructed from material excavated from cuttings in the higher sections along the route. Fill batters should be constructed no steeper than 1 vertical to 2 horizontal for stability purposes but where feasible should be flattened to 1 vertical to 3 horizontal for ease of maintenance. Batter slopes should be topsoiled and grassed to reduce the possibility of erosion.

Fill embankments across the Tabbimoble floodways and the Clarence River floodplain are not expected to create potential settlement problems, as most of the settlement is expected to occur within the construction period due to the drainage provided by the intermittent sand layers. The absence of such a drainage sand layer at the northern end (Richmond River floodplain, between Trustums Hill and Tuckombil canal) and the presence of soft clay at depth may create potential settlement problems. Detailed investigation in this area would be required to assess the amount of settlement.

Any soft ground should be over-excavated and replaced with suitable material. Alternatively, geogrids/geotextiles may be required. If over-excavation of softer ground is not possible, a bridging layer (with or without geogrid/geotextile depending on conditions) should be provided over the softer ground.

In soft/poor sub-grade area, a minimum embankment height of 1.5 m to 2.0 m should be adopted to assist with providing a suitable bridging layer over the sub-grade. Over-excavation is not recommended in potential acid sulphate soil areas.

Cuttings

Many existing cuttings show signs of soil erosion and weak rock material. The steeper batter slopes show signs of instability. Erosion and instability are generally associated with residual soil to highly weathered rock materials exposed in cuttings, and variable weathering of the layers of material. As part of any upgrading works, all batter slopes from ground surface should be reduced to 1 vertical : 2 horizontal. In addition, the batter slopes should be topsoiled and revegetated to minimise erosion. More detailed investigation and assessment of cuttings and batter slopes are required prior to adoption in the design.

Variable weathering and eroding of material can present excavation suitability problems as well as variable founding conditions for structures. The material is therefore expected to be suitable for reuse as general fill material with the possibility of selectively stockpiling some of the more competent rock, for reuse as select fill quality material.

Final design of cut batters will rely on future detailed geotechnical investigations, consideration of long term maintenance requirements (including a whole of life assessment) and an assessment of risks to both workers and motorists.

Erosion hazard

The fine-grained soils covering approximately 90% of the study area are extremely susceptible to high sheet and gully erosion when cleared of vegetation. However, the even topography associated with the corridor means that water run-off will be more easily controlled, therefore limiting erosion. Adequate protection of both cut batters and fill embankments would be provided, using measures such as revegetation, provision of cut-off drains, and landscaping.

7.3.2 Hydrology and hydraulics

The primary purpose of the hydrology and hydraulics study is to assist in the highway design process through determination of likely flood levels and prediction of flood volumes. Predicting the likely flood levels and flow volumes is critical for setting pavement levels for flood immunity, sizing of structures (e.g. culverts, pipes etc.), determining the required volumes and suitability of fill material, and ensuring that earthworks do not create a potential flood hazard upstream or downstream of the highway.

Design hydraulic modelling is being finalised at the time of writing this report. The following discussions describe design criteria and likely design measures to be applied once the highway design event immunity and vertical alignment has been set.

The following design criteria will be implemented into hydraulic modelling for design of the proposed alignment:

- Immunity of the Pacific Highway to design flood events. This will set the design vertical alignment for the highway.
- Afflux upstream of any raised sections of highway.
- Stability and scour protection for culvert structures.

Confirmation from the RTA regarding the design criteria has been sought.

Design measures

It is anticipated that the following design measures will be required for hydraulic design of the Pacific Highway proposed design alignment:

Table 7.2 Hydraulic design measures

Highway Immunity Scenario	Likely Hydraulic Design Measures
Immunity is acceptable	Extension of existing culverts Potentially some protection works for culvert inlet/outlets as required
Immunity not acceptable	Extension of existing culverts Additional culverts/bridges required to reduce afflux upstream of the highway Potentially some protection works for culvert inlet/outlets as required

7.3.3 Water quality

The water quality results indicate that the most important risks associated with the subsequent route development and construction phases of the project include:

- The potential for disturbance of high risk acid sulphate soil in the vicinity of Tabbimoble Canal during the construction phase.

- The potential for disturbance of low risk acid sulphate soil in the proposed construction corridor adjacent to creek SW12, with the potential for resulting acidic impacts to the creek.
- The potential for elevated total suspended solids levels caused by the off-site loss of suspended solids from construction activities to watercourses throughout the study area.
- The risk of water quality impacts to small creeks draining to sensitive SEPP 14 wetlands (principally Tabbimoble Overflow, Creek at the southbound rest area and Tabbimoble Floodway 1).

The risk will be further addressed during the environmental assessment, project approval and detailed design phase.

7.3.4 Ecology: threatened flora

A comprehensive flora study was undertaken for the Iluka Road to Woodburn project, refer to Section 3.5 and the Ecological Assessment, 2007 for further details. The TSC and EPBC Acts were consulted to determine if any threatened species occurred within the study area. The results of the ecology study showed that:

- Clearing of native vegetation (a 'Threatening Process' under the TSC Act) would be minimised under the project as proposed.
- By following the existing highway footprint as closely as possible, the proposed concept design will support a strategy of minimised native vegetation clearing, and protection of EECs.
- Notwithstanding, the proposal has the potential to have a significant impact on threatened flora species.

The likely overall effect of the proposed concept design on threatened flora species, either recorded in the study area or considered likely to occur (by virtue of the existence of suitable habitat), is summarised in the following paragraphs.

Melaleuca irbyana (Small-leaved Paperbark)

A population of *Melaleuca irbyana* is located within the study area, south of New Italy. The proposed upgrade may result in the loss of a number of *Melaleuca irbyana* individuals. This potential loss may in turn constitute a significant impact on the species in terms of its total distribution and population size.

A number of options have been investigated to minimise potential impacts on the *Melaleuca irbyana.* The initial concept design was likely to impact on 40% of the existing population. The preferred concept design been altered to reduce this impact to 30% of the population through adjustments to batter slopes and vertical alignments.

Translocation for the affected 30% of the population is being investigated. Because it is difficult to identify precisely the type of habitat required by *Melaleuca irbyana*, it is considered advantageous to translocate individuals to a site adjoining the present population, such as the cleared paddock area outlined in Figure 3.6. There are some *Melaleuca irbyana* individuals in this area, indicating that the population may have extended across the paddock originally.

Due to *Melaleuca irbyana's* suckering habit it is considered likely that this species can be transplanted with a high survival rate, given proper site preparation and post-planting care and maintenance. To provide habitat suitable for long-term population viability the following habitat restoration measures are likely:

- Remove exotic species.
- Re-establish suitable plant community structure.
- Re-establish species composition.

This land is currently in private ownership and consequently land acquisition or tenure options may need to be investigated.

The potential impact and measures to minimise the effect such as those outlined above would be further addressed during the environmental assessment, project approval and detail design phases of the project.

Lindsaea incisa (a Fern)

A population of *Lindsaea incisa* is located within the study area, in the Mororo State Forest. This species is located about 40m from the existing highway in swamp sclerophyll forest (protected ecological community). The duplication occurs to the east of the existing highway and therefore would not result in a direct impact on the species. It is considered that a loss of, or disturbance to, *Lindsaea incisa* plants in Mororo State Forest would have the potential to have a significant impact on the species in terms of its distribution and population size. This issue would be further considered during the environmental assessment, project approval and detail design phases of the project.

Cyperus aquatilis (a Sedge)

The population of *Cyperus aquatilis* in the study area appears to be part of a larger population extending north east into Tabbimoble Swamp Nature Reserve and Bundjalung National Park. The distance from the proposed upgrade means that this species is unlikely to be directly impacted. However, any loss of, or disturbance to, *Cyperus aquatilis* plants in the study area has the potential to have a significant impact on the species in terms of its distribution and population size and this issue would be further considered during the environmental assessment, project approval and detail design phases of the project.

Oberonia titania (an Orchid)

The single plant recorded at Nortons Road would not represent a viable population, however other plants may occur in the locality. The distance from the proposed upgrade means that this species is unlikely to be directly impacted. However, any loss of this specimen may have a significant impact on the species in terms of its distribution and population size. This issue would be further considered during the environmental assessment, project approval and detail design phases of the project.

Prostanthera palustris (Swamp Mint Bush)

The stronghold of *Prostanthera palustris* is in Bundjalung National Park east of the study area. The distance from the proposed upgrade means that this species is unlikely to be directly impacted. However, any loss of the population near Tabbimoble may have a significant impact on the species in terms of its total distribution and population size. This issue will be further considered during the environmental assessment, project approval and detail design phases of the project.

Maundia triglochinoides

Maundia occurs at three locations within the study area. Preliminary assessment indicates that the preferred alignment would not directly impact on the populations. There is however the potential for adverse effects on *Maundia* arising from changes in hydrology, water chemistry and exotic plant invasion, particularly during construction. Therefore, the potential impact and measures to minimise the effect would be further addressed during the environmental assessment, project approval and detail design phases of the project.

Species likely to occur but not recorded

The species that have been listed as likely to occur but not recorded during the field investigations (Table 3.5) would be subject to further investigation during the environmental assessment, project approval and detail design phases of the project.

Established populations of particular species, if occurring within the area likely to be affected by road construction, would be subject to detailed assessment during the environmental assessment, approval and detail design phases of the project.

Possible mitigation strategies are discussed in Section 7.3.6.

7.3.5 Ecology – threatened fauna

A comprehensive fauna study was undertaken for the Iluka Road to Woodburn project, refer to Section 3.5 and the Ecological Assessment, 2007 for further details. The results of the fauna study showed that:

- Diminished habitat continuity has the potential to disrupt movement and decrease the total amount of habitat available.
- Some impacts are likely to be minimised by construction adjacent to the existing highway, such as:
  - Impacts on hollow trees
  - Impact on foraging resources
- The roadway has the potential to disrupt wildlife linkage between two separate areas of bushland located in a cleared landscape.
- The proposed concept design has the potential to further fragment areas of native vegetation and habitat.

The likely effects of the proposal and potential mitigation measures are discussed below.

Potential impacts on fauna

The results of the fauna study shown that the main potential ecological impacts associated with the proposed Iluka Road to Woodburn upgrade on fauna include:

- Direct mortality of, or injury to, fauna during vegetation clearing.
- Loss of, or disturbance to, essential fauna habitat features, such as tree hollows, roost sites within culverts and under bridges, foraging habitat (particularly winter-flowering eucalypts).
- Loss of or changes to the hydrology and water quality of aquatic habitat.
- Increase in the barrier effect posed by the existing highway, as a barrier to movement and genetic dispersal and exchange.
- Increased fragmentation, removal, modification and isolation of habitats.
- Subdivision and isolation of populations.

Based on the work completed to date, there are a number of fauna species considered likely to be at risk from the project including, but not limited to:

- Hollow-dependent fauna such as the Squirrel Glider, Brush-tailed Phascogale, Yellow-bellied Glider, Masked Owl, Powerful Owl, Brown Treecreeper and Glossy Black-cockatoo due to the loss of tree-hollow habitat and a wider road corridor.
- Grey-crowned Babbler due to the loss of large contiguous habitat.
- North Coast Bioregion Emu population due to loss of habitat and a wider corridor increasing the potential for road kills.
- Microchiropteran bats, including tree-roosting and cave-roosting species (the latter are likely to be roosting in drainage structures along the highway) due to habitat removal.
- Frogs, including Green-thighed Frog, Wallum Froglet and other frogs not recorded in the targeted frog survey due to habitat removal and changes to the hydraulic regime.

Clearing of land is likely to be required along much of the length of the road corridor. However, some of the corridor is already cleared to a width that would be adequate to accommodate the proposed upgrade, eliminating the need for further clearing in these locations. Nonetheless, the

overall effect would be to create a road corridor that would be up to 50 m wider than the existing road corridor, for the full length of the study area.

It is important to note that the potential impacts of the Iluka Road to Woodburn are for the main part cumulative impacts, resulting from duplication of the highway along the existing alignment.

7.3.6 Ecology - mitigation and amelioration measures

Mitigation and amelioration measures may include, but not necessarily be limited to:

- The minimisation of vegetation clearance and disturbance, as far as practicable.
- Narrowing the road footprint (wherever possible, and subject to safety, geotechnical and other design requirements) to avoid significant habitat areas such as concentrations of hollow-bearing trees and locations of threatened plant species.
- Incorporating fauna underpasses and other fauna crossing provisions into the road design, and including dual purpose drainage structures that can act as 'default' fauna underpasses.
- Minimising construction phase disturbance of bat roost sites, such as culverts and bridges.
- Minimising sediment discharges and alterations to hydrological regime.
- Installation of directional/exclusion fauna fencing in appropriate locations.
- Landscaping and revegetation.
- Rehabilitation the site.
- Implementing traffic control and driver education (measures to reduce risk of road kill).

Fauna underpasses may be an option to mitigate some of the impacts on terrestrial fauna. However, consideration also needs to be given to mitigating the impacts on arboreal fauna, particularly gliders. Squirrel Gliders have been recorded gliding up to 50 m, while Yellow-bellied Gliders are known to glide as much as 100 m.

Specific details of the mitigation measures to be applied are not known at this stage but would be developed during the environmental assessment, project approval and detail design stages of the project. Most of the measures listed above are typically employed in highway planning to reduce ecological impact.

7.3.7 Climate and air quality

Air quality monitoring is not routinely carried out in sparsely populated rural areas and no specific air quality assessment has been carried out during the concept design development phase of the project. However, the results of studies carried out for other Pacific Highway projects indicate that atmospheric carbon monoxide concentrations are currently well below DECC criteria. This assumption is supported by previous studies carried out for PHPS's.

It can be assumed that total emissions from vehicles would increase as the volume of highway traffic increases. An assessment of the likely impacts of the predicted increase in traffic volumes on air quality will be made during the environmental assessment phase of the project.

7.4 Property and land use effects

7.4.1 Property effects

The potential impacts to private property have been assessed for this report based on a conservative estimate of the likely extent of the upgraded road reserve. The proposed concept design has been developed to a preliminary level, and will be subject to refinement. Therefore, the potential extent of property impact indicated in Figures 7.1a to k should be viewed as indicative.

A total of 35 properties are potentially impacted by the preferred highway route, comprising 31 privately owned properties and small sections of Devils Pulpit, Tabbimoble and Doubleduke State Forests.

One of the design aims of this project is to minimise property impact, and therefore the proposed concept design does not deviate significantly from the existing highway alignment through the majority of the study area. Where private property is affected, the impact would be acquisition of narrow strips of land along the highway frontage. The proposed highway upgrade would not result in any severance or isolation of private property. Any acquisition of agricultural land is likely to be minor and would not generally have a significant impact on the viability of individual agricultural holdings.

The only proposed notable deviation from the existing highway alignment is within a 3 km corridor east of the existing highway adjacent to Devils Pulpit State Forest. The land is already owned by the RTA, having been purchased for the specific purpose of diverting the Pacific Highway around a short section of the existing highway where the alignment is not suitable for upgrading to dual carriageway. A majority of the proposed deviation would not require any further private property acquisition.

Property acquisition requirements will not be finalised until the project has been subjected to the environmental assessment and planning approval stage. Property acquisition for the project will then be negotiated between the RTA and affected private landowners, in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*. This typically takes place approximately 18 months prior to commencement of construction.

Property accesses will be maintained at all times during and after construction either directly to the new highway, via side roads or by a service road.

State Forests

Where the proposed concept design requires the acquisition of land within State Forests, the acquisition process is partially governed by the Forest Management Zones (FMZ) applying to the affected parcel(s) of land. The DPI (NSW Forests) manages forests according to a zoning system which defines those areas to be used for log production, conservation, recreation, scenic protection and other categories as relevant. The area of land for each of the zones within the State Forests is outlined in Table 7.3.

Table 7.3 Forestry Management Zones

State Forest	FMZ Zone	AREA (m.sq.)	Area (ha)
Devils Pulpit SF	8	134	0.0134
Devils Pulpit SF	3B	28579	2.8579
Doubleduke SF	2	481	0.0481
Doubleduke SF	4	320	0.0320
Doubleduke SF	8	7772	0.7772
Doubleduke SF	3A	72825	7.2825
Doubleduke SF	3B	60682	6.0682
Mororo SF	8	4648	0.4648
Mororo SF	3A	30950	3.0950
Mororo SF	3B	12124	1.2125
Tabbimoble SF	8	841	0.0841
Tabbimoble SF	3A	4928	0.4928
Tabbimoble SF	3B	16508	1.6508

Source: Department of Primary Industries, 2005

Land within FMZ 3(a) – Harvesting Exclusions is protected under the *Forestry Act 1916*, and a parcel of land within the 3(a) FMZ having an area greater than 20 ha cannot be resumed

without an Act of Parliament to amend the Forestry Act. Parcels having an area of less than 20 ha may however be acquired through internal DPI administrative process, to revoke the State Forest dedication. As can be seen in Table 7.3, the areas of 3(a) FMZ are considerably less than 20 ha with a maximum of 7.3 ha required from Doubleduke State Forest. The total 3(a) FMZ required for the Iluka Road to Woodburn project is 10.9 ha.

7.4.2 Land use

An assessment of the extent to which acquisition affects the management and operation of land was undertaken as part of the Iluka Road to Woodburn project. The assessment also examined the potential effect of the proposal on current and future land use.

The assessment concluded that:

- The greatest area of land acquisition would be on residential properties at Whites Road, where the road corridor boundary would be realigned along the arc of the curve, up to 100 m west of the existing road boundary. The property on the northern side of Whites Road would potentially require acquisition of a wedge-shaped strip of land approximately 700 m long, and up to 100 m wide, tapering to a point approximately 700 m north of Whites Road. Most of this land is currently heavily wooded.
- Other rural residential properties would be affected by strip acquisition less than 100 m and typically 10 m to 20 m.
- Under the proposed concept design in its current form, no residences would be demolished although some residences would be up to 100 m closer to the road than they are at present.
- Most of the land fronting the highway, and which will directly impacted by highway upgrading, has a low agricultural land use capability and its current use is dominated by forestry or forest dominant reserves.

Overall, the potential impacts on agricultural (including cane farm) properties would be minor. The RTA would replace fencing where existing fences are affected. Most acquisitions would be in the form of strip acquisition along the frontage to the existing highway. This would not generally affect the management of the properties. However access arrangements would need to be considered for the construction stage.

7.5 Recreation and tourism

The immediate study area is not in itself a significant destination for recreation or tourism. The Pacific Highway through the study area does however provide access to Bundjalung National Park and two nature reserves which contain a number of camping areas under the control of the NPWS. To the south of the Pacific Highway provides access to Iluka and to the north, the coastal town of Evans Head is accessed via Woodburn.

The proposed concept design is not considered likely to result in any significant impact on these or any other north coast recreation and tourism facilities, other than to better facilitate travel to and from holiday and recreational destinations. Potential impacts on the New Italy Museum Complex are discussed below in Section 7.8.

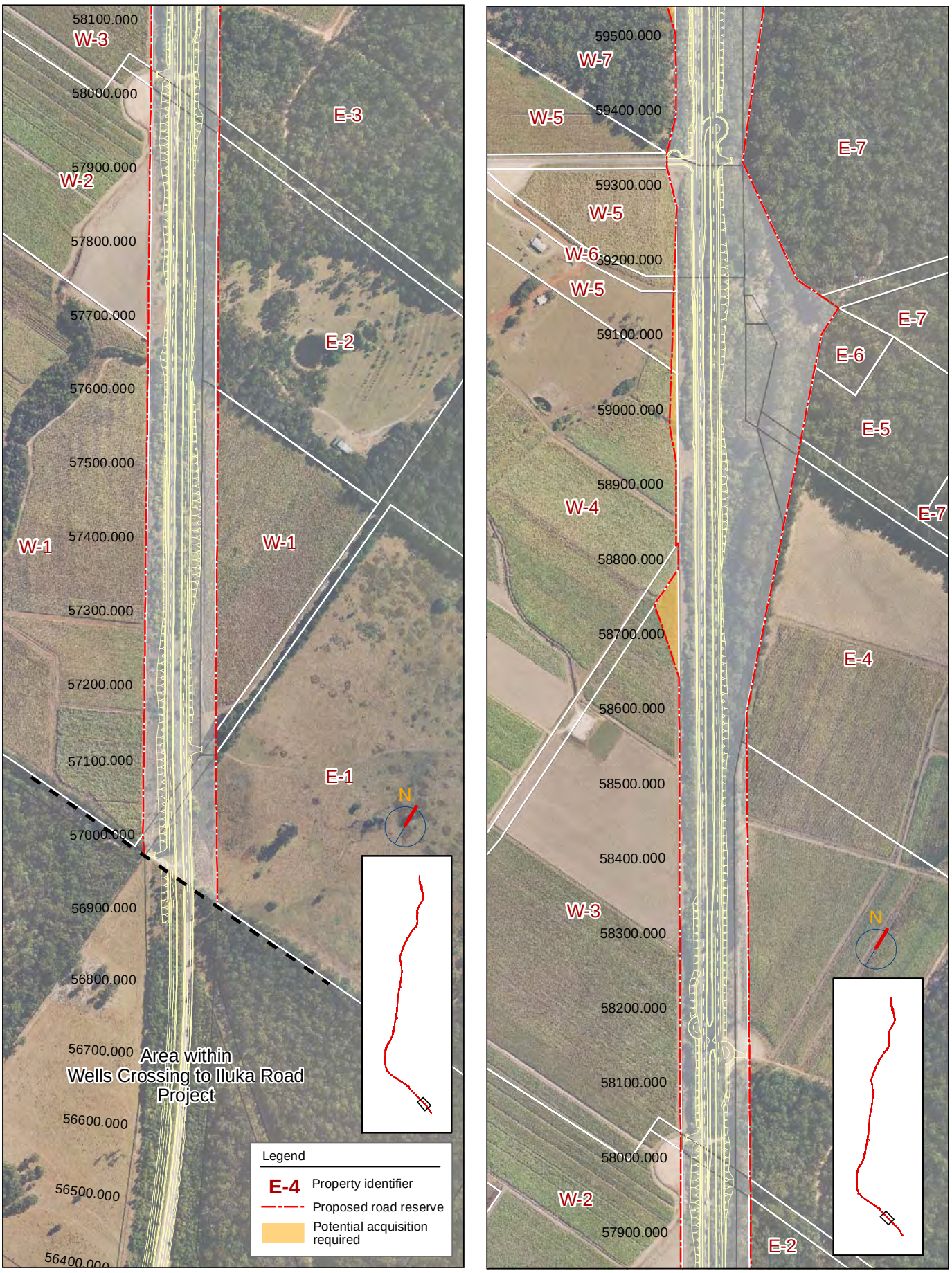

Figure 7.1a

Properties potentially affected by acquisition

0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

I2W\1235.17.GE\28-09-07\MAR\REV-3

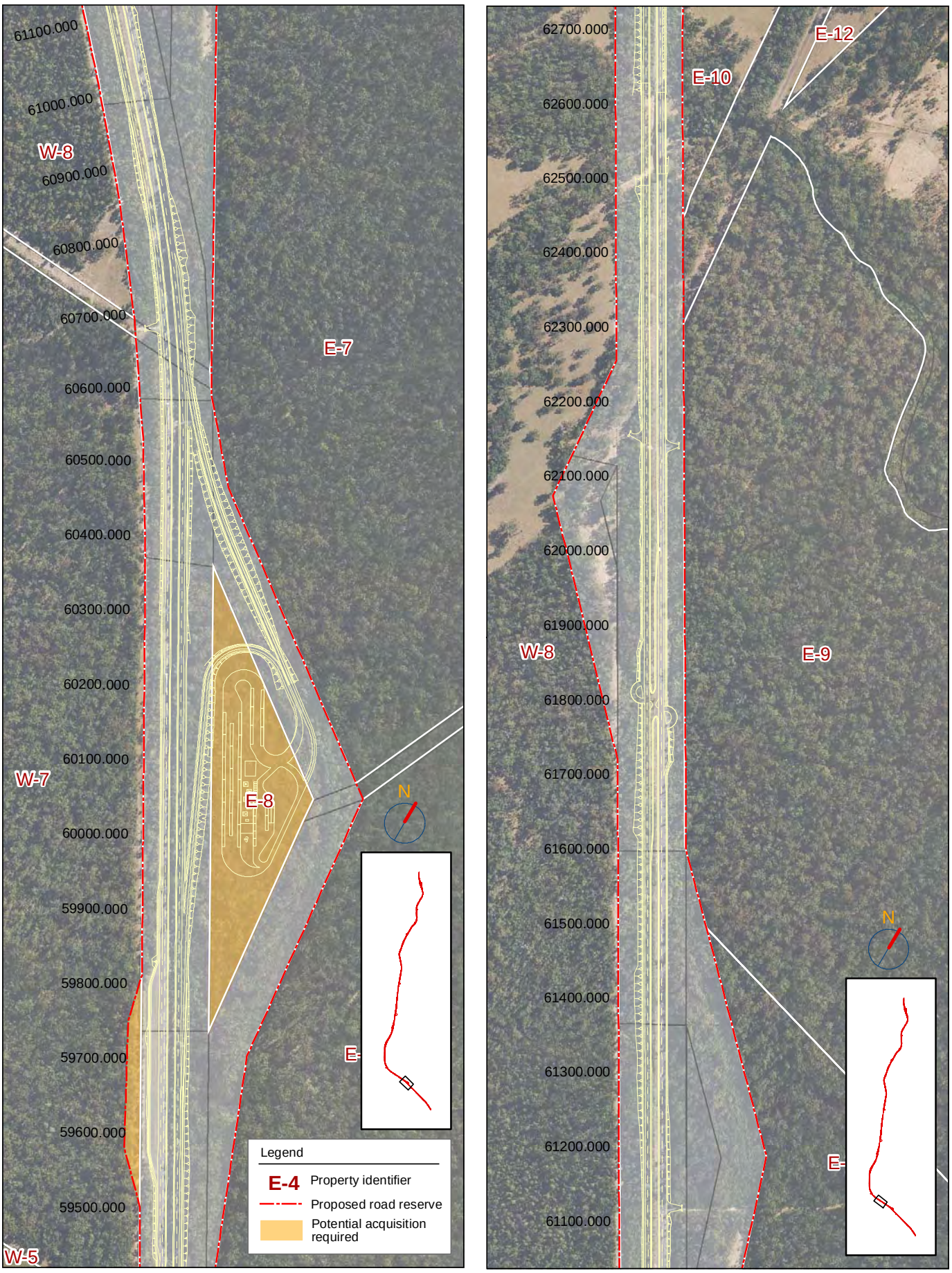

Figure 7.1b

0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

Properties potentially affected by acquisition

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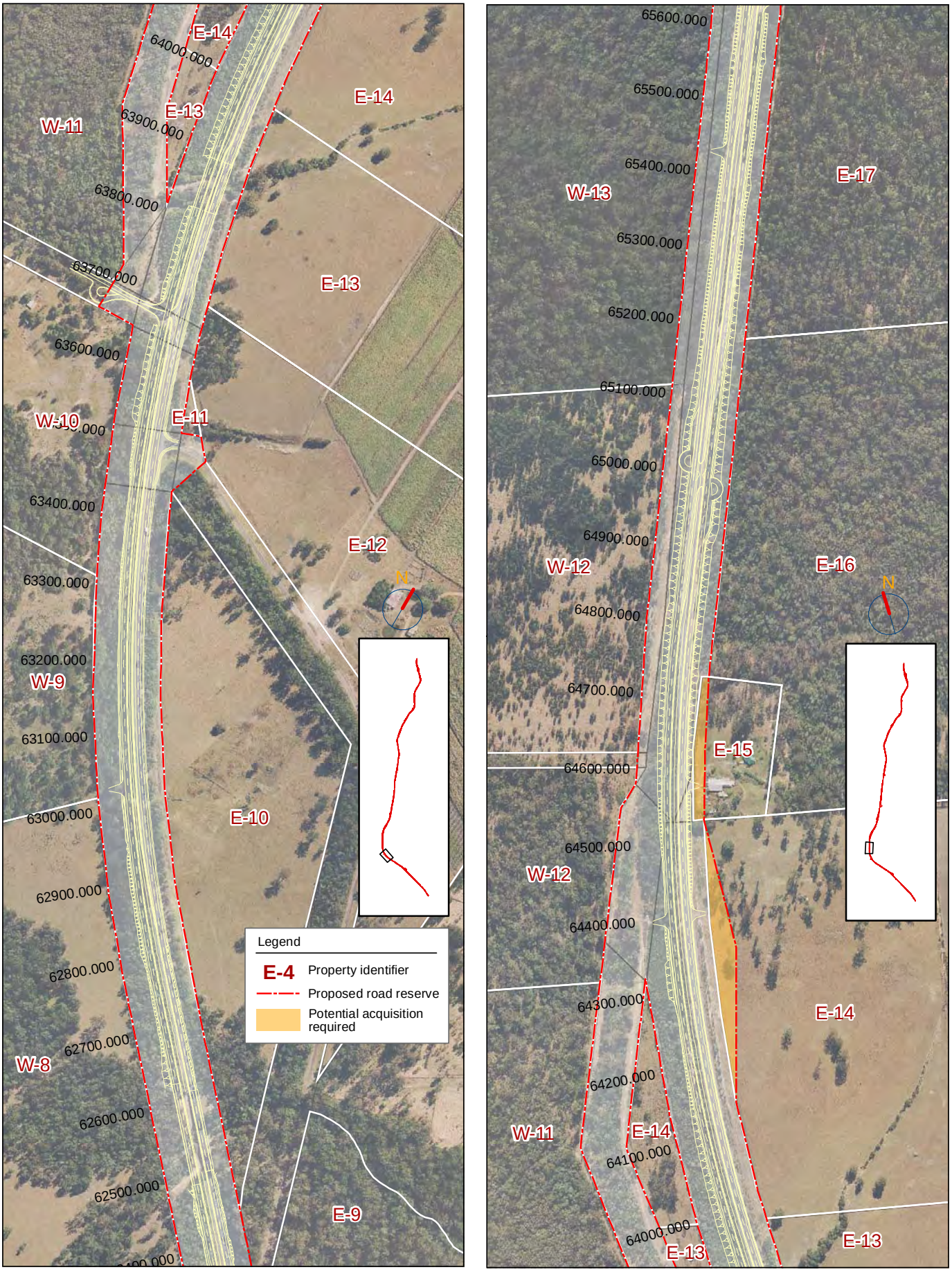

Figure 7.1c

Properties potentially affected by acquisition

0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

I2W\1235.17.GE\28-09-07\MAR\REV-3

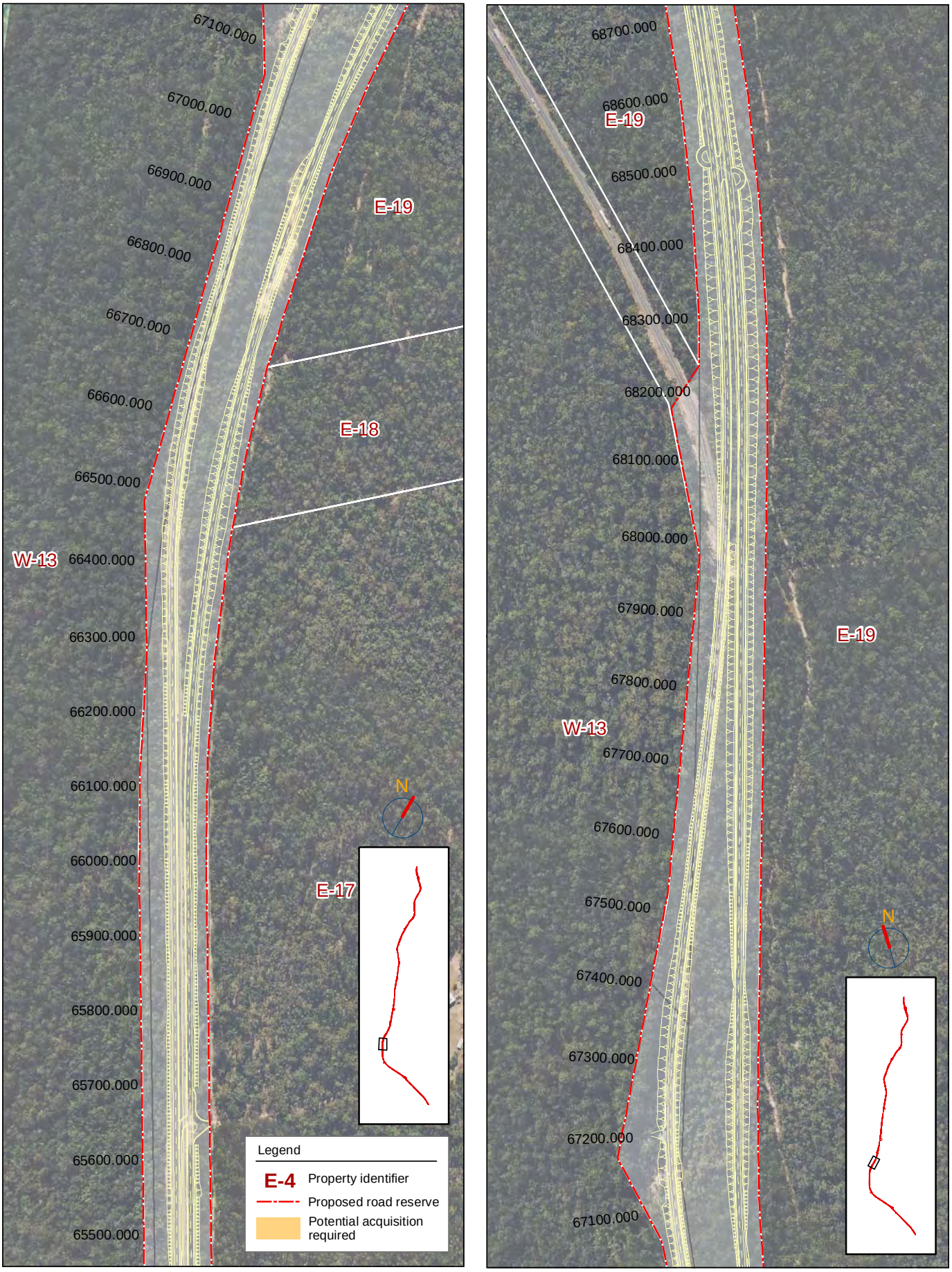

Figure 7.1d

0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

Properties potentially affected by acquisition

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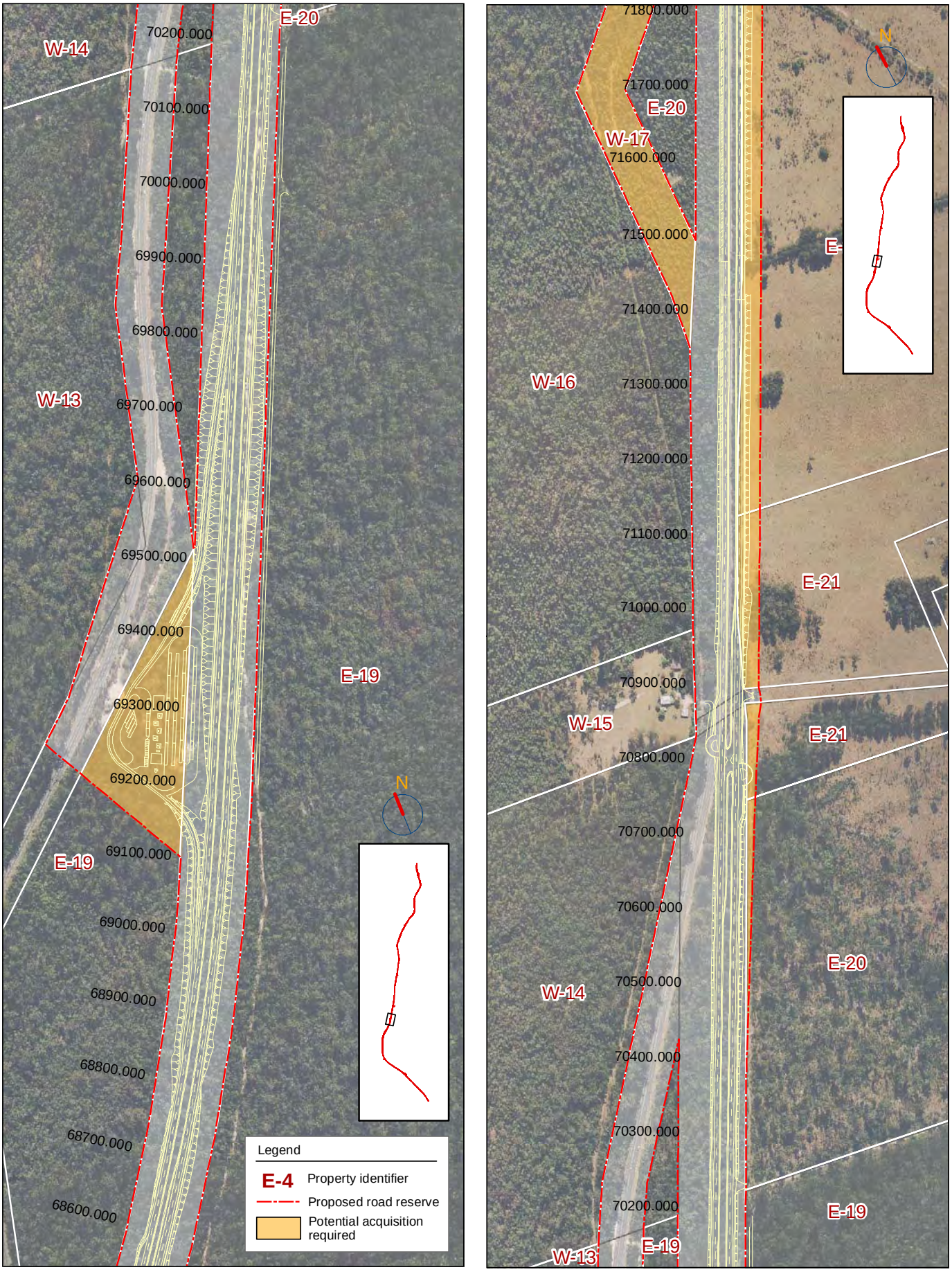


Figure 7.1e

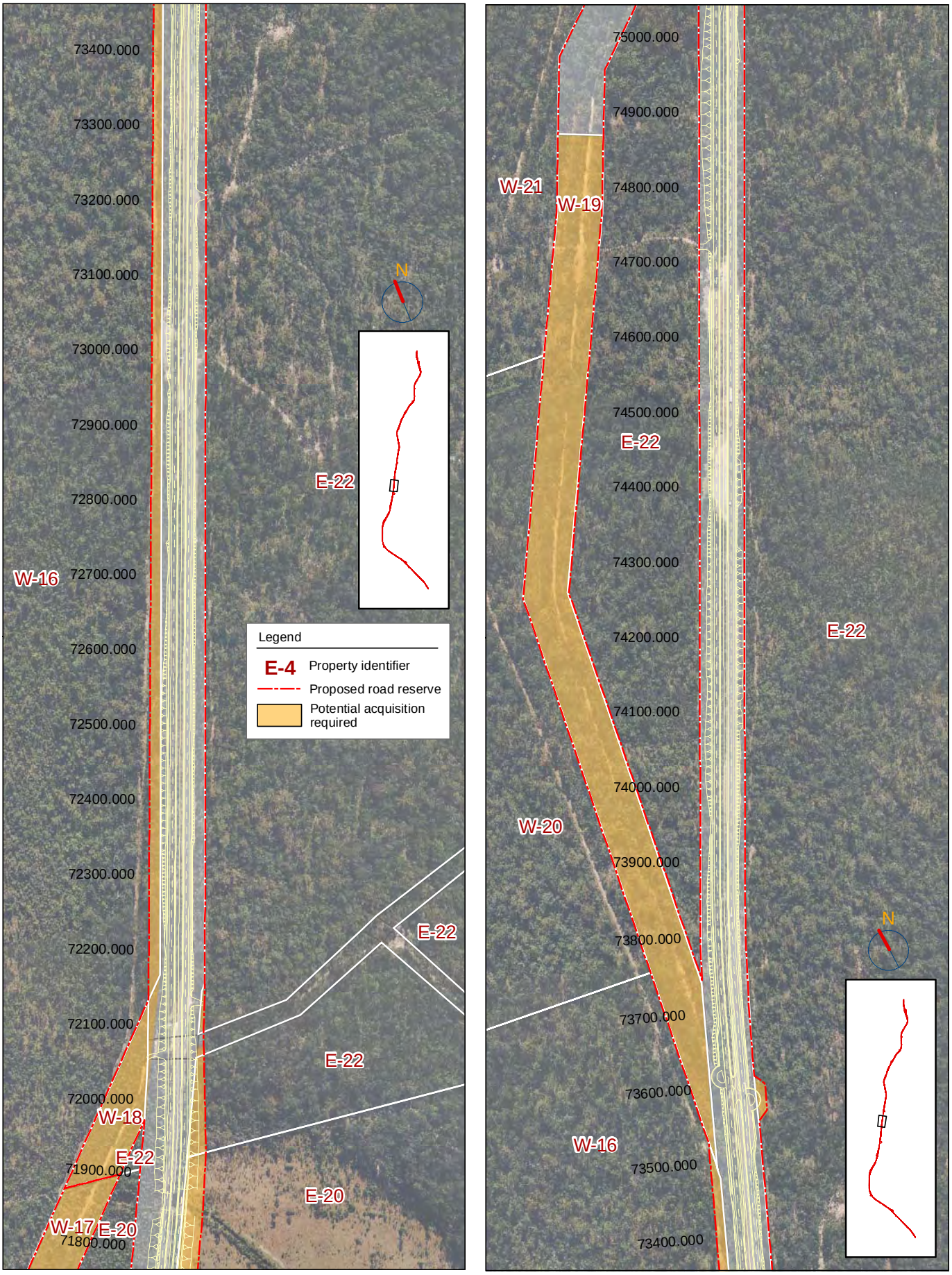
0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

Properties potentially affected by acquisition

I2W\1235.17.GE\16-07-08\MAR\REV-4



0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

Figure 7.1f

Properties potentially affected by acquisition

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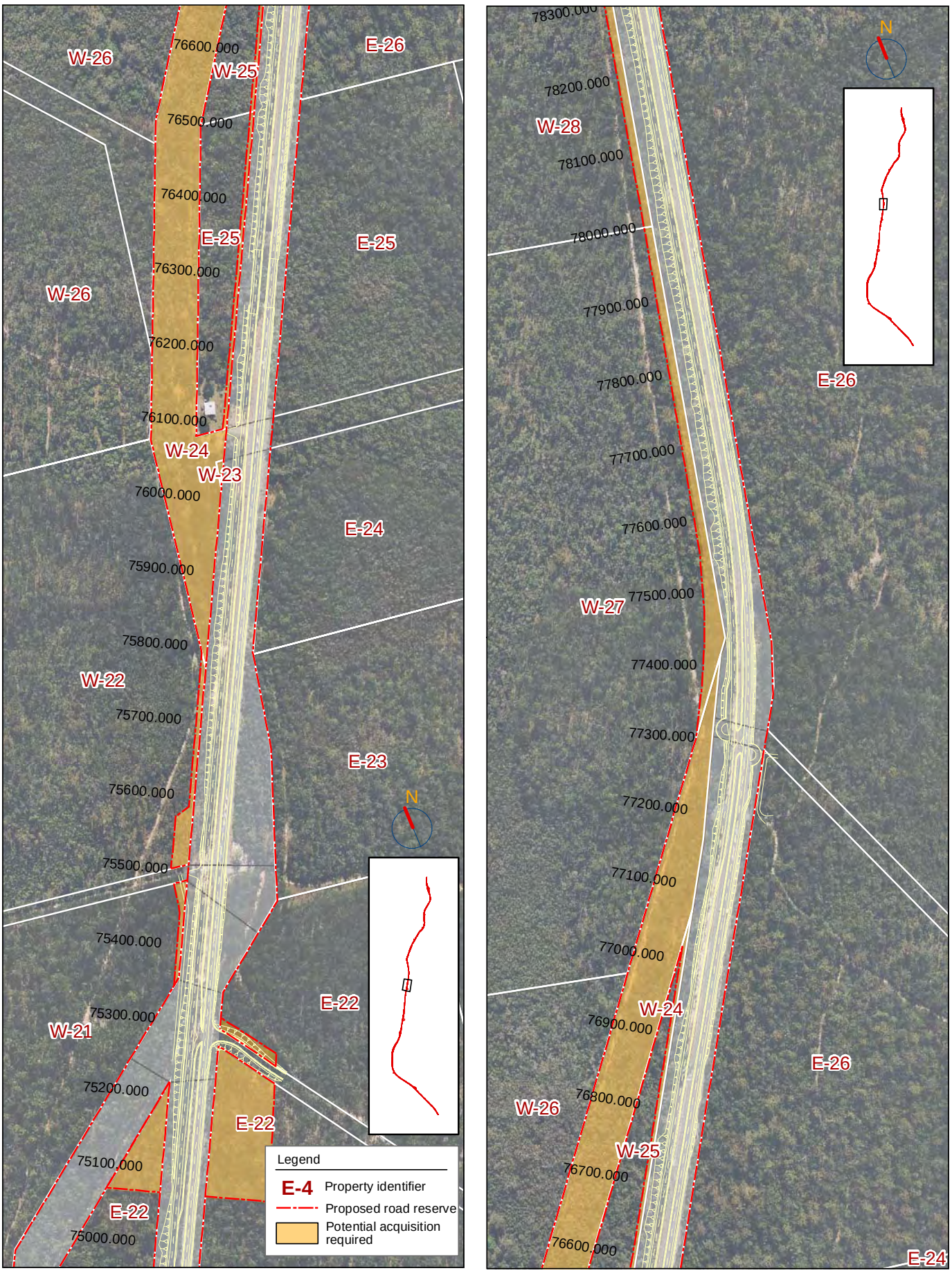

Figure 7.1g

0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

Properties potentially affected by acquisition

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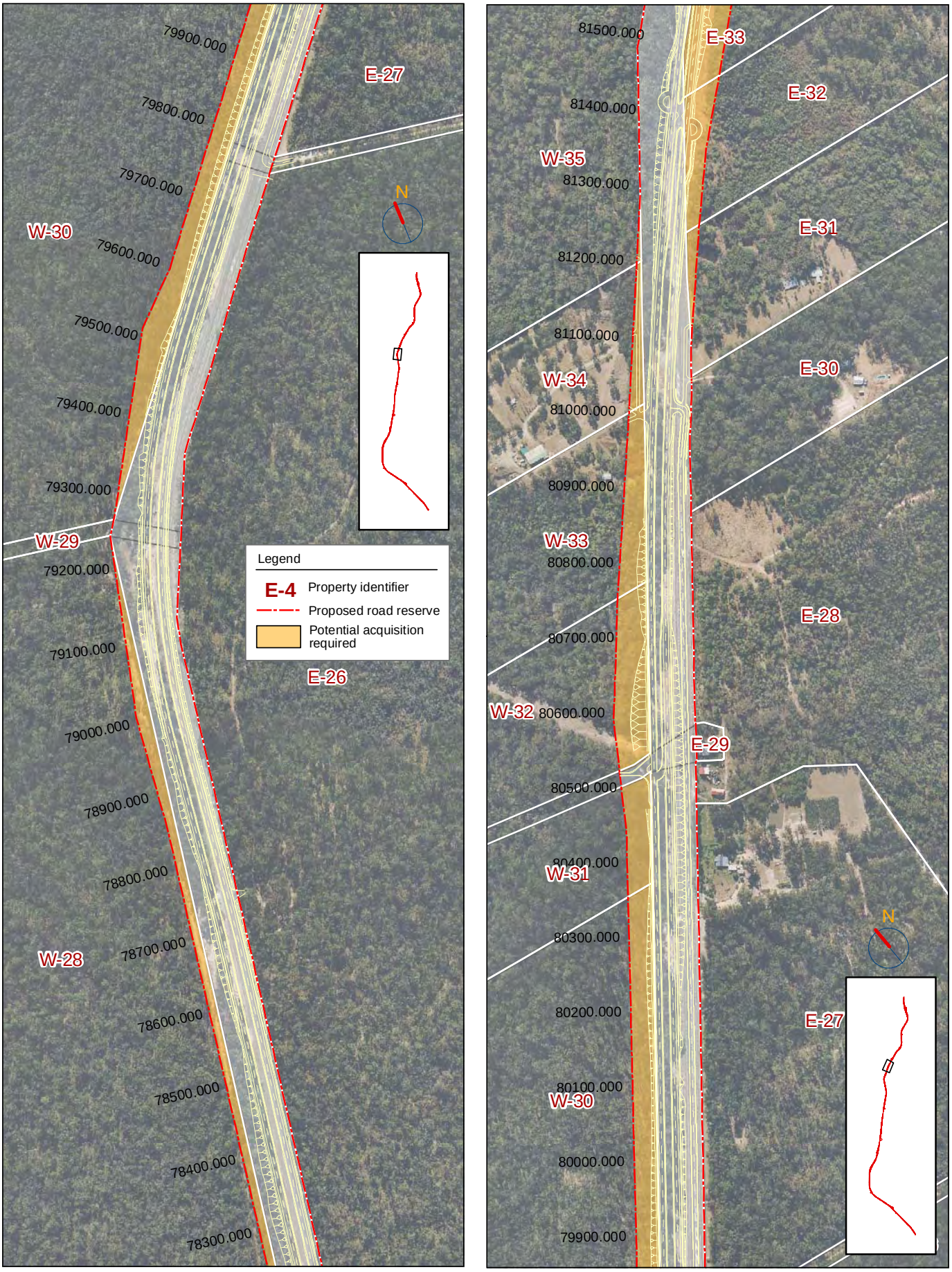

Figure 7.1h

0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

Properties potentially affected by acquisition

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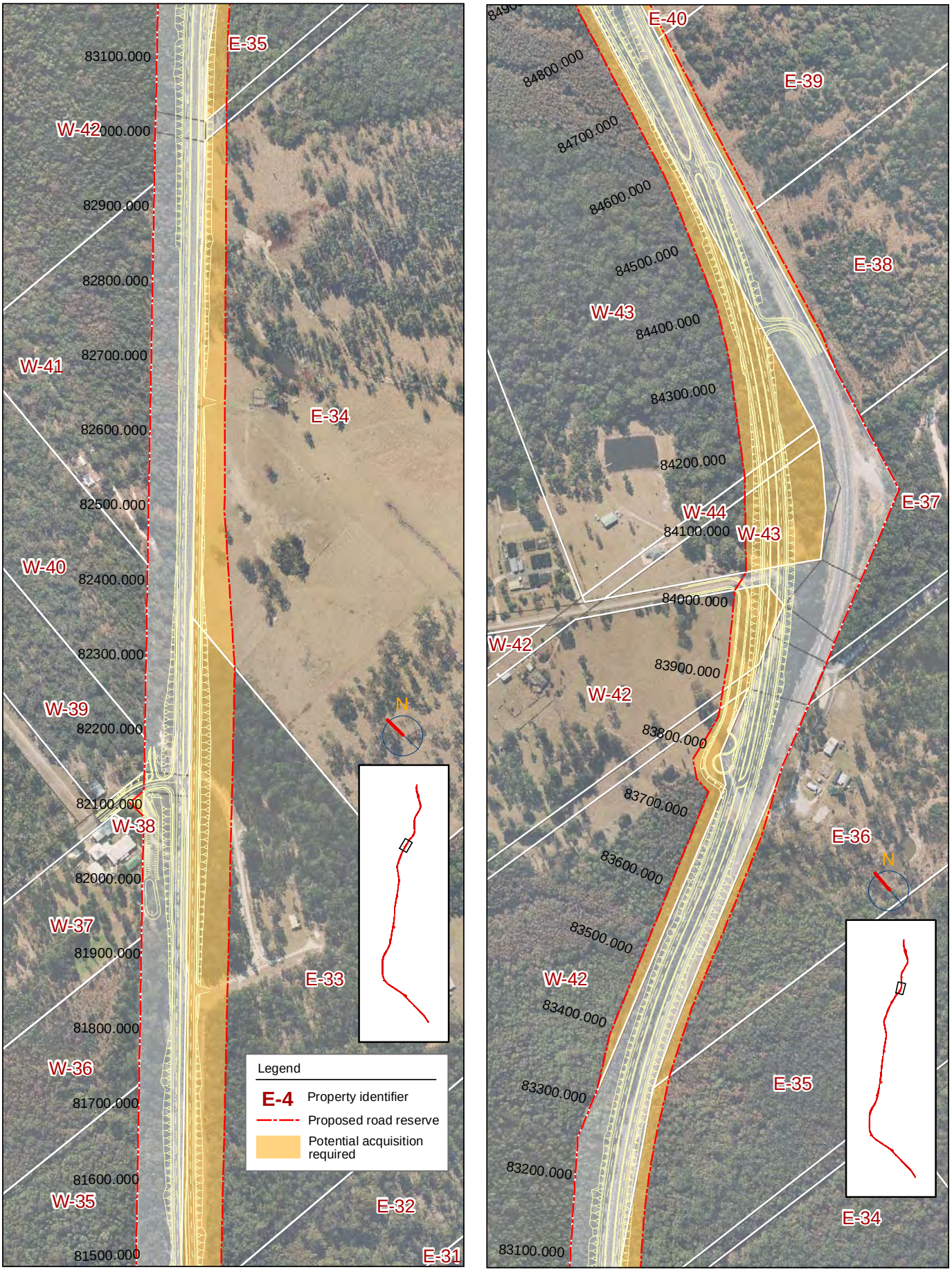

Figure 7.1i

0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

Properties potentially affected by acquisition

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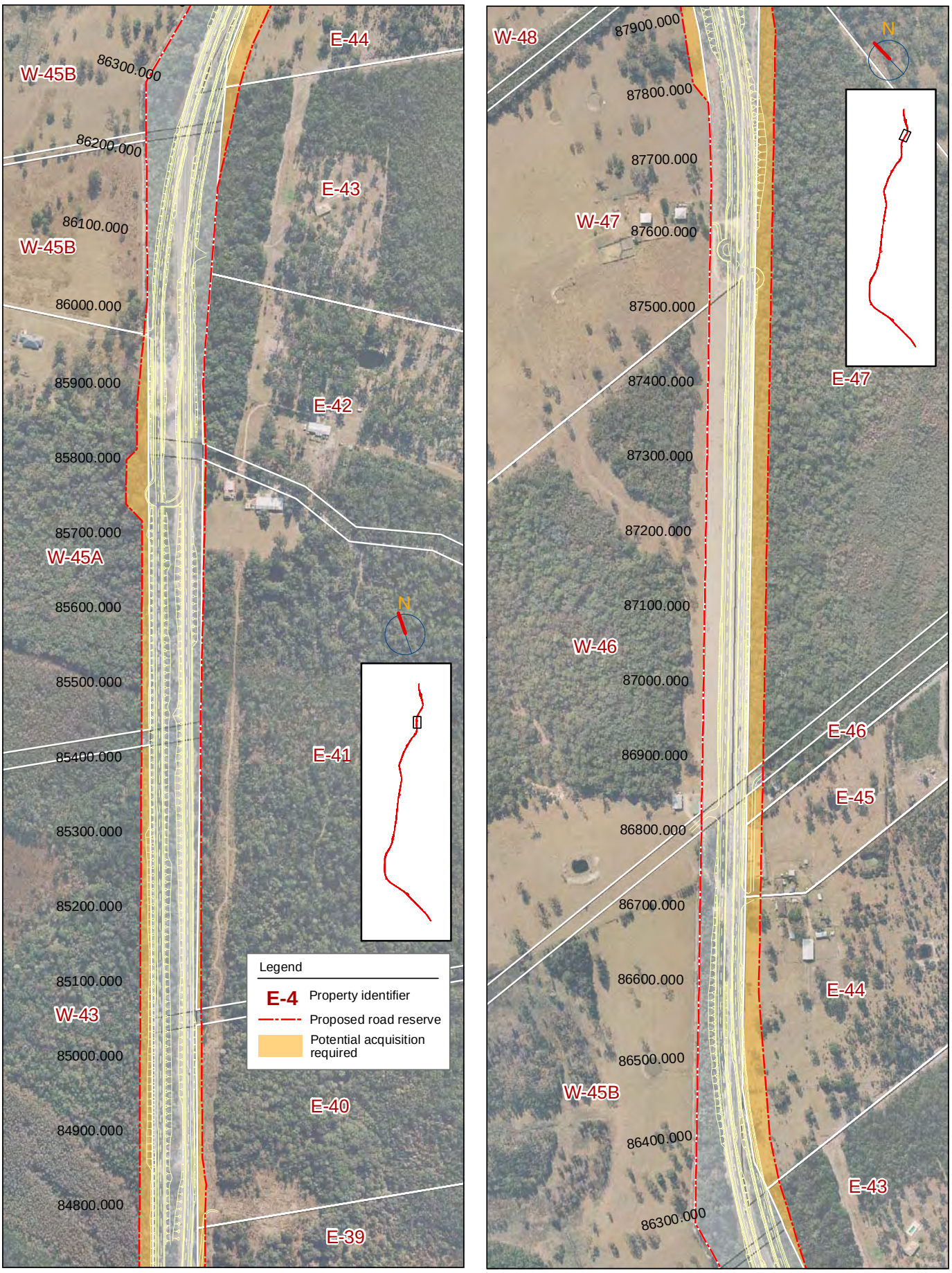


0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

I2W\1235.17.GE\16-07-08\MAR\REV-4

Figure 7.1j

Properties potentially affected by acquisition

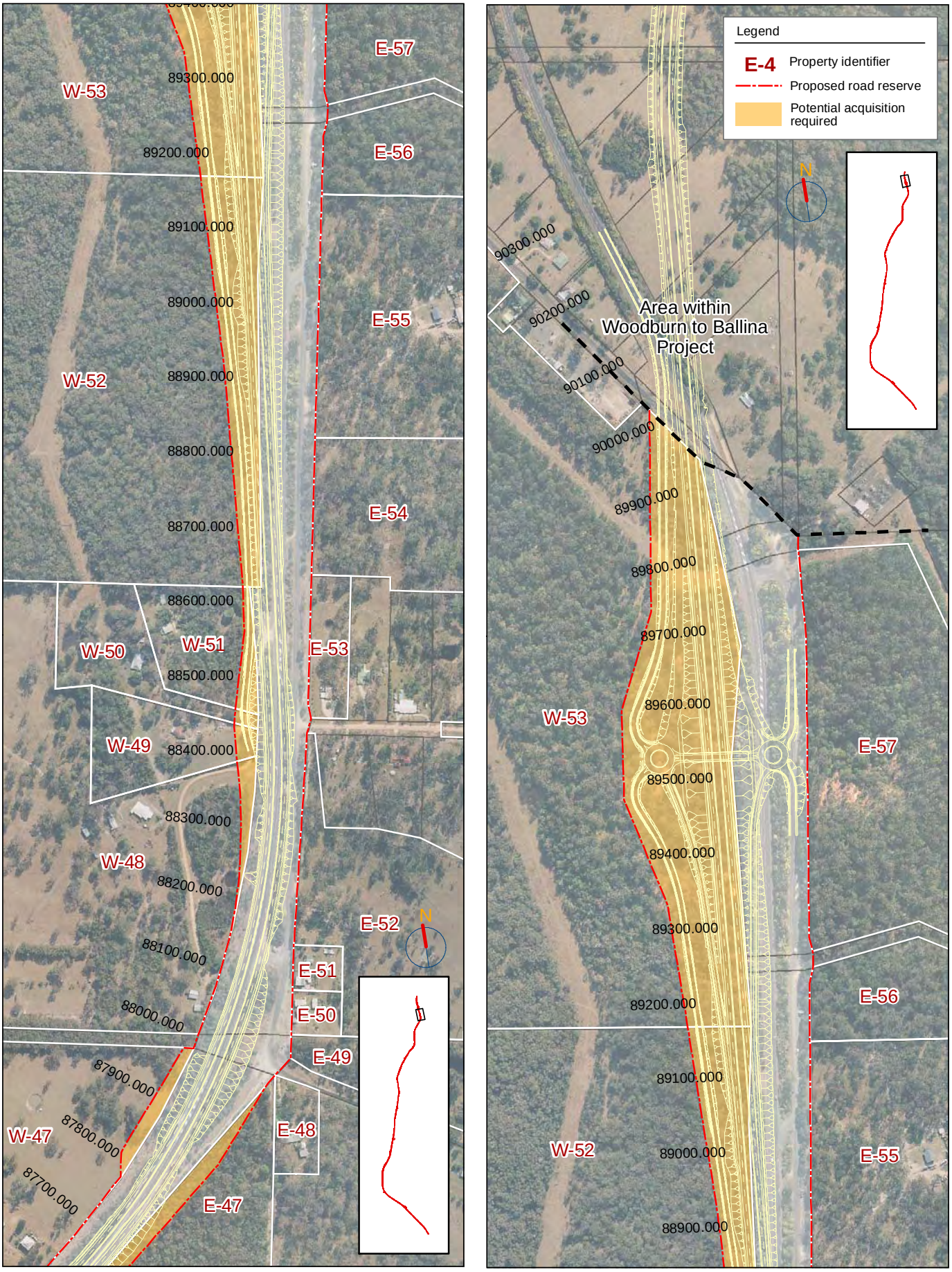


Figure 7.1k

0 100m 200m

SCALE 1:7,000 @ A4

Source: Base data - Roads & Traffic Authority 2007

Properties potentially affected by acquisition

I2W\1235.17.GE\16-07-08\MAR\REV-5

7.6 Public utilities

A number of utilities would be affected by the route, including electricity pylons, street lighting and telecommunication infrastructure.

Most of the services feeding the communities along the route are overhead and can be relocated relatively easily and with little disruption to residents. However the main Telstra Sydney to Brisbane fibre optic cable meanders across both sides of the highway and a total of 11.2 km of this asset would need to be relocated. Prior to construction, sections of the cable may need to be diverted to enable works to proceed without risk to communications services. There are no substantial impediments to diversion of sections of cable, and it is considered that this can be successfully achieved without disruption to telecommunications users.

The impact on assets owned by Clarence Valley and Richmond Valley Councils is considered minor and would not pose any significant disruption to service users as they are principally surface drainage for roadways.

7.7 Indigenous heritage

The results of the indigenous heritage field survey discussed in Section 3.7 found that the study area contains a low density of archaeological sites, probably indicative of resource gathering activities, but also reflecting that the study area has an existing high level of disturbance due to construction of the existing highway, agricultural activity and timber harvesting in the adjoining forests.

Local Aboriginal Land Councils and associated Elders groups were contacted prior to carrying out Indigenous heritage field surveys, and a representative of each organisation provided field survey assistance as required. Additionally, in order to determine whether any sites/places of particular significance or concern would be affected by the proposed highway upgrade, consultation was undertaken with local Elder and Native Title claimant (the late) Lawrence Wilson. Mr Wilson was acknowledged by all groups as the only person known to them with detailed traditional knowledge of the study locality.

The survey focused on reasonably intact, well-drained land beyond the highway reserve boundaries. Approximately 78% of the study area's length was walked as part of the survey and a further 8% had been included in past survey areas. It is concluded that the study area is unlikely to contain any significant undetected Aboriginal sites, and that undetected evidence will most likely be restricted to a low level background distribution of stone artefacts, few of which will be in a primary depositional context. Local Indigenous representatives involved in the field surveys have indicated their support for the study's conclusions, and raised no objections to the project proceeding, provided the burial site near The Gap Road, and the scarred tree near New Italy, are protected.

The scarred tree identified in Section 3.7 is a sufficient distance from the existing highway to ensure that it would not be affected by any of the works required for the proposed Pacific Highway upgrade.

7.8 European heritage

7.8.1 Heritage listings

A heritage study was undertaken as part of the Iluka Road to Woodburn project. The study area includes one item listed on the NSW State Heritage Register, the New Italy settlement, (Museum complex property) refer to Section 3.8 and the Iluka Road to Woodburn Non-Indigenous Heritage Assessment, RTA 2008).

The Museum complex property would be unaffected by acquisition. However, access arrangements to the complex would change, with the existing access closed for safety reasons and access provided via Swan Bay New Italy Road. The importance of access to the site, which functions as a driver reviver location and provides funds for ongoing management of this cultural asset, is acknowledged. Any detrimental effects to the car park would be addressed through the formalisation of parking spaces. Signage would also be provided.

Vineyard Haven and New Italy School Site and residence are listed on the State Heritage Register adjacent to the study area,1.5 km and 4 km respectively, (refer Figure 3.9). The proposal would not directly affect any aspect of Vineyard Haven nor the school site and residence.

7.8.2 Proposed listing of New Italy Settlement landscape on NSW Stage Heritage Register

The project would not affect properties that are currently listed on any heritage listing. However, discussion has commenced regarding the potential listing of the whole of the New Italy Settlement landscape and curtilage on the NSW State Heritage Register. The project would affect the proposed New Italy Settlement landscape and curtilage under both Class A and M scenarios as the curtilage directly abuts the road reserve.

Ongoing discussions with the community, Richmond Valley Council and the State Heritage Office are being held with regard to the New Italy curtilage, Roders well and mango trees (Figure 3.9) and the likelihood of heritage listing for these items. As a result of these discussions, the alignment has been moved further east as part of the refinements to the concept design. Broader changes to the alignment are constrained by the Tabbimoble Swamp Nature Reserve, which is protected under NSW legislation for its ecological values and because of the importance of retaining the driver reviver facility at New Italy.

There would be no direct impacts on Roders well or the historic mango tree plantings under the Class A scenario, although these items would be located within the road reserve. Further consideration under the Class A and M scenarios would be undertaken during the detail design, environmental assessment and project approval phases of the project.

7.9 Acoustic environment

7.9.1 Road traffic noise assessment goals

The noise goals applicable to the project are located in the DECC publication *Environmental Criteria for Road Traffic Noise* and the RTA's *Environmental Noise Management Manual*. The goals are described below.

'Baseline' goals

For arterial road/freeway upgrades and developments, 'baseline' noise assessment goals of 60dB(A) daytime and 55dB(A) night-time are required to be addressed. The goals are applicable at a distance of 1m from the most exposed external residential building facade at the road opening and 10 years after opening.

'Allowance' goal

Where the existing traffic noise exceeds the 'baseline' goals, the 'allowance' goal requires the proposed road upgrades/re-developments be designed so as not to increase the 'future existing levels' by more than 2dB(A). The 'future existing levels' are the noise levels resulting from 10-year traffic growth on the existing roads if there were no upgrades or developments.

'Acute' noise exposure

Where feasible and reasonable, consideration should be given to reduce the external traffic noise levels where the predicted future noise levels (10 years after road opening) exceed the 'acute' noise exposure levels of 65dB(A) daytime and 60dB(A) night-time.

7.9.2 Noise prediction

The noise predictions for the Iluka Road to Woodburn section are preliminary and for the purpose of developing conceptual noise control options. The noise predictions take account of projected traffic growth and changes to the road alignment. It was assumed that traffic speeds would be 110 km/h.

Detailed noise predictions will be undertaken during the environmental assessment and project approval phases of the project.

There are approximately 75 residential dwellings located within 260 m of the existing and proposed upgraded road alignments.

For the purpose of this assessment, a desktop study based on the calculation of road traffic noise (CORTN) modelling procedures was undertaken and shows that existing road traffic noise levels would:

- Generally increase by 1dB(A) at the road opening (2016) due to traffic growth.
- Generally increase by 2dB(A) 10 years after road opening (2026), due to traffic growth.
- Decrease by 1–4dB(A) at about 17 dwellings in 2016, due to the proposed road upgrade being further from the existing residents.
- Increase by 1–3dB(A) at about 16 dwellings in 2016, due to the road being closer to existing residents.

7.9.3 Noise assessment

The predictions show that, for the majority of dwellings along the study route, the increase in future road traffic noise levels (ten years after opening) would be within 2dB(A) and satisfy the 'allowance' goals.

For eight dwellings along the study route, future road traffic noise (10 years after opening) could increase by up to 5dB(A) and noise mitigation would need to be considered in order to satisfy the 'allowance' assessment goal of 2dB(A) above 'future existing levels' (ten year traffic growth).

Where feasible and reasonable, consideration would be given to reducing the external traffic noise levels to the 'acute' noise exposure levels of 65dB(A) daytime and 60dB(A) night time (10 years after road opening). Results of the noise measurements and preliminary calculations have shown that approximately 50 properties are likely to experience higher than the acute noise levels.

7.9.4 Noise control options

Noise mitigation options that could be considered for the proposal include quieter road surfaces, acoustic barriers/mounds and treatment to individual dwellings. Noise mitigation measures would be developed at the environmental assessment planning approval phases of the project, in consultation with landowners.

For the purpose of minimising truck pass-by noise levels, road design factors such as curvature and gradient (which contribute to the need for application of engine compression brakes, acceleration and deceleration), and pavement surface type have and will be taken into consideration in the road design.

Road construction works could cause localised noise and vibration impacts at exposed dwellings. These impacts would be minimised with the implementation of a construction noise and vibration management plan.

7.10 Traffic

7.10.1 Traffic forecasts

An analysis of the future highway traffic volumes and associated future traffic and transport conditions has been undertaken for the following scenarios:

- Base case (do minimum) - this scenario represents the existing highway and, in addition, includes all recent and proposed wire rope installations along the median of the highway from Ch75.4 km to Ch91.4 km (south of Tuckombil Canal).
- Proposal – Class A upgrade - this upgrade proposal represents the scenario with the highest volume of traffic that could potentially use the upgraded Pacific Highway. If the highway is upgraded at some time in the future to Class M or Motorway standard (with grade-separated intersections and a local service road), local traffic would be diverted to the parallel local service road, thereby reducing the overall highway traffic volume.

Forecasting method

Future traffic volumes were predicted based on historic traffic volumes and the annual growth in traffic between 1991 and 2001, using the linear growth method. It is assumed that this annual increase represents the underlying rate of traffic growth that occurred in the study area prior to the opening of the Pacific Highway upgrade between Yelgun and Chinderah.

It is also assumed that this historical rate of traffic growth will continue to occur in the future. Therefore, the historical growth rate has been applied to the 2007 AADT figures from Table 2.1, to predict traffic volumes in the future years of 2016 (theoretical opening year for the proposed upgrade) and 2036 (20 years after opening).

The higher rate of growth in the intervening period between 2001and 2005 represent the impact of the Yelgun to Chinderah upgrade on the volumes of traffic (and in particular heavy vehicles) using the Pacific Highway.

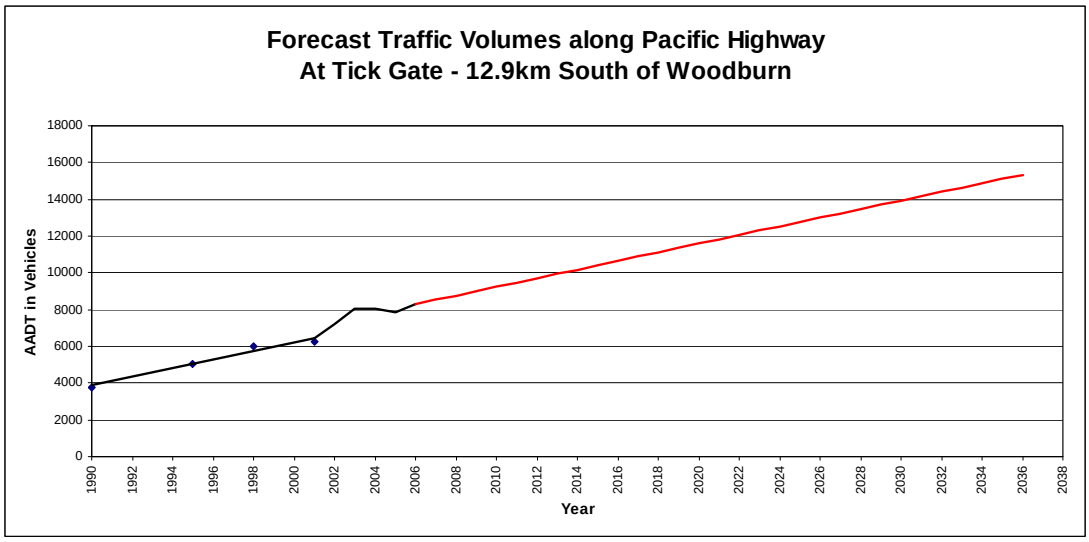
Lastly, it is assumed that no major land use developments are proposed within the study area during the analysis period. Therefore, no increase in local traffic is expected to occur.

Figure 7.2 illustrates the forecast traffic volumes as per the above method and assumptions. The forecasts are based on the AADT as calculated for the traffic counts taken north of The Gap Road, which represents the highest volumes.

As illustrated in Figure 7.2, the AADT volume along the highway is predicted to be 11,020 vehicle movements in 2016 (the assumed opening year of the proposed duplication and associated improvements), and 15,720 vehicle movements in 2036 (20 years after opening). Of these total volumes, heavy vehicle movements make up approximately 2,187 (20%) per day in 2016 and 3,120 (20%) in 2036. Both the total and heavy vehicle traffic movements are therefore predicted to increase by approximately 80% in 2036 compared to existing traffic levels.

Based on the historical growth rates and the linear forecasts, these results indicate that, even for the increased traffic volume, the highway is likely to operate at an excellent LOS (LOS A) for the proposed Class A highway upgrade up to 2036.

Figure 7.2 Forecast traffic volumes along the Pacific Highway



Source: Connell Wagner, 2007.

7.10.2 Future performance at intersections

The proposed Class A upgrade would include at-grade 'Seagull' type T-intersections at a number of locations including two of the three existing intersections where traffic surveys were carried out (see Section 2.1). An analysis of the future performance of the key intersections for the design hour (100th highest hour) has been undertaken for the proposal. The analysis of future performance of the intersections at Jacky Bulbin Road and Swan Bay New Italy Road revealed that the performance of the key intersections remains good (LOS B) for the key intersections in 2036.

The provision of 'Seagull' intersections at Jacky Bulbin Road, Serendipity Road and Swan Bay New Italy Road for the proposed concept design would increase the intersection capacity and safety at these locations relative to the base case. Since the performance of the highway would be good, sufficient breaks would be available for traffic to enter into the traffic stream travelling along the highway. Therefore, the future performance of these intersections is expected to be good with the proposed upgrade.

7.11 Summary and conclusions

In summary, the overall performance of the proposed concept design can be assessed as follows:

7.11.1 Soils and geotechnical

- Based on the studies undertaken to date the existing ground conditions do not pose any major constraints to the development of the proposed concept design.
- Excavation into this rock may require specialist machinery or equipment and treatment to exposed batters such as geotextile reinforcement.
- Potential acid sulphate soils would have to be managed in accordance with an approved Acid Sulphate Soil Management Plan.
- The fine-grained soils covering approximately 90% of the study area are extremely susceptible to high sheet and gully erosion when cleared of vegetation. Adequate protection of both cut batters and fill embankments would need to be provided, using measures such as revegetation, provision of cut-off drains, and landscaping.

7.11.2 Flooding

- There are recognised flood-prone locations that require bridging to meet the RTA's prescribed design standards.

7.11.3 Source of materials

- Sourcing of imported fill materials (if required) may be an issue for embankment construction. There is currently a surplus of materials in general which may lend to material being exported to the projects to the north and south. The linear nature adjacent to the existing highway may restrict the method materials are transported due to limited haulage loading on public highways.

7.11.4 Water quality

- The potential exists for disturbance of high risk acid sulphate soil during the construction phase.
- The potential exists for elevated total suspended solids levels caused by the off-site loss of suspended solids from construction activities to watercourses throughout the study area.
- There is high risk of water quality impacts to small creeks draining to sensitive SEPP 14 wetlands.

7.11.5 Ecology

- By following the existing highway footprint as closely as possible, the proposed concept design will support a strategy of minimised native vegetation clearing, and protection of EECs.
- Notwithstanding, the proposal has the potential to have a significant impact on threatened flora species. As the study area displays high species diversity and a number of threatened plant and animal species. The main potential ecological impacts include habitat fragmentation, increased barrier effects through corridor widening, subdivision and isolation of populations.
- Approximately 30% of the *Melaleuca irbyana* population south of New Italy would be potentially affected by the project. Mitigation measures, such as translocation, require further investigation.
- Threatened species of frog such as Wallum froglet and Green-thighed frog may be affected by the proposed upgrade through direct disturbance of habitat or changes to the hydrological regime.
- Hollow bearing trees provide important habitat for threatened species and numbers are likely to be reduced during vegetation clearance for the duplication.
- The roadway has the potential to disrupt wildlife linkage between two separate areas of bushland located in a cleared landscape.
- The proposed concept design has the potential to further fragment areas of native vegetation and habitat.

7.11.6 Air quality

- Results of air quality studies carried out for other Pacific Highway upgrade projects indicate that atmospheric carbon monoxide concentrations would be well below DECC criteria. Further assessment will be undertaken during the environmental assessment phase of the project but are expected to be within allowable limits.

7.11.7 Land use and property effects

- A total of 35 properties are potentially impacted by the preferred highway route, comprising 31 privately owned properties and small sections of Devils Pulpit, Tabbimoble and Doubleduke State Forests.
- The greatest area of land acquisition would be on residential properties at Whites Road, where the road corridor boundary would be realigned along the arc of the curve, up to 100 m west of the existing road boundary. The property on the northern side of Whites Road would potentially require acquisition of a wedge-shaped strip of land approximately 700 m long, and up to 100 m wide, tapering to a point approximately 700 m north of Whites Road. Most of this land is currently heavily wooded.

- Other rural residential properties would be affected by strip acquisition less than 100 m and typically 10 m to 20 m.
- Under the proposed concept design in its current form, no residences would be demolished although some residences would be up to 100 m closer to the road than they are at present.
- The potential impacts on agricultural properties are minimal. Forests NSW has indicated that there would not be any likely disruption to its operations as a consequence of the proposed highway upgrade.
- The proposed route does not deviate significantly from the existing highway alignment and therefore the potential property impacts are minimal. There are 67 parcels of private property where narrow strips of land along the highway frontage would potentially be affected. The proposed highway would not result in any severance or isolation of private property.

7.11.8 Recreation and tourism

- There is likely to be minimal negative impact on recreation and tourism as a result of the proposal as there are few facilities along this section of the highway.

7.11.9 Public utilities

- The main Telstra Sydney to Brisbane fibre optic cable meanders across both sides of the highway and a total of 11.2 km of this asset would need to be relocated.

7.11.10 Indigenous heritage

- The study area contains a low density of archaeological sites and it is most likely that any undetected evidence will be a low-level background distribution of stone artefacts.
- A scarred tree identified near New Italy would not be affected by the proposed highway upgrade.
- Two Potential Archaeological Deposit sites were identified during the indigenous heritage investigations and would require further investigation prior to construction.
- A burial site is located within the study area but away from the existing highway near The Gap Road. The preferred concept design results in a net increase of distance to the burial site from the highway.

7.11.11 European heritage

- The proposed highway upgrade would come closer to the New Italy Museum Complex, (without requiring acquisition), and the existing car parking facilities would require relocation. The Museum Complex and surrounding area is covered by the 2002 New Italy Settlement CMP. Recommendations have been provided by the CMP for the highway upgrade project and cover car parking, signage, the Driver Reviver and a thorough assessment of the potential heritage impacts on the Museum Complex.
- The potential impact on Roders well and mango trees under the Class M scenario will require further investigation at the environmental assessment, approval and detail design phases of the project.

7.11.12 Acoustic environment

- A preliminary noise assessment has been undertaken as part of the project planning. Following highway construction, 16 dwellings would be 5 m to 42 m closer to the highway alignment. With the combined effects of traffic growth and reduced distance separation, the predicted road traffic noise levels of 8 of these dwellings could increase by up to 1-3dB(A) in 2016 and a further 2dB(A) in 2026 and may require noise mitigation.
- Noise mitigation options would be developed in consultation with landowners.

7.11.13 Traffic

- The analysis of future highway traffic volumes and associated future traffic and transport conditions predicts the AADT volume along the highway to be 11,020 vehicle movements in 2016, and 15,720 vehicle movements in 2036 (20 years after opening). Of these total volumes, heavy vehicle movements make up approximately 2,187 per day in 2016 and 3,120 in 2036.
- The highway is likely to operate at an excellent LOS (LOS A) for the proposed Class A highway upgrade up to 2036.
- 'Seagull' type T-intersections are proposed for the proposed Class A upgrade at a number of locations including Jacky Bulbin Road, Serendipity Road and Swan Bay New Italy Road.
- The analysis of future performance of the intersections at Jacky Bulbin Road and Swan Bay New Italy Road revealed that the performance of the key intersections remains good (LOS B) for the key intersections in 2036.

7.11.14 Socio-economic assessment

- The New Italy Museum Complex relies solely on passing motorists along the highway for its income and access to the Museum Complex would need to be maintained for survival of this business. This access will be modified and signage installed. The ongoing viability of the Museum Complex is an important objective of this project.

7.11.15 Summary

The preferred concept design for the Iluka Road to Woodburn project has been subjected to a preliminary evaluation and assessment. The following issues are considered as key items:

- Impacts on threatened flora species.
- Fauna habitat fragmentation and loss of key habitat.
- Impacts on items of heritage significance.
- Impacts on items of Aboriginal significance.
- Impacts on and acquisition of private property.
- Access arrangements.

These items will be subject to further consideration, investigations and assessment during the environmental assessment, approval and detail design phases of the project.

8. Preferred concept design and next steps

8.1 Preferred concept design

The Iluka Road to Woodburn project was announced in 2004 and investigations commenced to determine options to upgrade this section of the Pacific Highway. As the work progressed, it became evident that the upgrading and/or duplication of the highway could feasibly be achieved through the utilisation of substantial proportions of the existing road and building two new lanes either east or west of the existing highway. In many locations the existing road corridor has sufficient width to accommodate the second carriageway within existing RTA road property boundaries. The Iluka Road to Woodburn upgrade is unusual in that it does not pass through any towns or commercial centres. Furthermore, deviation from the existing highway corridor would yield little or no functional or transportation benefits and would have substantial environmental impacts on the surrounding area.

Consultation with community and stakeholders, along with technical investigations were therefore commenced on this basis. The Concept Design Report was released in March 2006 and community input was sought. Community Information Sessions were held, along with face-to-face meetings, to help explain the project, understand the issues and seek feedback on the concept design.

The community and stakeholder feedback, along with the results of the technical investigations, has been incorporated into the refinement of the project. The preferred concept design includes the following amendments to the concept design:

Strategic changes:

- Emergency stopping bays, emergency u-turns and maintenance crossovers removed and replaced with combined u-turn, crossover facilities located at an average of 3 km at:
  - CH 58.000.
  - CH 61.800.
  - CH 65.000.
  - CH 68.500.
  - CH 70.800.
  - CH 73.600.
  - CH 77.300.
  - CH 81.300.
  - CH 81.300 with u-turn north to south only.
  - CH 87.450.
- Bus stops added to egress side of selected side roads.

Specific design changes (from south to north):

- Iluka Road access to be designed to connect final dual carriageway under Wells Crossing to Iluka Road Project, as a result Banana Road would connect to the Iluka Road Interchange via a new slip road.
- U-turn located at CH 59.400 just north of Mororo Road.
- Rest area just north of Mororo Road to be retained under Class A only.
- Southbound rest area to be shifted 30m north to reduce environmental impact.
- Jacky Bulbin Road seagull to include u-turn.
- Offline section realigned to conform with revised cadastral information.
- Median right turn added at CH 65.650 into private access.
- Merge Taper added at Serendipity Road.
- Median right turn added at CH 80.400 into Cypress Road.
- Cut at New Italy reduced to decrease impact on area, including *Melaleuca irbyana*.

- Road realigned between Cypress Road and New Italy Road to reduce land acquisition and impact of mango trees. Retaining wall added to eliminate batter adjacent to mango trees and well.
- Access to four properties 300 to 600 m north of Cypress Road to be combined to one egress only.
- Parking area to be formalised at New Italy to enable parking for 60 vehicles.
- Median right turn added with u-turn facility at Whites Road.
- Bend at Gap Road realigned to 1000 m to reduce impact on western side.
- Cut at New Italy reduced to decrease footprint and impact on area.
- U-turn located at CH 85.800 Nortons Road.
- Parallel service road from Wondawee Way to Trustums Hill Road added.
- Major design change at northern tie in due to excessive material requirements for the Woodburn to Ballina project. Full dumbbell interchange to be incorporated into design with future north facing ramps.

8.2 Next steps

Following the display of the preferred concept design, the Roads and Traffic Authority (RTA) will consider issues raised in any comments. Once this process is finalised the relevant local council will be approached to have the corridor formally reserved in its local planning instrument. The boundaries of the corridor will be based on the final concept design.

The next steps for the Upgrading the Pacific Highway Iluka Road to Woodburn project would be to apply to the Department of Planning for project approval under Part 3A of the EP&A Act and to undertake detailed environmental assessments. Further survey, geotechnical, ecological and other investigations would also be undertaken to provide input into the refinement of the design.

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

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

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

Further refinements may occur during the environmental assessment stage of the project and in response to community comments.

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