F3 Freeway to Raymond Terrace

Upgrading the Pacific Highway

CONCEPT DESIGN REPORT
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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.

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.

As part of the Pacific Highway Upgrading Program, the RTA is undertaking route selection and development of a concept design for the upgrade of a 15 kilometre section of the Pacific Highway between the F3 Freeway and Raymond Terrace. The F3 Freeway to Raymond Terrace section forms the 'missing link' between the F3 Freeway and the Raymond Terrace bypass, which is essential to complete the Pacific Highway Upgrade Program.

Planning for this upgrade of the Pacific Highway began in October 2004. A wide range of route options was investigated, including options proposed by the community both within and outside the initial study area. A preferred route was subsequently selected, and further refinement of the alignment and the interchange layouts have led to the current concept design for the upgrade.

Purpose of the report

The Concept Design Report describes the development of the concept design and provides information on the investigations undertaken and the constraints considered in the refinement of the design. Any further comments received as result of the concept design display will be considered by the project team.

The RTA recognises the need to provide certainty to the local community on the project's location and extent. Following the display of the concept design, the relevant councils will be approached to have the corridor formally reserved in their local environmental plans accordingly. The boundaries of the corridor will be based on the final concept design.

Project development

The F3 Freeway to Raymond Terrace section of the Pacific Highway has undergone a process comprising the following:

- Route options development (refer *The F3 Freeway to Raymond Terrace Route Options Development Report* –RTA, October 2005);
- Preferred route selection (refer *The F3 Freeway to Raymond Terrace Preferred Route Report* –RTA, August 2006);
- Specialist investigations for the development of the concept design of the preferred 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.
- Construction of the project.

Investigations in developing the concept design

Detailed investigations have been undertaken to select the route options, preferred route and to form the concept design. These are described in detail in the *F3 Freeway to Raymond Terrace Route Options Development Report* (RTA, October 2005) and the *F3 Freeway to Raymond Terrace Preferred Route Report* (RTA, August 2006) and include, flora and fauna, non-Indigenous heritage, Indigenous heritage, traffic and transport, geotechnical, hydrology and hydraulics, public utilities and property impacts.

Project description

The project length is 15 km comprising a new dual carriageway motorway standard road between the F3 Freeway and the Raymond Terrace bypass, crossing the Hunter River and floodplain.

The project would have four grade-separated interchanges linking the new route to the local road network. The existing Pacific and New England highways are dual carriageway roads through the full length of the project and will remain in operation to carry local traffic and for the major links to Newcastle and Maitland. The route crosses the New England Highway at Hexham adjacent to the Hunter River. The concept design layout drawings (Figures A.1 to A.13) are attached in Appendix A.

Design Standards

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 limit, controlled access condition roadway with grade-separated interchange access, and a continuous alternative route.

Staging

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. Potential staging considerations have been discussed further in this report.

Way forward

The information contained in this report provides two key functions:

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

Following the display of the concept design, the Roads and Traffic Authority (RTA) will consider issues raised in any comments received. Once this process is finalised the relevant council will be approached to have the corridor formally reserved in its local environmental plans. 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 on funding availability. Further refinements may occur during the environmental assessment stage of the project and in response to community comments.

1 Introduction

1.1 Concept Design Report

1.1.1 Definition of concept design

This report describes the development of the concept design for the F3 Freeway to Raymond Terrace project (the project).

There are various design phases in the development of a major highway project from preliminary design through to detailed design. These design phases are progressed in parallel with the project approvals and delivery process. In selecting the preferred route the design for each route option was developed to a preliminary level, with engineering features such as interchanges and bridges identified but not developed.

Concept design supports the planning approval for the project, and is developed to sufficient detail such that:

- A feasible design is developed to meet project constraints and engineering challenges; and
- Sufficient design is undertaken to set the project's 'boundaries 'and therefore provide certainty as to the project's extent.

This concept design will form the basis for preparing the environmental assessment. Further refinements may occur during the environmental assessment stage of the project and in response to community comments.

1.1.2 Purpose of this report

The Concept Design Report describes the development of the concept design and provides information on the investigations undertaken and the constraints considered in the refinement of the design. Any further comments received as a result of the concept design display will be considered by the project team.

The RTA recognises the need to provide certainty to the local community on the project's location and extent. Following the display of the concept design, the relevant councils will be approached to have the corridor formally reserved in their local environmental plans. The boundaries of the corridor will be based on the final concept design.

More detailed information on the need for the project, the selection of the route options and preferred route and consultation undertaken are covered in previous reports. The reader is referred to these reports for more detailed information of previous stages of the project. Section 1.2.3 of this report describes the previous work undertaken and associated reports.

1.1.3 Setting the project's boundaries

The project's boundaries must include all land required to accommodate:

- The final highway alignment;
- Any minor amendments to alignment or design as identified through further investigation or design refinement;
- Additional infrastructure required for the highway's operation and maintenance (stormwater treatment, maintenance access etc.);
- Land required to construct the new highway (construction accesses, lay-down areas, site offices etc.).

In setting the project's boundaries a balance must be struck between minimising the effects on adjacent land and ensuring flexibility for further design optimisation that may arise during detailed design.

1.2 F3 Freeway to Raymond Terrace upgrade

1.2.1 Completing 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.

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.

As part of the Pacific Highway Upgrading Program, the RTA is undertaking route selection and development of a concept design for the upgrade of a 15 km section of the Pacific Highway between the F3 Freeway and Raymond Terrace. The project study area is shown on Figure 1.1

Planning for this upgrade of the Pacific Highway began in October 2004. A wide range of route options were investigated, including options proposed by the community both within and outside the initial study area. A preferred route was subsequently selected in August 2006, and further refinement of the alignment and the interchange layouts have led to the current concept design for the Project.

1.2.2 Traffic and transport context

The F3 Freeway to Raymond Terrace section forms the 'missing link' between the F3 Freeway and the Raymond Terrace bypass, which is essential to complete the Pacific Highway Upgrade Program.

Between the F3 Freeway at Woods Gully and Raymond Terrace bypass, the existing traffic route follows John Renshaw Drive and the New England Highway before joining the Pacific Highway at Hexham Bridge over the Hunter River. The existing Pacific Highway crosses the Hunter River, proceeding past Tomago and continues through the township of Heatherbrae before connecting to the completed Raymond Terrace bypass, east of the Masonite Road roundabout.

As future development occurs in the Lower Hunter Region including Thornton and Raymond Terrace, traffic flows on the existing road network are expected to increase. Traffic modelling indicates that traffic volumes in the study area are expected to more than double by 2029 compared with 2004 levels.

Crash statistics indicate 173 crashes have occurred along this route between 2004 and 2006, of which 3 were fatal. Construction of the project would decrease the number of conflict points for through traffic and reduce the number of crashes that would be expected if the project was not completed.

Should a new link between the F3 Freeway and Raymond Terrace bypass not be constructed, higher traffic volumes would be experienced on the current route, with a subsequent increase in congestion, travel time and accidents.

For further detail on the need for the project and the traffic studies undertaken, refer to *The F3 Freeway to Raymond Terrace Preferred Route Report* (RTA, August 2006).

1.2.3 Previous work undertaken

Investigation on the project commenced in October 2004 with the development of a number of route options and this phase of the investigation was subject to public display (21 October 2005 to 2 December 2005) and the public were given the opportunity to make submissions on the route options. The RTA selected the preferred route for the project, and this was announced on 30 August 2006, and was subject to public display (30 August to 13 October 2006). Submissions from the public were again invited.

Reference should be made to the *F3 Freeway to Raymond Terrace Route Options Development Report* (RTA, October 2005) and the *F3 Freeway to Raymond Terrace Preferred Route Report* (RTA, August 2006) for a more detailed review of the constraints associated with the development of route options and the selection of the

preferred route. Both reports may be downloaded from the RTA web site: www.rta.nsw.gov.au/pacific (see project reports under the F3 Freeway to Raymond Terrace section of the Pacific Highway Upgrade). It should also be noted that the *F3 Freeway to Raymond Terrace Route Options Development Report* (RTA, October 2005) established the need for the project based on several road user and wider community criteria.

The route selection process involved many iterations incorporating input from detailed studies, community consultation and stakeholder input. These detailed studies have formed the full project development process and as a result potential environmental impacts have been avoided or minimised. The project team has utilised the previous studies and feedback in developing the concept design and it is intended that this report builds on that previous work, rather than repeating it. The information presented in this report provides a brief summary of the more extensive specialist investigations undertaken.

Figure 1.2 summarises the process that is being followed for the project's development. This process is consistent with other projects in the Pacific Highway Upgrade Program.

1.2.4 Project boundary and scope

The study area selected for the investigation and development of the preferred route is shown in Figure 1.1. It covers a total area of 2166 hectares and extends from the F3 Freeway south of the John Renshaw Drive roundabout to the Raymond Terrace bypass.

The study area comprises land from the three local government areas of Newcastle, Maitland and Port Stephens.

Key urban areas situated within the study area include Heatherbrae and part of Black Hill. Within these areas are residential dwellings, motels, caravan parks, service stations, fast food outlets, recreational parks, community/tourist facilities and light commercial/industrial premises.

The townships of Beresfield and Tarro are located immediately to the north of the study area. The Hexham and Tomago industrial areas are located immediately to the south of the study area.

Terrain within the study area is characterised by gentle to moderate undulating ground at the western and south eastern extents. Broad, low lying floodplain areas of the Hunter River dominate the central sections, linking the residual landforms at Black Hill and the Tomago Sand Beds which define the western and eastern sections of the study area.

Since the commencement of the project in October 2004, the study area was expanded in the vicinity of Hexham to facilitate a crossing of the Hunter River upstream of the existing Hexham bridges and the utilisation of the existing Pacific Highway corridor east of the river.

Figure 1.1 Study Area

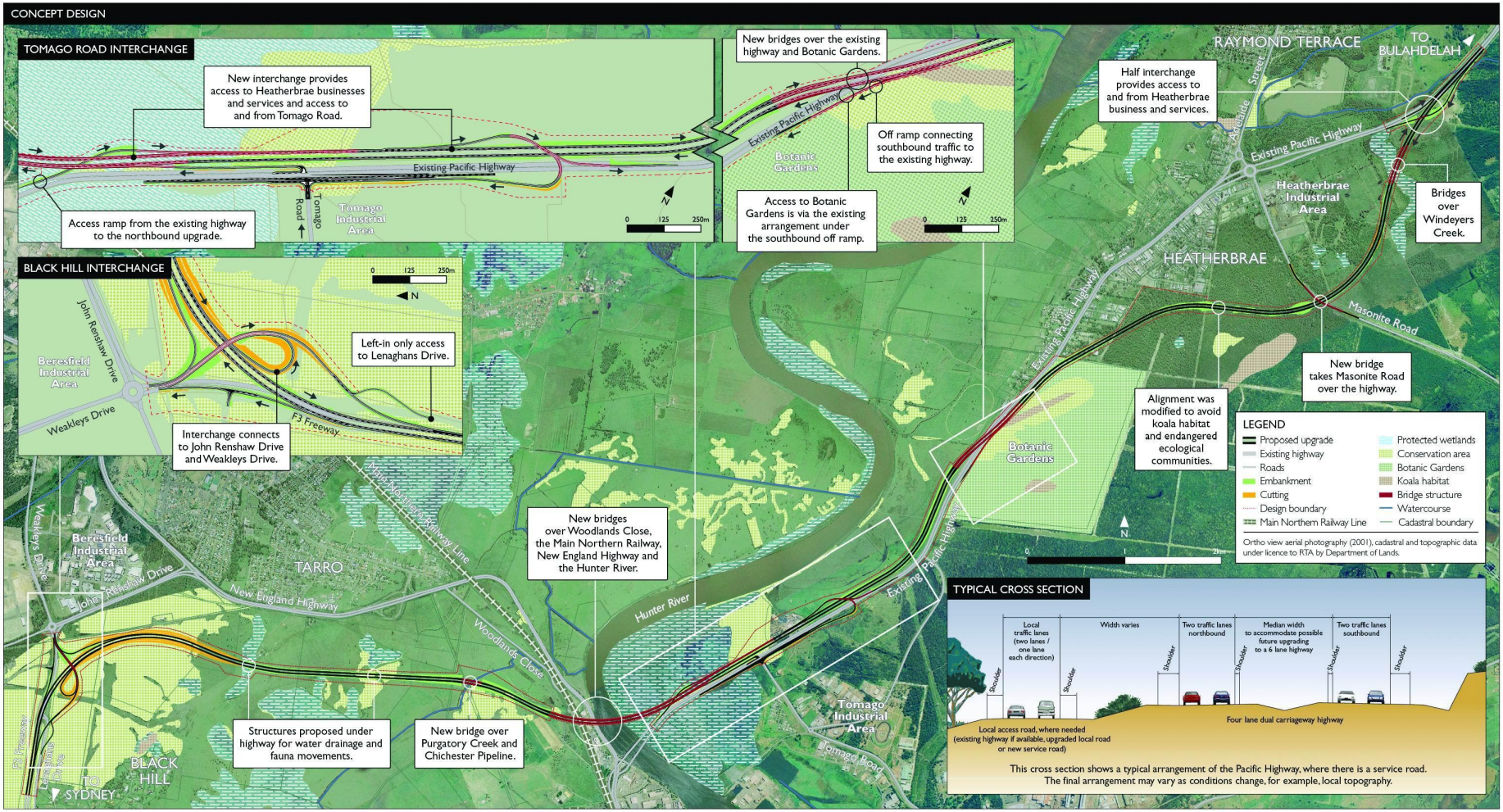
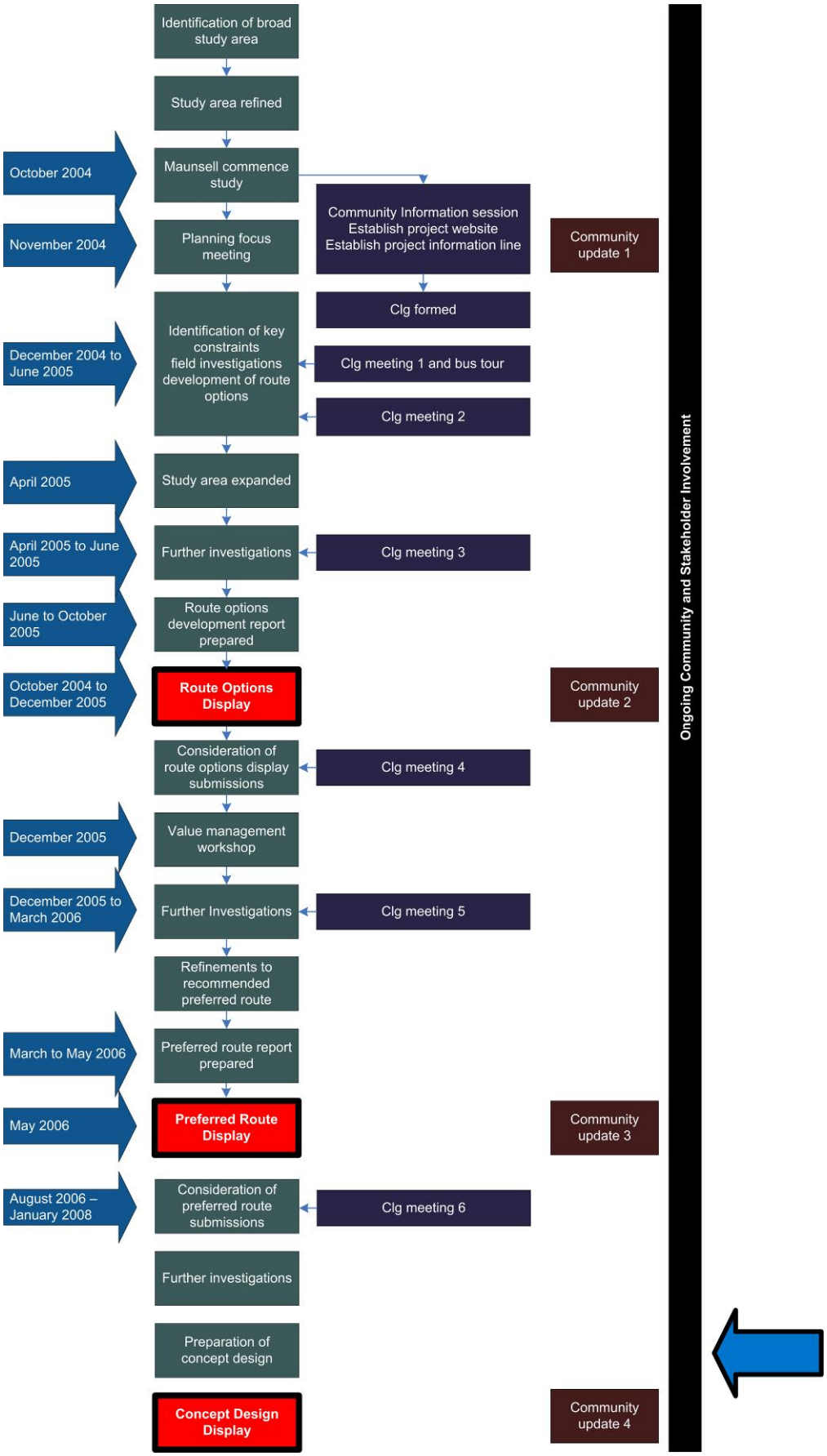


Figure 1.2 Project development process



1.2.5 Purpose of this report

The purpose of this report is to document the process in developing the preferred route to the concept design level.

The report is structured as follows:

- Chapter 1 provides an introduction to the project, the concept design, the study area and the project development process;
- Chapter 2 summarises the project objectives;
- Chapter 3 summarises community consultation and involvement and community issues and concerns arising;
- Chapter 4 provides a review of the key environmental characteristics of the site and factors in developing the concept design;
- Chapter 5 describes the preferred route concept design;
- Chapter 6 describes the future development of the project.

2 Project objectives

2.1 Pacific Highway Upgrade Program objectives and design principles

Route selection and the development of the concept design were guided by the objectives for the Pacific Highway Upgrade Program. The Pacific Highway Upgrade Program objectives are to:

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

2.2 Pacific Highway Upgrade Program urban design objectives

The RTA's *Pacific Highway Urban Design Framework – urban design guidelines for SH10 from Hexham to Tweed Heads* provides the urban design framework for all the projects along the Pacific Highway. It was written to ensure that the completed route will be cohesive and that it will also reflect the regional variance along the route. The guideline's objectives for the route, and the way in which they are addressed in the project's design are set out in Table 2.1 below:

Pacific Highway Upgrade urban design objectives	Project urban design response to achieve the objectives
A flowing road alignment that is responsive and integrated with the landscape	• The profile of the project has been 'minimised' in keeping with the generally flat and low lying terrain, whilst satisfying requirements for drainage, minimum bridge clearances and interchange connection.
A well vegetated natural road reserve	• To be addressed during the detail phase.
An enjoyable interesting highway with varied views and vistas of the landscape and pleasant 'restful' places to stop	• The concept design maximises opportunities to enjoy the open landscape of the corridor and several suitable rest locations already exist and can be easily accessed from the route.
Value the communities and towns along the road	• The motorway bypasses all communities and towns, but provides clear, well signposted access to those places.
Provision of consistency-with-variety	• To be addressed during the detail design phase.

in road elements	
A simplified unobtrusive road design	• The profile of the project has been "minimised "in keeping with the generally flat and low lying terrain, whilst satisfying requirements for drainage, minimum bridge clearances and interchange connection.

These objectives inform all stages of the project development process from route selection through to concept development and delivery.

2.3 Project Objectives

The RTA developed a set of project objectives to sit alongside the Program's objectives. These objectives are specific to the project and reflect the requirements of that section of highway. The project-specific objectives established for the proposed upgrade are outlined in Table 2.2 below

Table 2.2 Objectives for design development and environmental impact assessment

Pacific Highway Upgrade Programme Objectives	Project Objectives
Significantly reduced road accidents and injuries	• Develop a dual carriageway road with a route target crash rate of a minimum of 15 crashes per 100 MVK over the project length. • A concept design for a 100 km/hr design speed for the vertical alignment and 110 km/hr design speed for the horizontal alignment. • No access points between interchanges along the length of the project. • Retain or replace existing rest areas within the study area.
Reduced travel times	• Provide a route that maximises the reduction in travel time for Pacific Highway traffic. • Provide intersections designed to at least a Level of Service (LoS) C, 20 years after opening for the 100th Highest Hourly Volume. • Minimise user delay from incidence and road closure on the Highway including from flooding. • Reduce delays from holiday congestion. • Minimise disruption and delay during construction.
Reduced freight transport costs	• Provide a route which reduces overall freight transport costs of trucks using the Highway. • A route that meets or exceeds B-double requirements.
Develop a route that involves the community and considers their interests.	• Develop a project that meets the objectives of the community and stakeholders involvement plan and specifically the criteria for a successful project. • Minimise the physical and traffic impacts of the route such as traffic noise levels, intrusion, community severance and access patterns. • Minimises the physical impacts on heritage (indigenous and non-indigenous) sites. • Provide transport developments which are complementary with land use. • Maintain access to affected properties and land during construction.

Pacific Highway Upgrade Programme Objectives	Project Objectives
	• Maximise use of the existing road reserve, where possible. • Upgrade and improve the existing highway where it is retained as part of the project. • Provide a strategy for future upgrades to be easily integrated into the project from both engineering and environmental perspectives. • Optimise the route option and concept design to minimise the need for modifications during the environmental assessment process and subsequent project phases.
Provide a route that supports economic development	• Improve accessibility for local industries to regional and interstate markets. • Improve access to local and regional centres of economic importance. • Minimise the impacts on business/service facilities dependent on Pacific Highway traffic. • Provide flood immunity on at least one carriageway between 1% Annual Exceedance Probability (AEP) (target) and 20% AEP (absolute minimum).
Manage the upgrading of the route in accordance with ecologically sustainable development principles.	• A route which is designed to minimise emissions during construction and operation. • A route which is designed considering the potential impacts of climate change. • A route which avoids areas of high conservation significance wherever possible rather than proposing mitigation measures. • A route which is designed for future traffic demands. • Minimises the effects on sensitive habitats and native vegetation to ensure conservation of biological diversity.
Provide the best value for money.	• Ensure the project outcomes achieve value for money.

These objectives, which were central to the route selection process, have continued to guide the concept design.

3 Community and stakeholder involvement

3.1.1 Planning and design process

Since the announcement of the project in October 2004, a comprehensive community consultation program has been implemented and is described in detail within the *F3 Freeway to Raymond Terrace Preferred Route Option Report* (RTA, August 2006). Community involvement activities conducted in the lead up to and during the development of the concept design are summarised in Table 3.1.

3.1.2 Post-selection process and activities

The next stage of the overall process is to further develop the concept design and undertake environmental impact assessment of the preferred route. Environmental assessment (EA) is required in accordance with Part 3A of the Environmental Protection and Assessment Act (EP&A Act) when the next stage of the project commences.

Table 3.1 Summary of consultation

Meeting	Date	Key Discussion Points
Community information tools		
1800 Project information line	Ongoing	A 1800 (toll free) project information line was established in October 2004 with 169 calls recorded by February 2008.
CLG	Ongoing	A Community Liaison Group (CLG) was established in early December 2004.
Project website	Ongoing	A project website was established in November 2004 and has been progressively updated.
Community update 1	November 2004	Announcement and introduction of the project, including an overview of the project development process and an invitation for nominations to participate in the CLG.
Community update 2	Friday 21 October 2005	Provided a summary of the outcomes of the route options Development process.
Community update 3	Wednesday 30 August 2006	Announcement of the preferred route.
Community information sessions		
CIS1	Monday 15 November 2004	This information session was held to introduce the study team to the community and provide more information about the project. The community was provided with the opportunity to give feedback on any issues or suggestions about the proposed upgrade.
CIS2	Tuesday 28 February 2006	Community briefing meeting with Option B community group.
CIS3	Wednesday 27 September 2006	Tarro/Beresfield/Hexham community forum – update on preferred route outcome.
Community Liaison Group		
CLG1	Monday 13	To formalise the establishment of the CLG, agree ground

Meeting	Date	Key Discussion Points
	December 2004	rules ’and provide an overview of the project development process and key constraints and opportunities within the study area.
CLG2	Tuesday 18 January 2005	CLG meeting No.2 involved a bus tour of the study area so that members could gain a more thorough understanding of the key attributes and physical conditions within the study area.
CLG3	Tuesday 1 February 2005	This involved a workshop and provided the CLG members with an opportunity to generate route options on aerial base and constraint plans, as a follow up to the study tour.
CLG4	Monday 13 June 2005	Update on the route options development process and to present the key constraints and issues being considered by the project team.
CLG5	Thursday 3 November 2005	Introduced the two feasible route options short-listed, explain the route options display and value management process, and the next steps toward the selection of the preferred route.
CLG6	Tuesday 17 January 2006	Update on the route options development and value management process.
CLG7	Thursday 7 September 2006	Presentation of the preferred route.
CLG8	Thursday 26 April 2007	Update on concept design process.
Community displays		
Route options display	Friday 21 October 2005 to Friday 2 December 2005	The route options display held between Friday 21 October 2005 and Friday 2 December 2005.
Preferred route display	Wednesday 30 August 2006 to Friday 13 October 2006	The preferred route display was held between Wednesday 30 August 2006 and Friday 13 October 2006.
Meetings with Stakeholders and Landowners		
Landowner meetings	Ongoing	A series of landowner interviews were conducted on site by the RTA and Maunsell representatives to obtain their preference and individual issues during the project familiarisation and route options development phases of project development.
Stakeholder meetings	Ongoing	Ongoing liaison in the form of email exchange, telephone discussions, meetings and workshops continue with a range of government agencies, local councils, utility providers and other interest groups.
Hunter Water		
Stakeholder meetings	Thursday 1 December 2005	RTA meeting with Hunter Water Corporation to discuss issues at Tomago Sand Beds and the modified Option B3.
Stakeholder	Thursday 23 Feb	RTA meeting with Hunter Water Corporation to further

Meeting	Date	Key Discussion Points
meetings	2006	discuss issues at Tomago Sand Beds and the modified Option B3.
Stakeholder meetings	Thursday 13 September 2007	Maunsell meeting with Hunter Water Corporation to discuss issues at Tomago Sand Beds, in particular strategies for catching, treatment and discharge of run-off and spills.

3.1.3 Feedback on the preferred route option display

The preferred route was made available for public submissions from Wednesday 30 August 2006 to Friday 13 October 2006. The approach to consultation included:

- Seven display locations in and around the study area;
  - On Friday 8 September and Saturday 9 September, members of the project team staffed selected displays;
- Five broad groups were advised of the preferred route by letter:
  - Directly affected property owners;
  - Property owners in the vicinity of the study corridor;
  - Property owners no longer affected by the study corridor;
  - Members of the Community Liaison Group (CLG);
  - Other parties that have registered an interest in the project.

Directly affected property owners were contacted by telephone to follow up the letter and to offer a meeting with the project team. Individual meetings were arranged to further discuss specific issues and these were conducted by the project team at various locations, including potentially affected property locations, the RTA's Hunter Office and Maunsell's Sydney office.

All submissions received by Maunsell and the RTA have been considered during the further development of the concept design and the responses will be provided within a submissions report when feedback on the concept design is complete.

3.1.4 How the community provided input into the concept design

Throughout the consideration of the options and development of the concept design, community issues, concerns and suggestions were considered and appropriately incorporated and addressed. The community has provided valuable local knowledge that has helped to guide investigations and develop the concept design. Table 3.2 outlines the areas of interest to the community as identified since the announcement of the preferred route and the way in which the concept design responds to these issues. Further explanation of some of these issues is contained in Chapters 4 and 5.

Table 3.2 Community feedback on the preferred route and influence on the concept design

Submission issue	Response in concept design
Flooding behaviour and drainage issues	Road levels and flood openings have been reviewed in the light of local knowledge of flooding patterns.
Flood emergency responses for people and stock	Northbound carriageway above 5% AEP flood event. Sufficient stock accesses provided to provide safe egress during flood events.

Submission issue	Response in concept design
An understanding of Indigenous heritage and culture in the area	Road corridor footprint minimised in sensitive areas.
The potential presence and location of threatened flora and fauna species	Footprint minimised and alignment adjusted to avoid key habitat areas.
Local road networks and access issues, including public transport operations	Local of interchange ramps selected to suit major local traffic movements and public transport needs, in particular future access to airport.
Emergency services operations	Provision for clear zones and emergency access for fire fighting, particularly near Botanic Gardens.
Suitable interchange locations	Interchange ramp locations positioned to permit easy access into Heatherbrae and for Tomago industrial area.
Interchange at Tomago Road – requested to access the industrial area.	This interchange has been incorporated into the concept design.
Interchange with the New England Highway – requested to provide further accessibility.	The possibility for an interchange in this location was investigated; however, it was discounted on engineering and cost grounds, but the interchange configurations selected have provided the same functionality.
Weathertex factory - minimise disturbance to bore fields and irrigation areas to avoid closure of the factory, and to minimise the footprint on land with potential for industrial development.	The alignment has been altered in order to minimise disturbance to the Weathertex operations.
Tomago Special Area – avoid key bore lines.	The alignment has been altered to avoid key bore lines.
Botanic Gardens – minimise encroachment into gardens.	In the vicinity of the gardens the highway is on an elevated structure crossing the existing highway. This has minimised encroachment at this pinch point.
Hexham swamp – minimise disturbance.	The road alignment and the location of flood relief structures has been selected to minimise the environmental impacts on Hexham Swamp.
Interchange layouts at Black Hill and Tomago.	The interchange layout at Black Hill has been designed for all traffic movements, but arranged to minimise the footprint in this sensitive area.

4 Characteristics of the study area and factors in the development of the concept design

The study area is made up of a mixture of urban and rural vegetation environments. Key areas include Heatherbrae, Black Hill, Hunter Valley Botanic Gardens and areas of wetland along the Hexham swamp and the Hunter River.

Significant characteristics and key attributes within the study area have influenced the process throughout and have been incorporated into the selection process of the preferred route and the subsequent refinement of the concept design. These characteristics and attributes have already been described in detail in the *F3 Freeway to Raymond Terrace Route Options Development Report*, (RTA, October 2005) and the *Preferred Route Report* (RTA, August 2006). Below are the main area characteristics that have influenced the development of the concept design.

4.1 Economic issues

The Pacific Highway is the principal coastal transport corridor connecting Sydney to Brisbane. The highway is used to carry freight as well as tourists and commuters.

A highway upgrade project which results in the bypassing of urban areas or townships where some businesses have a high reliance on trade generated from highway traffic, can have a significant impact on businesses. The concept design aims to minimise the impacts of the re-alignment of the highway on the Heatherbrae businesses through the configuration of the entry and exit ramps on either side of the town. The ramps would allow easy access to and from the town for traffic using the highway.

The road user benefits arising from the construction of the upgrade are significant in terms of travel time and vehicle operating cost savings, both of which are minimised by the flat grades of the upgrade and the reduction of traffic congestion over significant lengths of the route. The potential reduction in traffic accidents through reducing the conflict points for through traffic is a further significant economic benefit .

4.2 Planning and land use

4.2.1 Water catchment and SEPP 14 wetlands

A portion of the eastern section of the study area is Hunter Water Corporation freehold land, located within the Tomago Special Area boundary. The concept design has included measures to ensure continued operation of the borefields by avoiding key borelines and by included measures to control run-off and potential spills.

A total of six SEPP 14 wetlands are located within the study area. The location and importance of these wetlands was understood at the route selection stage and the preferred route was selected to minimise impacts. At the concept design stage further refinement has resulted in minimising of the road footprint and adjustment of alignment to maximise distance to critical areas.

4.3 Biophysical characteristics

4.3.1 Topography, geology and soils

The route is largely across the Hunter River floodplain, and the topography is relatively flat. Only one significant hill, at the Black Hill end of the project, will provide the fill material for

embankment construction across the floodplains. The alignment has been designed to minimise the fill required.

The geology of the floodplain includes significant depth of soft soils. The impact on the concept design is to have deep foundations for structures and the requirement for ground treatment to control settlement of the embankments and to minimise the risk of embankment failure during construction. The expected embankment settlements will also control the selection of pavement types.

The alluvial deposits of the Hunter River floodplain are classified as high probability for Acid Sulfate Soils (ASS). ASS include Actual Acid Sulfate Soils (AASS), where the soil pH is below four and/or Potential Acid Sulfate Soils (PASS), which may form AASS when drained or exposed to the atmosphere. This has influenced the concept design by avoiding excavation in the susceptible materials. The drainage strategy adopted has been treat run-off in bunded areas before slowly discharging into the surrounding watercourses.

4.3.2 Flooding and drainage

Landform across the study area is dominated by the Hunter River floodplain which covers approximately 1406 hectares (65 per cent) of the study area. The concept design provides the appropriate level of flood immunity, in accordance with the Pacific Highway Route Strategy that as a minimum, one carriageway of the upgrade would provide immunity from a 1 in 20 year Average Recurance Interval (ARI) flood event.

4.3.3 Water quality

The Hunter River is a disturbed ecosystem receiving agricultural and urban runoff. It has elevated levels of nutrients and high turbidity. However, the wetlands are particularly sensitive to sediment and pollutants such as oil and changes to pH. In order to minimise impacts on water quality, arising from soil disturbance and stormwater pollutants entering the Hunter River, its tributaries and wetlands, the concept design includes surface water treatment devices within the footprint of the road alignment (refer Section 5.14).

4.3.4 Ground water resources

The Tomago Special Area encompasses the Tomago Sand Beds, which form part of the sensitive water supply catchment for Newcastle and the Lower Hunter. The concept design protects this feature through minimising the project's footprint encroaching in the area and ensuring that road run-off is captured and treated in lined sedimentation ponds before slow discharge into the sand beds downstream of the borelines. The alignment is generally on low embankments through the Tomago Sand Beds with no excavations below or near the water table.

4.3.5 Terrestrial ecology

Where possible the concept design has aimed to minimise encroachment on areas of significant terrestrial ecology, this is achieved through:

- Road alignment designed to minimise impact on remnant block of native vegetation located at Black Hill in the western part of the study area;
- Adjustment of road alignment to skirt edge of Tomago Sand Beds;
- Avoiding major nature reserves such as Hexham Swamp
- Bridging rivers and significant wetlands.

4.3.6 Aquatic ecology

Two threatened aquatic ecological communities of coastal saltmarsh and freshwater wetland complex are located on the floodplain areas, along the Hunter River corridor and/or on the western edge of the Tomago Sand Beds in the study area. The concept design aims to minimse impacts by the selection of an alignment that avoids significant areas.

4.3.7 Existing infrastructure

Infrastructure within the study area includes the Main Northern Railway, Chichester trunk gravitation water main, water and sewer, high and low voltage overhead powerlines, gas and telecommunication infrastructure. All major infrastructure and utilities have influenced the development of the concept design.

The Main Northern Railway is crossed by structure as part of the main Hunter River crossing.

The road alignment near Black Hill avoids the Chichester pipeline in this area, and the pipeline is crossed by structure at Purgatory Creek.

The horizontal and vertical alignments have been selected to avoid the need for modifications to the major 330kV transmission line. Other utilities have been avoided by a combination of alignment and the location of structures.

4.4 Cultural and social features and issues

4.4.1 Indigenous heritage

The importance of the indigenous heritage has been recognised and investigations carried out have been outlined in the previous reports. The road alignment in the sensitive Black Hill area has been revised to minimise the road corridor footprint.

Additional sub-surface investigations are proposed at Black Hill, these will be carried out as part of the environmental assessment.

4.4.2 Noise and vibration

The consideration has been given to noise and vibration throughout the development of the project, including in the assessment between different route options. Road traffic noise criteria in NSW are based on guidance in the Department of Environment and Conservation's (DEC's) *Environmental Criteria for Road Traffic Noise* (1999).

The preferred route was selected to be as far from residential areas as possible, thus minimising noise and vibration impacts. The full assessment and development of mitigation features will be undertaken as part of the environmental assessment.

4.4.3 Urban design, landscape and visual amenity

The existing traffic route also passes through this landscape affording traveller views of the floodplain and river corridor. The *Pacific Highway Urban Design Framework – urban design guidelines for the SH10 from Hexham to Tweed Heads* (RTA) notes the importance of views to the Hunter River. The concept design has considered the importance of this view and would maintain it through sensitive landscaping.

The concept design for the preferred route is described in Section 5.

5 Preferred route preliminary concept design

5.1 General description of the preferred route

This section describes the concept design for the preferred route. The route was refined as a result of community consultation during and after the selection of the preferred route. Further refinement of the route has occurred during the latest development of the concept design, in particular determination of the location and configuration of the interchange ramps giving access to the highway.

The concept design of the preferred route is shown in Figure 5.1. The route was previously shown as a 150 metre wide corridor to allow for fine tuning of the alignment, to provide for interchanges, and to accommodate other facilities such as surface water treatment ponds, construction compounds, batching plant facilities and access roads. The concept design route corridor has been optimised to where possible reduce its width. At pinch points, such as near the Botanic Gardens, the width is significantly less than the previous 150 metres wide corridor.

The concept design layout drawings (Figures A.1 to A.13) are attached in Appendix A.

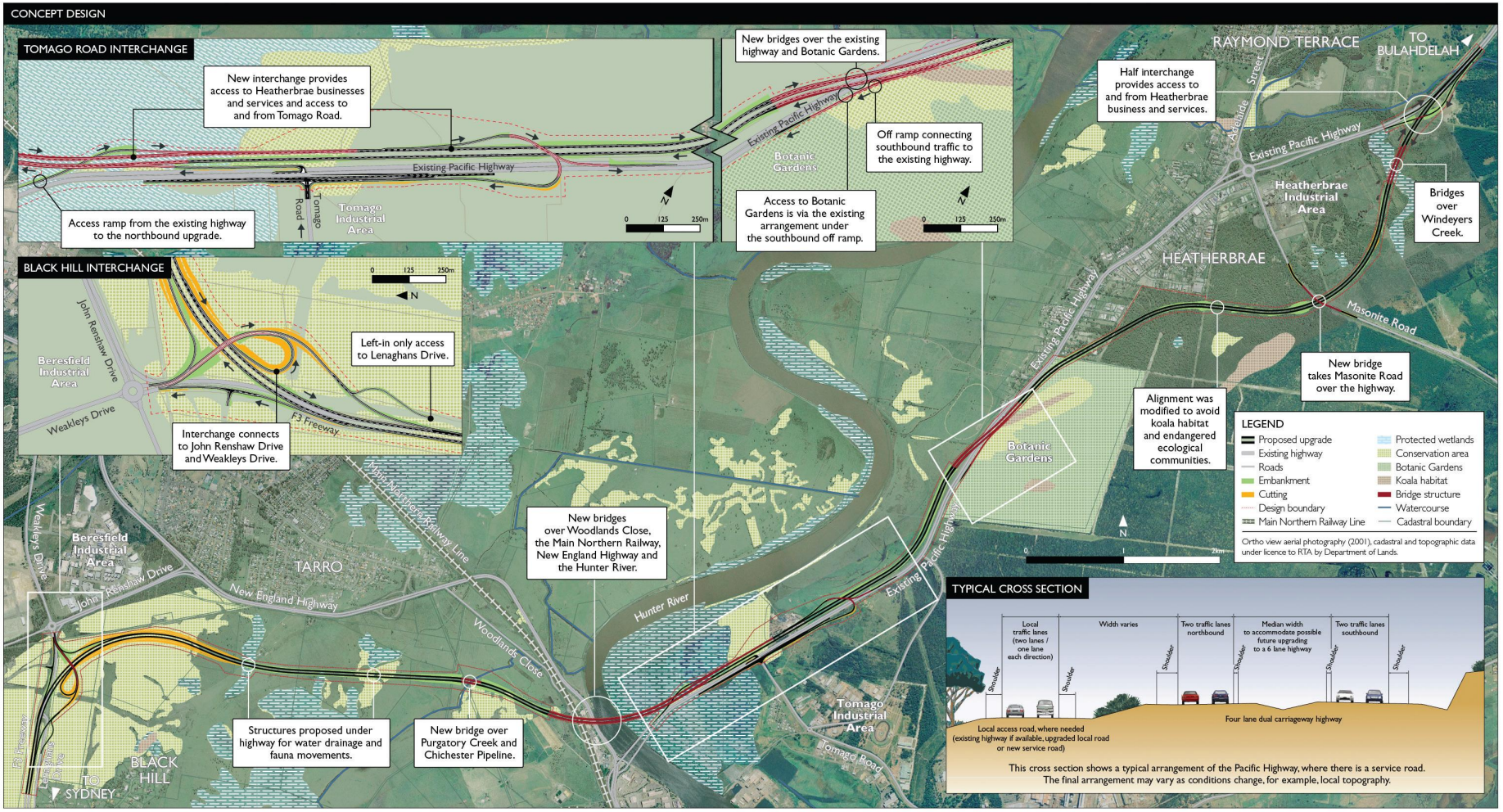
The alignment of the route closely follows the alignment as described in the *F3 Freeway to Raymond Terrace Preferred Route Report* (RTA, August 2006). There have only been slight changes to the alignment during the development of the concept design.

The western section of the route alignment commences with a full interchange at the F3 Freeway south of John Renshaw Drive roundabout, before crossing through an area of native vegetation at Black Hill. This section passes close to the Chichester trunk gravitation water main and the Glenrowan homestead.

The route then heads in a south-easterly direction, crosses under the 330 kV transmission lines, then passes through some communities of Swamp Oak Floodplain Forest. The route crosses the New England Highway at Hexham, not far from the existing bridges, and requires a long bridge structure to cross Woodlands Close, the Main Northern Railway line, New England Highway and the Hunter River. North of the Hunter River the route closely follows the alignment of the existing highway.

South of Heatherbrae the route crosses the existing Pacific Highway near the Hunter Region Botanic Gardens and then skirts to the east of Heatherbrae, passing across the northern edge of the Tomago Sand Beds. The alignment is crossed by Masonite Road, avoids the Weathertex factory and passes across land proposed for future industrial development, before joining the existing highway north of Windeyers Creek.

Figure 5.1 Concept design of the preferred route



5.2 Functional elements of the preferred route

5.2.1 Main carriageway

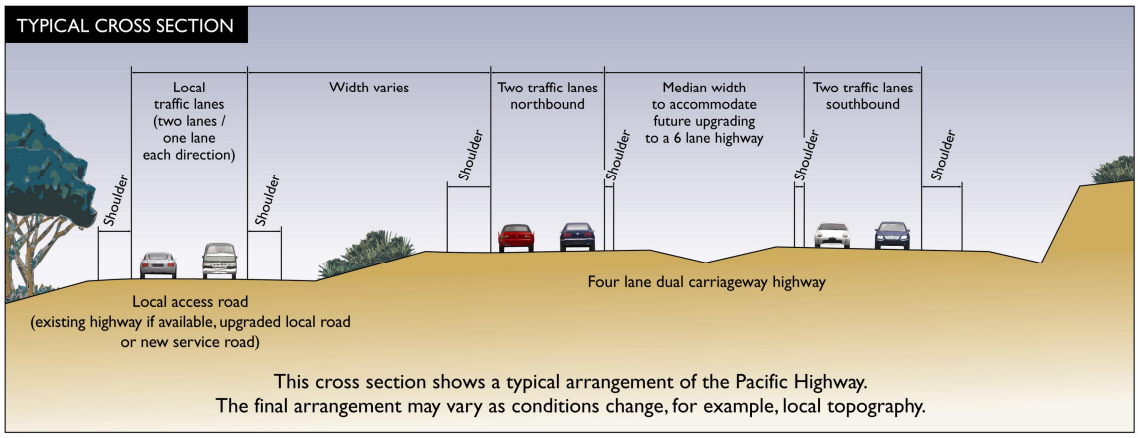
The preferred route would be constructed to provide dual carriageways having two traffic lanes in each direction with a provision to upgrade to three lanes each direction in the future. The future third lane would be constructed in the central median.

The pavement areas on each carriageway would comprise two 3.5 metre wide traffic lanes and a 2.5 metre wide outer shoulder. Additional widths would be provided for verges and these would be dependent on batter configurations.

A typical arrangement for a cross section of the Pacific Highway is shown in Figure 5.2.

The final arrangement would vary along the preferred alignment route, being dependent on study area characteristics, such as local access road provisions and topographical variations.

Figure 5.2 Typical cross section



The preferred route alignment would be in cut, fill, at grade or elevated on structure along its length depending on:

- Local variations in topography;
- RTA engineering design standards for highways;
- The need to raise the road level above the 1 in 20 year ARI design flood event.

5.2.2 Access

The project would be constructed to M Class 'standard which would entail controlled access along the full length of the upgrade route. Configurations would be generally as follows:

- Access to the main carriageway would be limited to interchanges;
- Access to local roads would be maintained by the provision of service roads, construction of overpasses and adjustments to individual property access if required;
- Temporary access arrangements may be required as part of specific construction staging works.

The existing road network would remain and access to townships such as Heatherbrae, Tarro and Beresfield, would be maintained.

5.2.3 Overpasses

To maintain local connectivity, overpass structures would be utilised at interchange or potential cross over locations. These would occur near the F3 Freeway, near Tomago and the Hunter Region Botanic Gardens and at the tie in to the Raymond Terrace bypass.

5.3 Road alignment and cross-sections

5.3.1 Alignment

The highway would be constructed to provide dual carriageways having two lanes in each direction, with a provision to upgrade to three lanes in the future.

The main carriageways would have a design speed of 110 km/hr for the horizontal alignment and 100 km/hr for the vertical alignment. The reduced design speed for the vertical alignment is to minimise the height of embankments over areas of soft ground.

Curve widening on structures would be provided where necessary to meet the sight distance requirements for the future lane configurations.

5.3.2 Cross-section –Future highway

The lane configuration for each carriageway comprises two 3.5 m wide traffic lanes, a 2.5 m outer shoulder, and a 1.0 m inner shoulder.

Future widening would be allowed for by construction of lanes within the median. The initial median width would generally be 15.0 m.

Based on geotechnical advice, cut slopes would have a maximum slope of 1:2 (vertical to horizontal), with horizontal benches at intervals not exceeding 6 m vertical separation.

Embankment fill slopes would not be steeper than 1:2 (vertical to horizontal), but because of the generally soft ground, the embankments would be widened and the batters flattened across the flood plain areas in order to increase the embankment stability and allow for increased surcharge during construction.

An additional width of carriageway to provide a width between kerbs of 11.5 m on major bridges would be provided so that future road widening would not require structural widening for long bridges. The distance between bridges could thus be reduced in some instances (e.g. near the Botanic Gardens) in order to minimise the encroachment upon sensitive areas.

5.3.3 Cross-section –Existing highway

The existing highway would be maintained for local access. No further reconstruction or re-alignment of the existing highway is required, as it is currently dual carriageway over the full length of the project.

5.3.4 Cross-section –Interchange ramps

Interchange ramps would generally comprise one 3.5 m wide traffic lane, a 2.5 m outer shoulder, and a 1.0 m inner shoulder.

Traffic figures indicate that the two ramps of the Black Hill interchange linking to the existing F3 Freeway are required to be of two traffic lanes each.

5.3.5 Cross-section –Local roads

The only local road crossing the route which would require re-alignment is Masonite Road, which would be maintained near its current horizontal alignment and within current road

reserve boundaries. It would be re-aligned vertically to cross over the upgrade alignment. Two 3.5 m wide traffic lanes and 2.5 m shoulders would be provided.

The new Pacific Highway would cross over Woodlands Close, but no change to the alignment of Woodlands Close would be required.

5.4 Interchanges and intersections

5.4.1 Black Hill interchange

A full interchange would be provided at Black Hill, near where the current F3 Freeway joins the Weakleys Drive / John Renshaw Drive roundabout. The potential ramp configurations are shown in Figure 5.1.

The main F3 carriageways would become the new Pacific Highway route.

Ramps would be provided as follows:

- Northbound exit ramp of two traffic lanes from F3 Freeway to Weakleys Drive. This ramp follows closely the alignment of the existing F3 Freeway in the vicinity of Weakleys Drive;
- Southbound entry ramp of two traffic lanes, from Weakleys Drive roundabout, crossing over the new Pacific Highway, and joining the F3 Freeway in the vicinity of Lenaghans Drive;
- Northbound entry ramp of one traffic lane, from Weakleys Drive to join the new Pacific Highway.
- Southbound exit ramp from new Pacific Highway to Weakleys Drive. This ramp would be of one traffic lane, and would have a reduced design speed of 60 km/hr.

The alignment of the southbound exit at ramp has been designed having a loop in order to reduce the required land take for the interchange in the sensitive Black Hill area. In addition, the loop in the southbound exit ramp would assist in slowing the traffic prior to entering the Weakleys Drive roundabout.

The access to the existing Boral (Rio Tinto) site Black Hill would be restricted to left-in and left-out only from the northbound exit ramp. Access to the site from the north would require vehicles to travel along Lenaghans Drive to the existing Blackhill Road interchange bridge. When any redevelopment occurs on the Boral site (which could possibly occur before the project) then additional accesses would be required from and to John Renshaw Drive.

Access to Lenaghans Drive is provided by a left-in only from the southbound entry ramp. This is a similar entry arrangement to the existing interchange. The current exit from Lenaghans Drive to F3 southbound, however, would not be provided because this entry point would be too close to the ramp merge with the F3. Southbound traffic would need to follow Lenaghans Drive to Minmi, but this is considered acceptable as the road is of a high standard.

The free left turn from John Renshaw Drive to F3 entry ramps would be deleted. There is insufficient space to retain the ramp as currently configured.

The existing Weakleys Drive / John Renshaw Drive roundabout may require upgrading prior to construction of the project. This design for such an upgrading is not part of this project.

5.4.2 Tomago and Heatherbrae South interchange

The interchange concepts as indicated in the *F3 Freeway to Raymond Terrace Preferred Route Report* (RTA, August 2006):

- Provide a link to the upgraded Pacific Highway near the Hunter River;
- Allow easy access to Heatherbrae by providing half interchanges to both the north and south of the town;
- Allow for a possible future interchange at Tomago Road;
- Retain the existing Pacific Highway for local traffic.

Design development has highlighted a number of issues which influence the interchange configurations:

- The relatively short distance from the Hunter River to Heatherbrae effectively requires that this area (Hexham/Tomago/Heathbrae South) be treated as a single interchange;
- Flooding issues between Hunter River and Tomago Road would require that at least one carriageway be on structure over this length;
- The interchange between two parallel roads (new Pacific Highway and existing Pacific Highway) would generally require either significant long, skewed bridges or complex and inefficient traffic movements.

Many interchange configurations have been investigated. The most efficient configuration from both traffic and cost considerations involves a single exit and entry ramp in each of the northbound and southbound directions, located between the Hunter River and Heatherbrae.

Northbound traffic from Newcastle would enter the upgraded Pacific Highway via a ramp immediately to the north of the existing Hexham Bridge. The ramp would pass beneath the bridges carrying the upgraded highway over the Hunter River.

Northbound traffic would exit the upgraded Pacific Highway via a ramp in the vicinity of Tomago Road. The ramp would split, with one branch taking northbound traffic to Heatherbrae, and one branch looping back and crossing the existing highway to allow traffic to exit to Tomago Road.

Southbound traffic would enter the upgraded Pacific Highway at Tomago Road. This location of this entry ramp permits Tomago traffic to access the highway, as well as providing easy access to the highway for southbound traffic which has used Heatherbrae as a service town.

Southbound traffic would exit the highway just to the south of Heatherbrae. The location of this exit permits traffic from the north to access Newcastle and Tomago Road without the need to travel through Heatherbrae.

The ramps configurations provided also allow the most efficient movements to and from the New England Highway in both directions. Additional ramps connecting with the New England Highway at Hexham would be difficult to achieve because of the limited space and close proximity of the railway and river. Those ramps are not required because the functionality has been provided by the Tomago and Black Hill interchanges.

5.4.3 Heatherbrae North

To the north of Heatherbrae the Upgrade Pacific Highway would join the Raymond Terrace Bypass just to the north of Windeyers Creek. A half interchange would permit traffic from the north to either follow the upgrade towards F3 or to enter Heatherbrae. The reverse traffic movement would also be permitted, namely northbound traffic from Heatherbrae can join the Pacific Highway by following the existing highway.

5.5 Strategic Traffic issues

The project would divert traffic from the existing Pacific Highway and New England Highway, leading to improved conditions on the existing route for local trips and a reduction in crash rates.

Access to and from the Beresfield Highway Service Centre would be provided from the western interchange at Black Hill. Traffic would leave and return to the motorway via the same interchange location.

Heatherbrae businesses would continue to service passing trade. To visit Heatherbrae, traffic travelling northbound would leave the motorway west of Heatherbrae, pass through the town and rejoin the motorway at the Raymond Terrace bypass interchange. Southbound traffic would effectively take the reverse order of interchanges.

5.6 Local access

The upgrade would have controlled access for the full length of the route, with access points at interchanges only.

The existing Pacific Highway would continue to provide local road connections for all modes of transport. Underpasses and overpasses of the upgrade would be provided where necessary to permit access to the existing road system. Bus services in the area would not be affected.

Access to the Botanic Gardens would be maintained. The southbound exit ramp from the motorway would cross above the entry, permitting access from the existing highway as at present.

Access to the community of Black Hill is maintained from Leneghans Drive. The access from Leneghans Drive to the southbound F3 Freeway is from Minmi Interchange.

5.7 Bridges and major structures

New bridges and culverts would be required to cross existing infrastructure and enable the passage of flood waters without adversely affecting water levels upstream. The following key structures would be required:

- New major structure over the Main Northern Railway, New England Highway and Hunter River approximately 1200 metres in length;
- Structure to elevate the northbound carriageway above the 1 in 20 year flood level across SEPP 14 wetland no. 830, located on the eastern side of the Hunter River approximately 700 metres in length. The southbound carriageway would be constructed at grade within the existing road reserve;
- A new bridge structure carrying Masonite Road over the new highway;
- New bridge structures over Windeyers Creek;
- New bridges at grade separated interchange locations;
- New bridge for the crossover structure to maintain the existing Pacific Highway connection;
- Bridges or culverts in the freshwater wetland area located adjacent to Black Hill;
- Bridges or culverts in the floodplain west of the Hunter River, to provide for passage of floodwaters. These culverts could also act as fauna underpasses, although where the route crosses farming land no specific fauna underpasses are required.

5.7.1 Design standards

Bridges would be designed to the requirements of AS5100, the Australian Bridge Design Code.

5.7.2 Bridge cross section

Major bridges would be built with a width of 11.5 m between kerbs, to allow for future carriageway widening, without a need for further widening of those structures.

5.7.3 Structural form of bridges

The major bridges of the Hunter River would be required to match the 10 m vertical and horizontal navigational clearance provided by the existing bridge. These bridges would also be required to provide a minimum vertical clearance over the rail of 7.1 metres, in accordance with Australian Rail Track Corporation requirements to allow double stacking of trains. The existing northbound Hexham Bridge has span lengths of 39 m, which provides a clear navigational width in excess of the 30 metres required.

Urban design would be an important factor in the selection of the final form of the bridges. An initial position is that:

- The span lengths would match the spans of the existing northbound bridge;
- Navigation spans would align as far as other design constraints permit; and
- A concrete box form of construction might be suitable.

5.8 Flood mitigation and drainage

As a minimum, one carriageway of the upgrade must target immunity from a 1 in 20 year ARI flood event. A numerical flood model was developed for the project and this indicates 1 in 20 year ARI flood levels within the study area varying between 2.2 metres AHD near Black Hill to 3.0 metres AHD near Heatherbrae. For immunity against a 1 in 100 year event, the flood model indicates levels varying between 3.8 and 4.5 metres AHD, but immunity from this event has been considered impractical due to:

- The requirement to import significant volumes of fill material for construction of the additional volume of embankment;
- Excessive settlement and instability of the embankment;
- Additional length of waterway area required to minimise potential impact on upstream water levels;
- Visual impact arising from excessive height of embankment or structure required across the floodplain.

To provide immunity from the 1 in 20 ARI flood levels, a combination of embankment, culverts and structure would be utilised. Sufficient waterway area would be provided to minimise impact on upstream water levels, control flood velocities and scour and minimise potential changes to inundation durations.

During flood events above the 1 in 20 year ARI, floodwaters breach the New England Highway embankment near the crossing of the Main Northern Railway, and a significant proportion of the floodwaters traverse the floodplain west of the Hunter River.

The main spans of the new structure over the existing constriction at the Hexham bridges would extend partially onto the western floodplain and several hundred metres of additional structure and/or culverts would be also be provided for the passage of floodwaters,

provision of local drainage and for fauna underpasses. The exact length and location of these structures is being determined by modelling the preferred route in the calibrated numerical model that has been developed for the project.

The location of the proposed new bridge crossing over the Hunter River is away from the natural bend in the River where geomorphologic change and scour are less likely to occur.

The existing Pacific Highway between the Hunter River and Tomago Road is overtopped during flood events greater than approximately the one in five year ARI and this area conveys a significant volume of floodwater during larger flood events. The southbound carriageway of the preferred route would be constructed to the level of the existing Pacific Highway in this area and would not impact on the existing flood regime. The northbound carriageway would be constructed on structure above SEPP 14 wetland no 830 and the 1 in 20 year ARI level.

East of Tomago Road the existing Pacific Highway is above the 1 in 20 year ARI and the upgrade would be constructed to a similar elevation on embankment.

Additional detailed modelling has been performed for the concept design in order to establish the required flood openings, particularly to the south of the Hunter River.

The effect of potential sea level rise arising from climatic change has been included in the flood modelling. Because the upgrade is sufficient distance from the entrance of the Hunter River to the sea, a potential rise of sea level of 500 mm does not affect estimated flood levels at the new bridge crossing or further upstream.

5.9 Utilities and services adjustments

A number of existing infrastructure items would be traversed by the preferred route alignment including:

- The Chichester trunk gravitation water main;
- High voltage overhead transmission lines (330 kV) (Transgrid) and (132 kV) (Energy Australia);
- Raymond Terrace trunk watermain;
- The Main Northern railway;
- The New England highway;
- Woodlands Close.

Hunter Water Corporation (HWC) plans to upgrade the section of Chichester trunk gravitation water main, which the route crosses near its crossing of Purgatory Creek. At this location the new pipeline is proposed to be at approximately the same level as the existing pipeline. A minimum clearance of one metre would be provided over the pipeline.

The high voltage overhead transmission lines (330 kV) (TransGrid) would be crossed at Black Hill and on the floodplain. The key objective would be to ensure adequate lateral offset and overhead clearance (minimum 12 metres). The route would also pass under a set of 132 kV transmission lines near the Hunter Region Botanic Gardens.

The Raymond Terrace trunk watermain consists of three parallel pipes that lead into Raymond Terrace from the bore lines within the Tomago Sand Beds. The preferred route alignment would pass over the pipeline in fill. Consultation to ensure adequate access for maintenance and future upgrade would need to be undertaken with HWC during detailed design.

The Main Northern Railway, New England Highway and Woodlands Close would be traversed in one structure incorporating the Hunter River crossing. The vertical clearances

required over the Main Northern Railway and New England Highway are 7.1 metres and 5.3 metres, respectively. A 30 metre clear span and 10 metre vertical clearance is required for navigation in the Hunter River.

5.10 Earthworks

The majority of the length of the route would be located on low embankment over flat flood plains. The only significant cut on the project is the large cut at Black Hill from where the route leaves the existing F3 Freeway alignment until the wetland near Glenrowan at Chainage 2700. Of the fill material, approximately 50% is required both north and south of the Hunter River. Haulage to the north of the river would be over parts of the existing highway, as construction of embankments over soft ground would be required as an early activity and before construction of the bridgeworks would be completed.

The vertical grading of the alignment has been designed to minimise the likelihood of requiring additional imported fill. This has been achieved by keeping the embankments as low as possible throughout the length of the project, consistent with the flooding requirements.

Additional fill would be required to compensate for major embankment settlements arising from the underlying soft soils. The drainage strategy is to have continuous bunds on either side of the embankments where possible, and additional fill would also be required for the construction of the bunds.

The earthworks quantities calculated for the current concept design alignment and grading show a slight surplus of cut material and so avoids requiring imported fill.

A summary of earthworks quantities is given in Table 5.1 below.

Table 5.1 Summary of earthwork quantities

Strip topsoil	85,000 m^3
Cut to unsuitable	52,000 m^3
Cut to fill (including berms, bunds, allowance for settlement)	998,000 m^3
Cut to spoil	102,000 m^3

5.11 Pavements

5.11.1 Subgrade

The basic subgrade conditions along the route are:

- Black Hill (to Ch 2600). The road is in cut in this section, but there is potential for mining subsidence;
- Purgatory Creek and Hexham Swamp Floodplains (Ch 2600 to Ch 5100). Extensive presence of soft soils, which are indicated to be to depths in excess of 40 m. Flood requirements require embankments of up to 3 m, so differential settlements expected even after ground treatment;
- Flood Plains East of Hunter River (Ch 7100 to Ch 9300). Underlain by soft soils, requiring ground treatment. Varying depth of soft ground within each cross section would increase the likelihood of differential settlements;
- Tomago Sand Beds (Ch 9800 to Ch 12600). Settlements are expected to be less than other locations because of lower heights of fill and the better subsurface conditions. There may, however, be some local inclusions of soft soils;

- Windeyers Creek (Ch 12600 to Ch 15000). There are soft soils present in the section, and settlements are expected.

The existing route is subject to inundation due to flooding above 5% annual exceedance probability. The design of the pavements would include consideration of ongoing use following saturation by flooding.

5.11.2 Suitable pavement

The investigation of the pavement designs considering whole of life costs has not yet been completed. A major factor is expected to be maintenance of the pavement to maintain the ride quality as a result of long term settlement of the soft soil subgrade. Pavements with the best results in these situations are either heavily bound pavements with an asphalt wearing surface, or a continuously reinforced concrete pavement (CRCP).

The long term deformations of the pavement are dependent on the earthworks construction methods and programme, and thus the final selection of the pavement details will be made in conjunction with the overall construction planning.

5.12 Lighting

The new Pacific Highway route between F3 Freeway and Raymond Terrace is a rural motorway and lighting would be limited to the interchanges. The extent of lighting in the vicinity of the Tomago Interchange will require careful consideration to ensure appropriate lighting levels are achieved where ramps are staggered and where the new upgrade runs adjacent to the existing highway.

The existing highway would be maintained with the current levels of lighting.

5.13 Landscaping and urban design

Consideration of urban design both for road users and the local community has informed the project at each stage. It is acknowledged, however, that no project of this nature would occur without an effect on the existing urban design, visual and landscape characteristics of the area.

The alignment would be in cutting through the vegetated area of Black Hill, minimising the visual and noise impacts for the surrounding residential areas, before emerging onto the vast expanse of the Hunter River floodplain. Flat batters of 1:4 (vertical to horizontal) or flatter would be utilised where embankment is constructed on the floodplain, to blend the upgrade with the flat topography and to satisfy the geotechnical considerations for construction over the soft soils.

Bridges and culverts for the passage of floodwaters over the floodplain west of the Hunter River would be designed to conform to the Pacific Highway Upgrade Program's urban design objectives (refer to section 5.2).

The new crossing of the Hunter River near the existing Hexham bridges would be highly visible and would require careful consideration in the form and geometry of the structure provided.

East of the Hunter River, the alignment parallels the existing highway, consolidating this infrastructure corridor. The use of landscaping would aid in separating the existing highway from the Upgrade while maintaining existing views across the floodplain and Hunter River.

Where the alignment traverses the northern edge of the Tomago Special Area behind Heatherbrae, revegetation would be undertaken to mitigate the potential impact on the Coastal Sand Apple Blackbutt Forest area.

Noise mounding and plant screening at the Hunter Region Botanic Gardens could also be considered. The noise environment of Heatherbrae would be improved with fewer traffic movements within the town.

5.14 Water quality mitigation measures

In order to minimise impacts on water quality, arising from stormwater pollutants entering the Hunter River, its tributaries and wetlands, the concept design includes water quality treatment measures.

Water quality treatment would be required during both the construction and operational phases of the project. During the construction phase, the key issue for water quality management would be erosion and sediment control resulting from soil disturbance. During the operational phase, the key issue would be the treatment of surface runoff from the highway to ensure that gross pollutants, fine sediments, nutrients and other contaminants including hydrocarbons and heavy metals do not exceed acceptable levels. The containment of potential spills from highway accidents is also a key issue during the operation.

The proposed water management strategy for the project will comprise the following:

- Maximise use of grassed swales parallel to the highway embankment to treat surface runoff from the roadway (primarily along the floodplain areas where surface grades are low to maximise filtration through the vegetation);
- Capturing and piping surface runoff from the roadway within sensitive environmental areas (such as the Tomago Sand Beds) and also from cuttings, bridge structures and exit/entry ramps, with discharge to storage treatment devices;
- Strategically locate the storage treatment devices where possible to enable use during both the construction and operational phases of the project.

Based on the above strategy, the proposed treatment measures will comprise a "treatment train "system consisting of one or a combination of the following:

- Grassed open drains/swales to convey surface water to provide natural water filtering which reduces the impacts of runoff pollutants and minimises sediment deposits and also provides some flow attenuation;
- Water quality ponds located at the outlet to natural watercourse to primarily reduce the impacts of runoff pollutants (such as suspended solids and nutrients) and also provide flood detention, as required.

From a preliminary assessment, a total of 17 water quality ponds will be required along the proposed route and within the footprint of the road alignment. The ponds would act as sedimentation basins during construction and permanent wet basins during operation. Where required, the basins (including drains/swales) will be earth lined to minimise sub-surface infiltration and therefore the risk of potential groundwater contamination, particularly within sensitive environmental areas (such as the wetlands and Tomago Sand Beds). The ponds will also act as containment storages of potential spills from highway accidents.

5.15 Property considerations

Property acquisition and the terms of agreement would be negotiated between the RTA and the individual land-owners in accordance with the *Land Acquisition (Just Terms Compensation) Act* 1991 and the RTA's *Land Acquisition Policy*. The acquisition can be either partial or total.

Property access adjustment would be required to a few properties to accommodate the project.

Property access adjustment plans are instigated in the detailed concept design stage and are finalised during final design. Tentative new property boundaries have been set based on the current concept design. These boundaries would be shown to the relevant land owners for comment, alteration and agreement in principal, before the final design stage.

5.16 Environmental controls and management

The following environmental mitigation measures may be required:

- Refinement of route and bridge location and design details to minimise impacts on flora and fauna communities and corridors;
- Use of bridges used to cross SEPP14 wetlands and to avoid koala habitat;
- Minimisation of the footprint in critical vegetation areas;
- Provision of erosion and sedimentation controls,
- Management of acid sulfate soils;
- Provision of water quality ponds where necessary to capture road pollutants and spills;
- Consideration of road geometry and infrastructure to minimise visual impact and complement the existing environment;
- Landscaping of the road corridor which is changed by construction or previous damaging works;
- Provision fauna fencing where required on the project;
- Provision of compensatory habitat, if required;
- Provision of noise attenuation where required by the use of low-noise pavement surfacing, noise barriers or structural methods;
- Implementation of construction controls to manage traffic, noise, vibration and air-quality impacts.

These environmental control measures and others, as identified and necessary would be developed during the environmental impact assessment (EIA). An Environmental Management Plan(s) would be developed which would include specific environmental data and performance criteria, management principles, implementation measures, monitoring requirements, corrective processes and auditing.

5.17 Potential construction methods

The project would generally be constructed using standard road building techniques. The standard road building techniques involve:

- Earthwork by ripping with bulldozers, material haulage by scrapers or trucks, spreading and compaction. Rock blasting could be investigated in locations where ripping is not possible or economic, however is unlikely due to the close proximity of houses. Earthworks haulage south of the Hunter River could be largely contained to the route corridor. Haulage on the existing highway would be kept to a minimum but would be required for transporting material from the Black Hill cut to embankment construction north of the river;
- Bridge construction with bored or driven piles and deck units for minor bridge structures;

- Bridge construction using precast segmental box girder for long viaduct structures over the Hunter River and adjacent floodplains, supported on deep bored pile foundations;
- Drainage construction using precast pipe culverts, reinforced concrete box sections, cast-in-situ concrete drains and open swale drains;
- Select subgrade placement and compaction using graders and rollers. The upper material layers could be improved with stabilising materials if required;
- Heavy-duty pavement construction is expected to be heavily bound or deep-lift asphalt;
- The majority of the works would be undertaken clear of traffic. Construction sequencing would be necessary at the crossover from the existing northbound carriageway at either end of the project to the existing southbound (to be northbound) carriageway through the central section of the project.

5.18 Staging

The construction of the works could conveniently be staged. The route crosses the existing Pacific Highway just to the south of Heatherbrae, and a temporary interchange at this location could permit construction of the route either side to be carried out separately. If the project is staged there is a slight earthworks imbalance for the northern section around Heatherbrae and some imported material would be required. The decision as to whether the project is staged would be dependent on factors such as funding.

6 Future development of the project

As discussed in section 1.1.2 the purpose of this report and the design development to date is to set the project's boundaries for inclusion in the relevant local environment plans and to provide greater certainty to the local community.

Following the display of the concept design, The Roads and Traffic Authority (RTA) will consider issues raised in any comments received. Once this process is finalised the relevant councils will be approached to have the corridor formally reserved in its local environmental plans. 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 on funding availability. Further refinements may occur during the environmental assessment stage of the project and in response to community comments.

7 References

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  B to I.
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Appendix A: Concept design layout drawings

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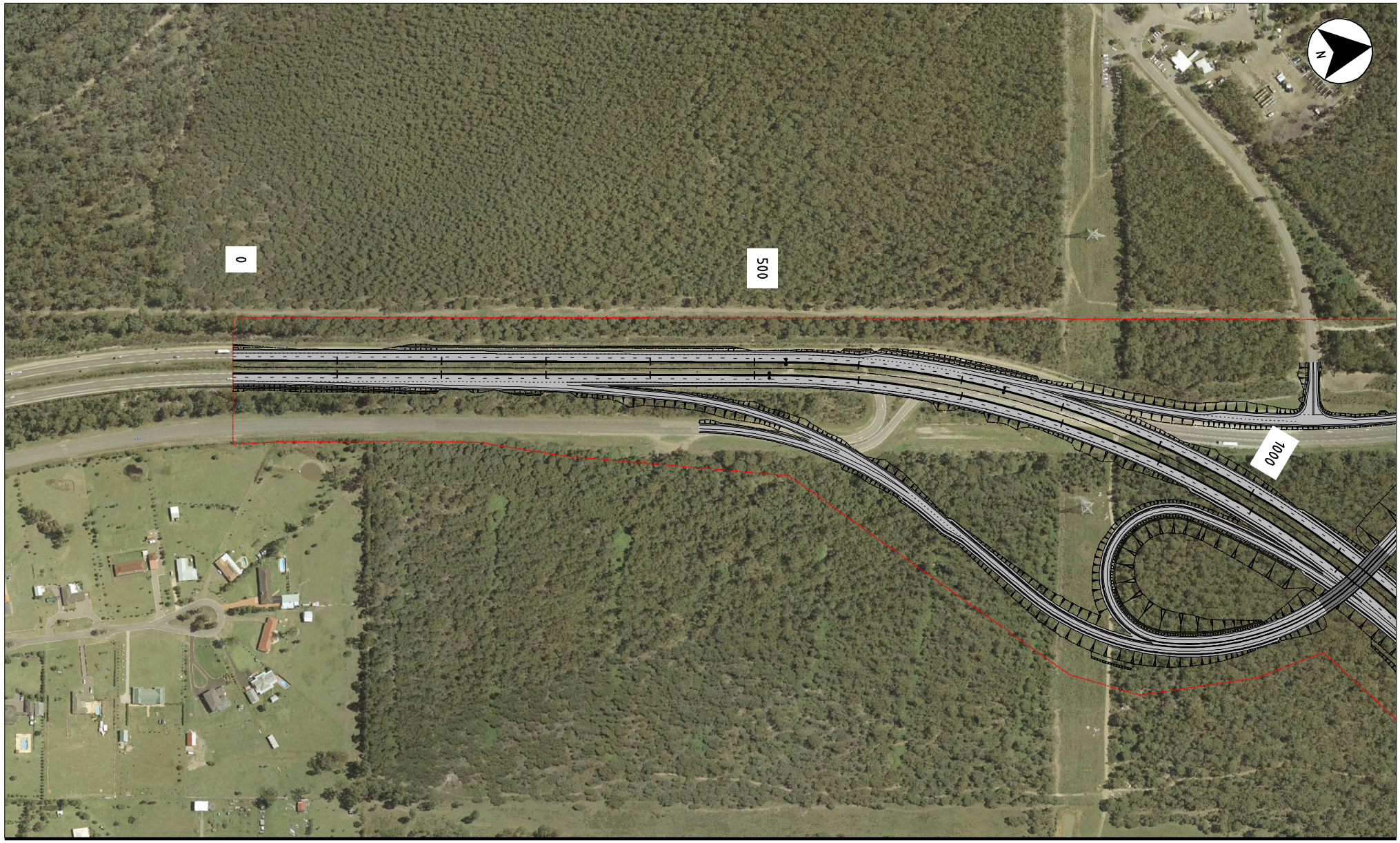

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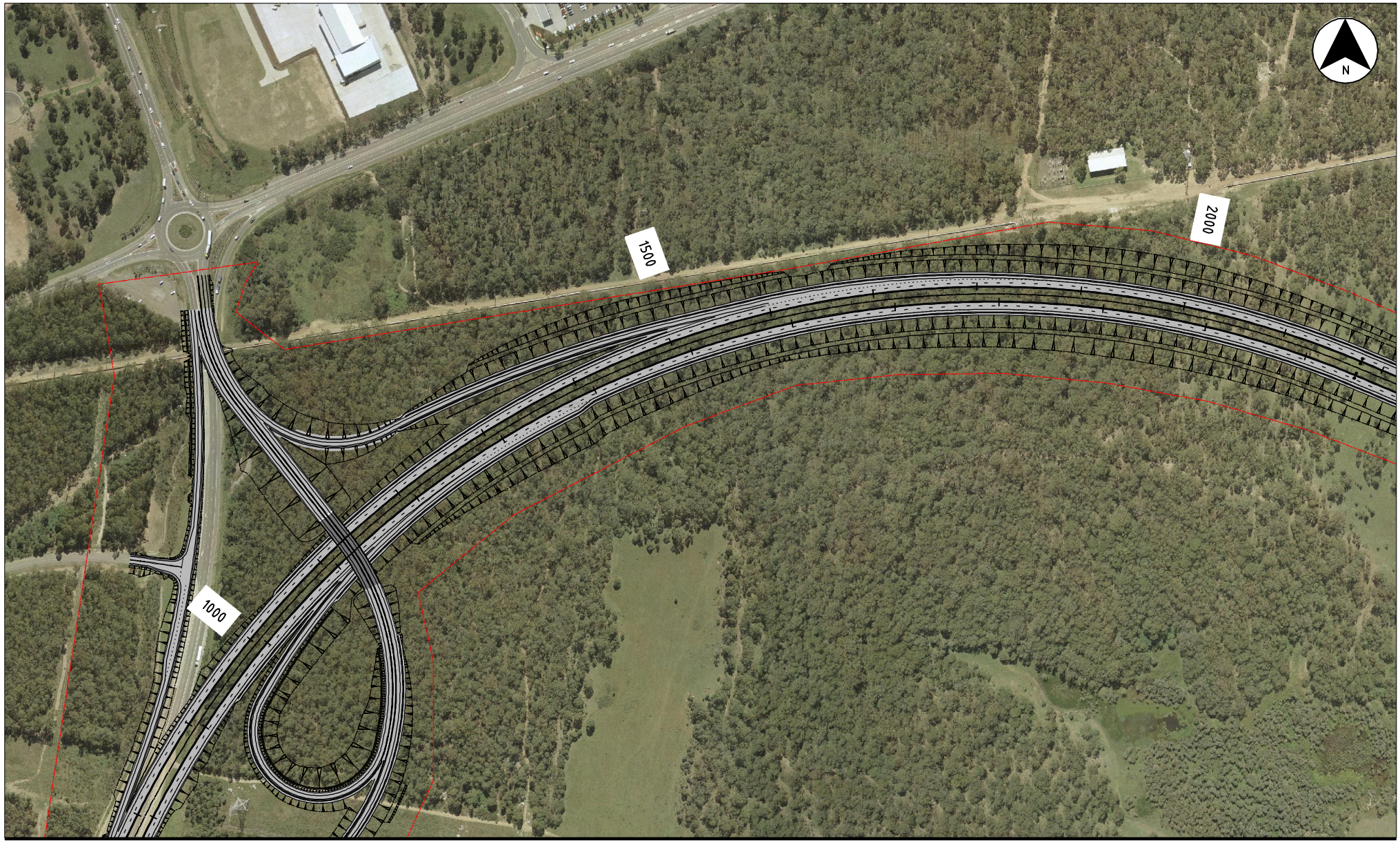
NSW ROADS AND TRAFFIC AUTHORITY
F3 TO RAYMOND TERRACE
CONCEPT DESIGN LAYOUT

Figure A.1

MAUNSELL | AECOM



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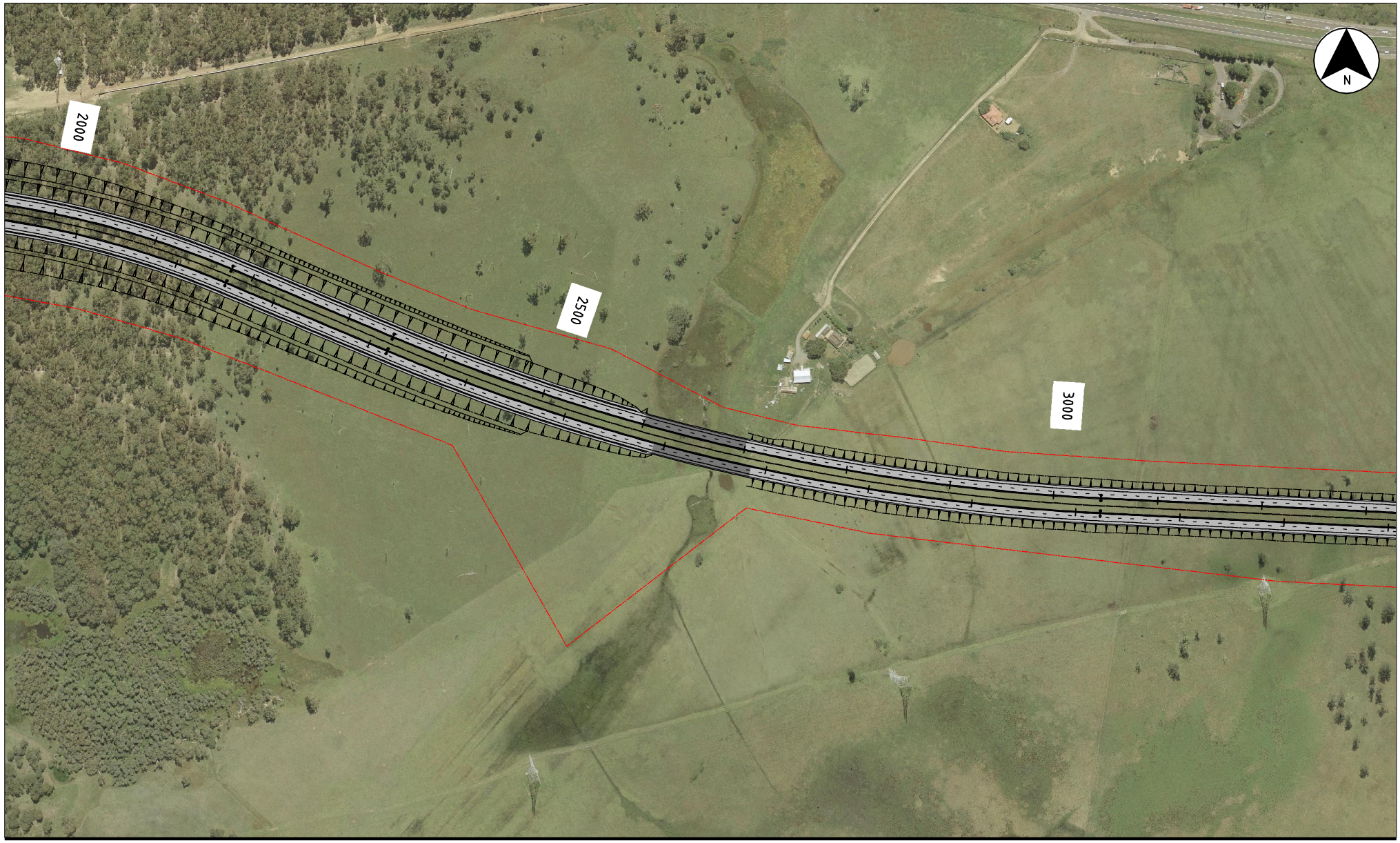
NSW ROADS AND TRAFFIC AUTHORITY

F3 TO RAYMOND TERRACE

CONCEPT DESIGN LAYOUT

Figure A.2



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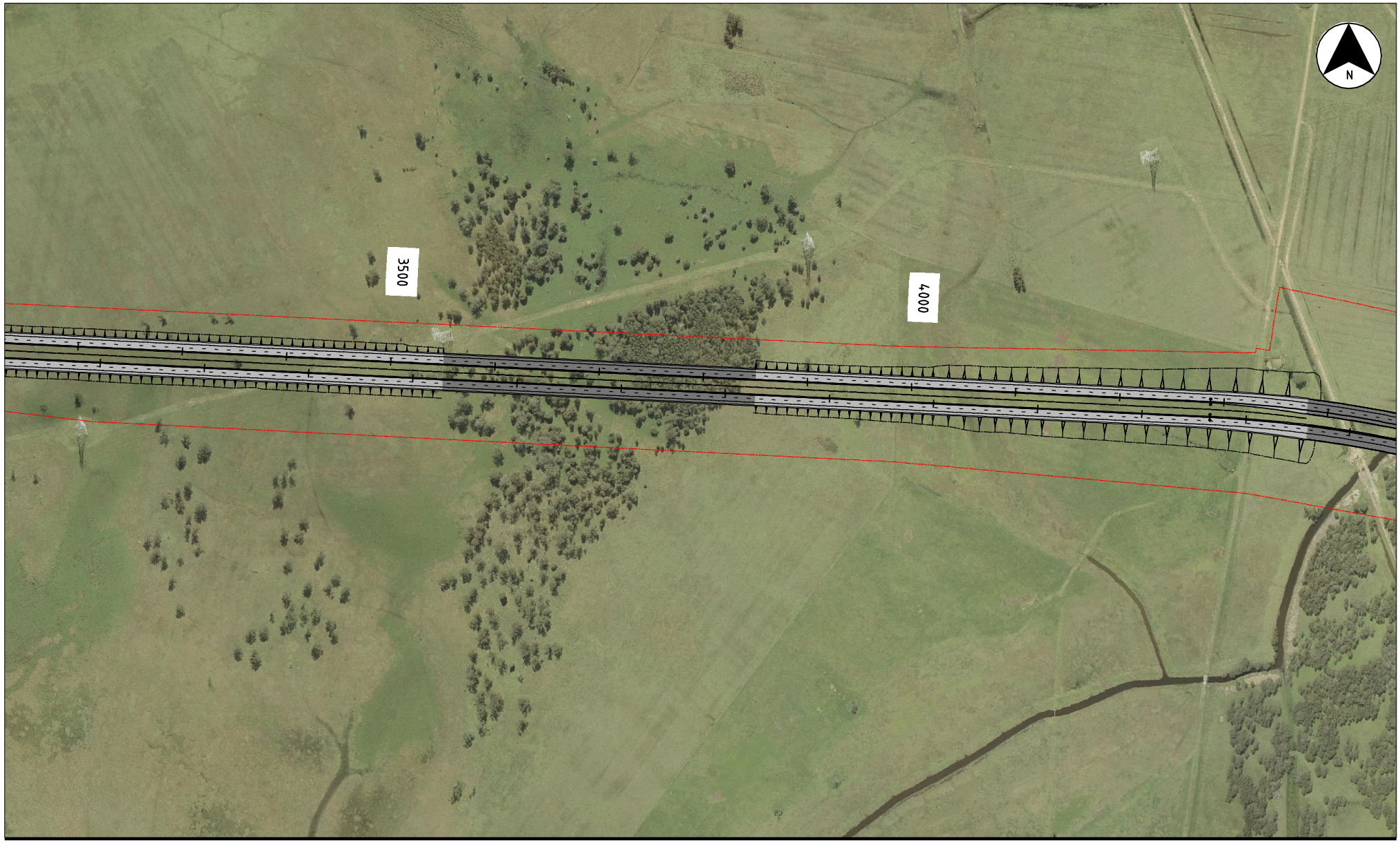
NSW ROADS AND TRAFFIC AUTHORITY
F3 TO RAYMOND TERRACE
CONCEPT DESIGN LAYOUT

Figure A.3

MAUNSELL | AECOM



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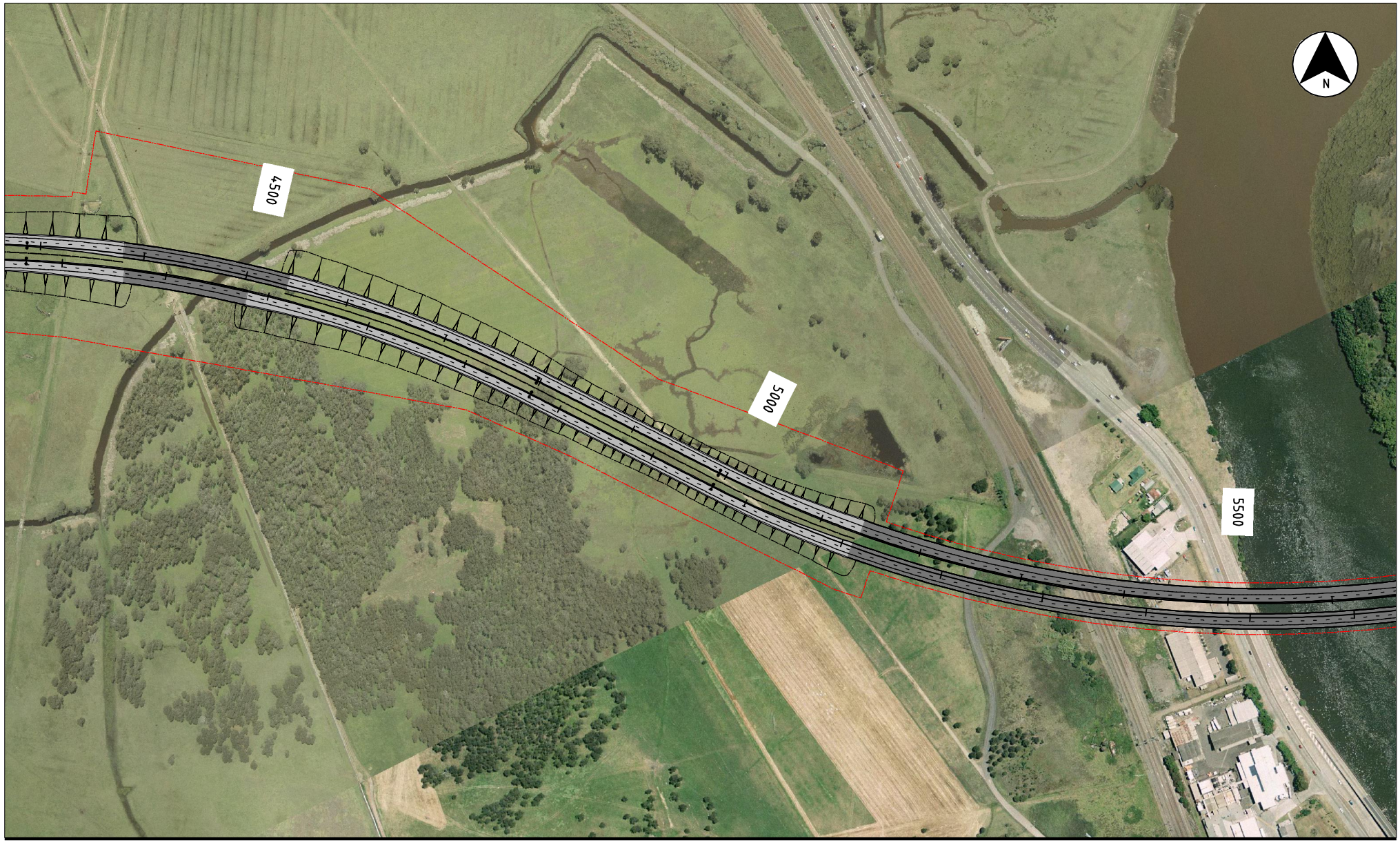
NSW ROADS AND TRAFFIC AUTHORITY

F3 TO RAYMOND TERRACE

CONCEPT DESIGN LAYOUT

Figure A.4

MAUNSELL | AECOM



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NSW ROADS AND TRAFFIC AUTHORITY

F3 TO RAYMOND TERRACE

CONCEPT DESIGN LAYOUT

Figure A.5

MAUNSELL | AECOM

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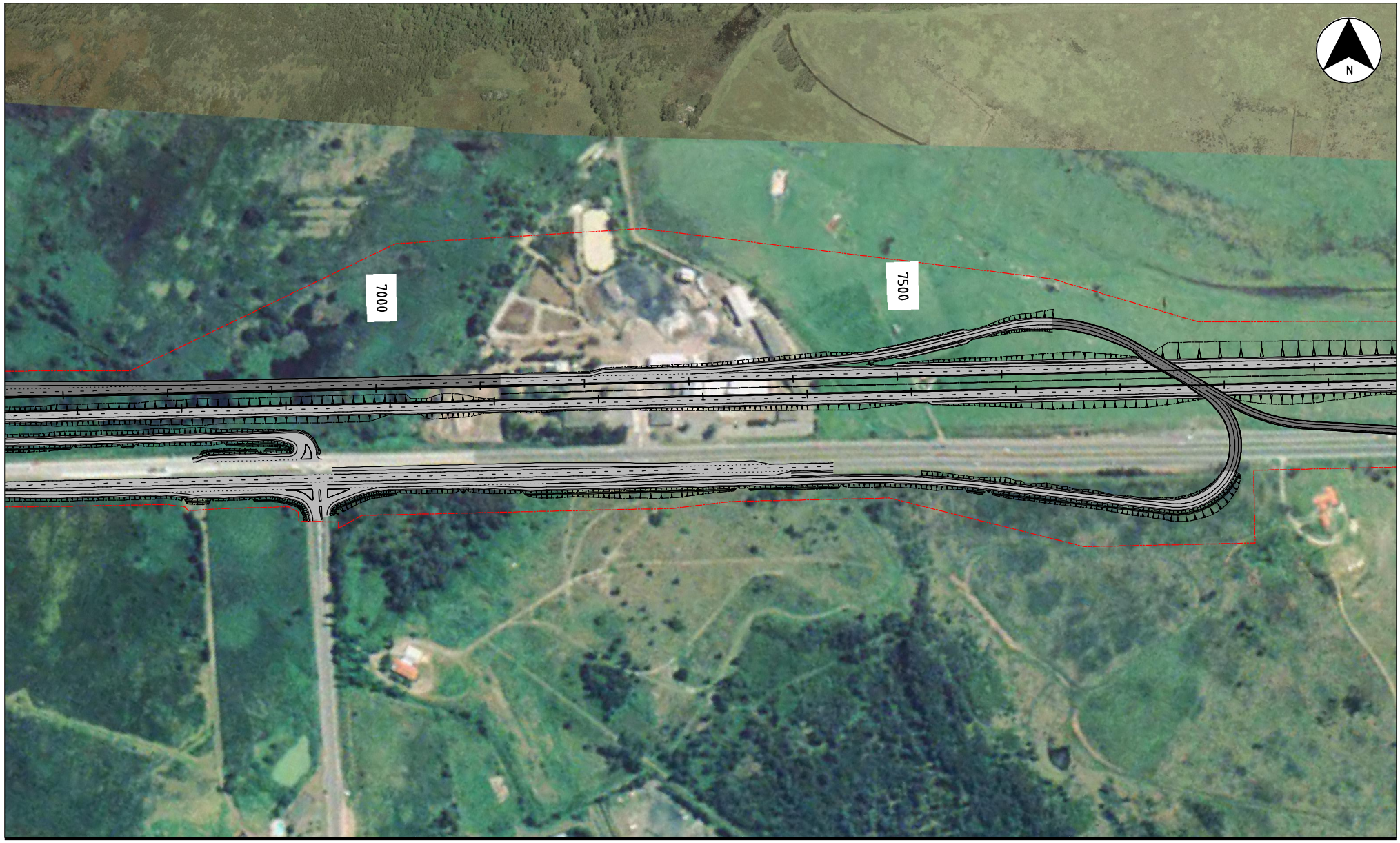
NSW ROADS AND TRAFFIC AUTHORITY

F3 TO RAYMOND TERRACE

CONCEPT DESIGN LAYOUT

Figure A.6

MAUNSELL | AECOM



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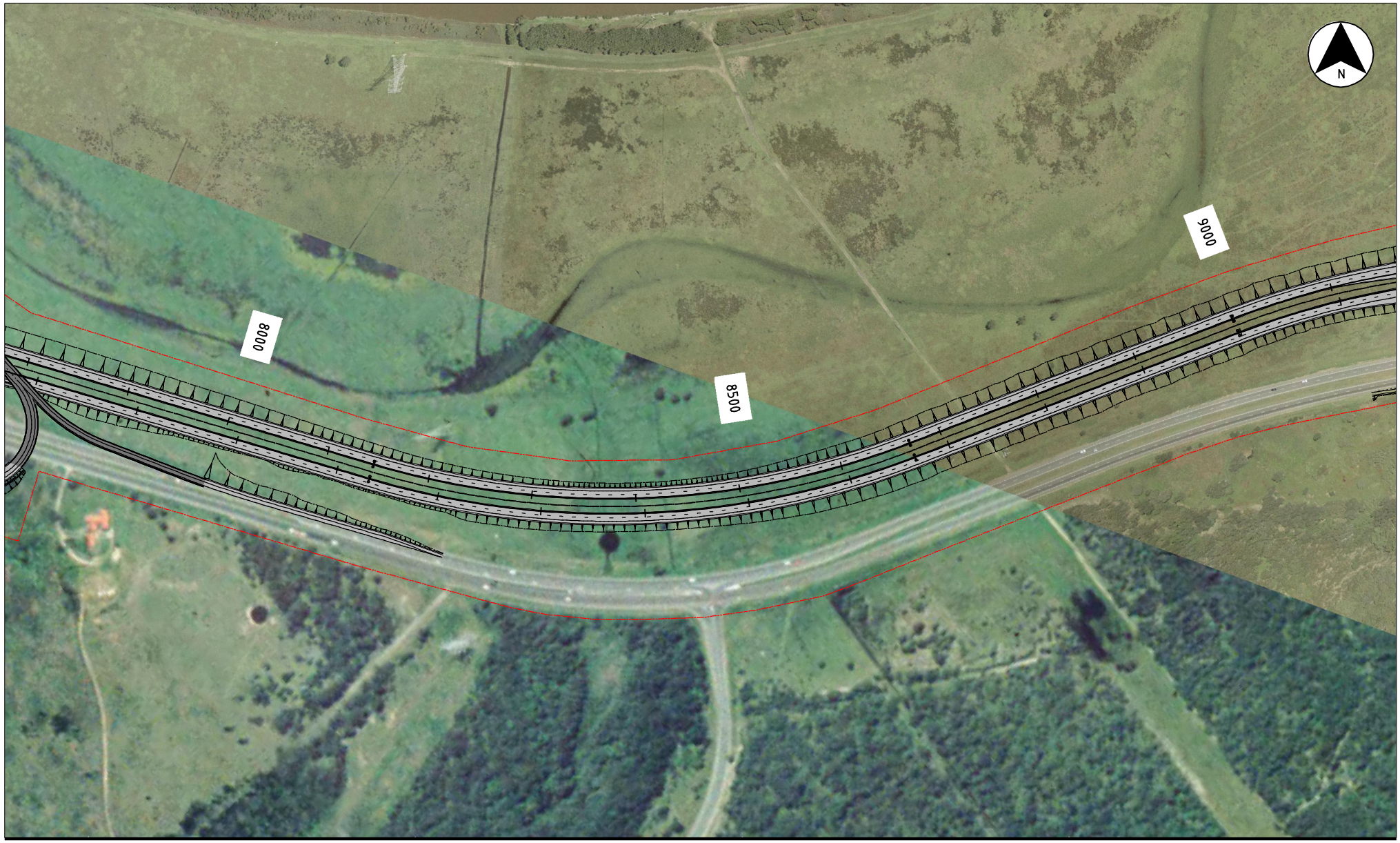
NSW ROADS AND TRAFFIC AUTHORITY

F3 TO RAYMOND TERRACE

CONCEPT DESIGN LAYOUT

Figure A.7

MAUNSELL | AECOM



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NSW ROADS AND TRAFFIC AUTHORITY

F3 TO RAYMOND TERRACE

CONCEPT DESIGN LAYOUT

Figure A.8

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NSW ROADS AND TRAFFIC AUTHORITY

F3 TO RAYMOND TERRACE

CONCEPT DESIGN LAYOUT

Figure A.9

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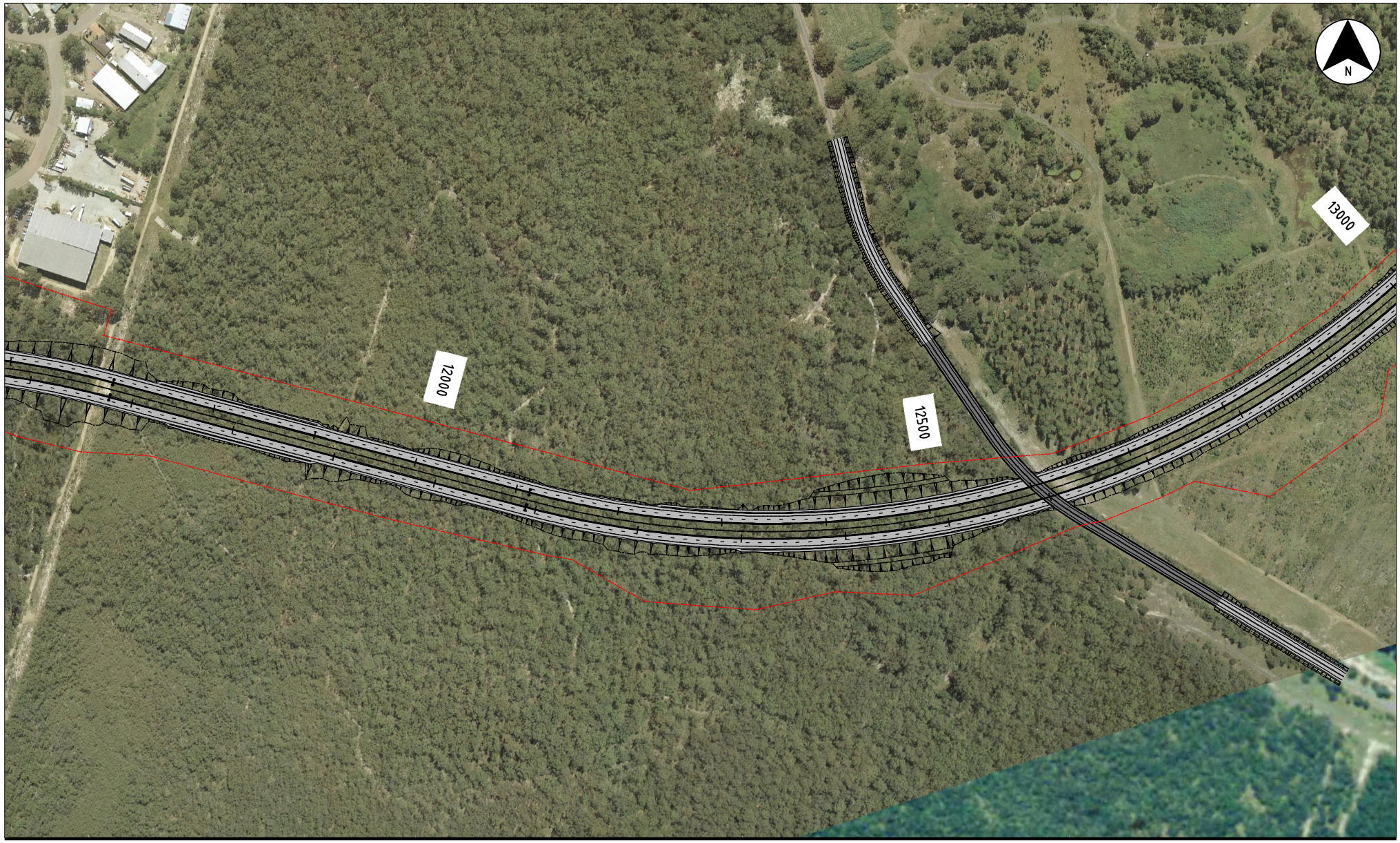
NSW ROADS AND TRAFFIC AUTHORITY

F3 TO RAYMOND TERRACE

CONCEPT DESIGN LAYOUT

Figure A.10



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NSW ROADS AND TRAFFIC AUTHORITY
F3 TO RAYMOND TERRACE
CONCEPT DESIGN LAYOUT

Figure A.11

MAUNSELL | AECOM

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NSW ROADS AND TRAFFIC AUTHORITY

F3 TO RAYMOND TERRACE

CONCEPT DESIGN LAYOUT

Figure A.12

MAUNSELL | AECOM

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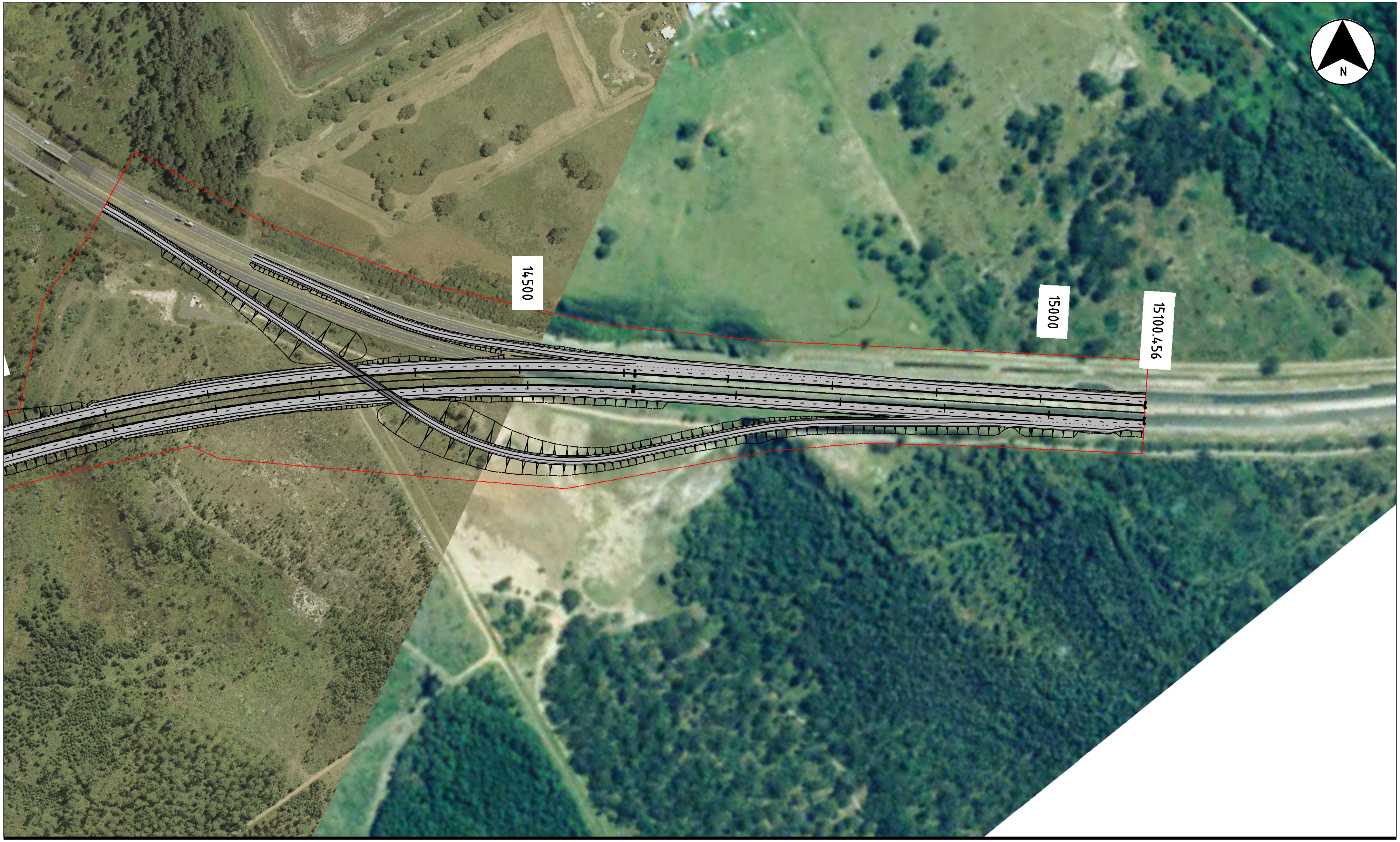

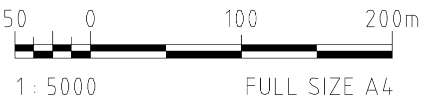

NSW ROADS AND TRAFFIC AUTHORITY
F3 TO RAYMOND TERRACE
CONCEPT DESIGN LAYOUT

Figure A.13