

Woolgoolga to Ballina Pacific Highway upgrade

Urban design and landscape plan



Richmond River to Ballina - Sections 10 and 11

Prepared for:



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GLOSSARY AND ABBREVIATIONS

TERMS IN THIS REPORT	DEFINITION
Bioregion	Classification of Australia’s landscape into 89 distinct bioregions based on climate, geology, landform and native vegetation and species information. The Woolgoolga to Ballina project site is within the NNC - New South Wales North Coast Bioregion as defined by ABRA mapping.
Compost blanket	Consists of high quality compost incorporating organic tackifiers, biological stimulants, wetting agents, soil ameliorants and seed mix that is applied to the batter surface with pneumatic blowers at a thickness of between 25-100 mm depending on type of vegetation to be established.
Cover crop	Fast growing, but short lived non-native pasture grasses with low reproduction levels (low fecundity) used to revegetate exposed batters to minimise erosion and weed infestation.
Direct return	Stripping and replacement of site soils that contains a seed bank of native indigenous species.
Drill/broadcast seeding	Seeding using a mechanical disc seeder towed by a tractor. Drill seeders have metal discs that create small furrows into which seed is placed. Broadcast seeding involves the mechanical spreading of seed on the soil surface using a trailer or truck mounted spinning type or agitator type seed spreader. After seeding, the soil is harrowed to cover the seed with a thin layer of soil.
Fauna crossing structure	Structures that allow animals to safely cross over human-made barriers such as highways.
Frangible	Planting which breaks under the impact of a motor vehicle (and hence helps to stop a vehicle). Generally trees and shrubs with a mature trunk diameter of less than 100 mm at about 500 mm above ground are considered frangible.
Hydromulching	Various types of organic fibrous materials mixed with water and sprayed onto the soil surface in slurry form that sets to form a layer that provides temporary protection from wind and water erosion. The mix may include seed of a cover crop, legume, native ground cover, shrub or tree species.
Hydroseeding	Hydraulic application of seed, seed carrier and soil ameliorants added to a tank fitted with an agitator and pump. It is commonly followed by hydromulching or straw mulching to provide surface protection.
Indigenous species	Plant species native to the bioregion in which the project is located.
Landscape Management Plan	A defined combination of techniques and frequency of activities for the successful establishment, maintenance and ongoing management of all landscape areas developed by seeding, planting or bushland regeneration.
Landscape soil	Soil profile that is either modified from a natural soil or manufactured and installed using artificial components for the purpose of sustaining vegetation that is chosen to achieve a particular landscape design outcome or revegetation.
Local provenance seed	Seed collected from plants growing in the locality of the project site which may include the road corridor and adjoining areas within the NSW North Coast Bioregion.
Native Grasses	Grass species that are native to Australia.
Natural soils	Soils remaining insitu which have formed distinct horizons and typically sustaining specific plant communities.
Non-native	Plants that are not native to the bioregion in which the project site is located.
Noxious	Plants declared noxious weeds which are classified into one of five control classes with specified action for each class by the Noxious Weed Act, 1993 and Weed Control Order 2014.
Pasture Grass Mix	Mix of grasses and legumes; predominantly gasses with a portion of legumes to provide nitrogen; typically used on areas that are not to be managed.

TERMS IN THIS REPORT	DEFINITION
Plant container	Containers for plant stock in various sizes and volumes. Pots are containers with rigid walls, which are identified by their diameter in mm. Bags are containers with flexible or woven walls, which are identified by their volume in litres.
Reconstruction	The practice of revegetating areas where the soil profile has been disturbed by building activity; the process involves soil treatment, which may include return of bushland soil, followed by drill seeding, hydromulching or mass planting.
Regeneration	The practice of restoring disturbed or cleared bushland areas where the soil profile remains intact by reinstating and reinforcing the natural regeneration processes in areas within or adjoining bushland, primarily through weed control (weed cover should be less than 15 percent after 12 months from commencement of the work).
Revegetation	Re-establishing vegetation on an area by direct seeding with native species using manual or mechanical means such as hydromulching, straw mulching, or tractor seeding. A cover crop of annual grass or legume species may be required to provide surface protection in some situations.
Seed provenance	The area from which seed is collected from native plants.
Tubestock	Rigid plant containers with a top edge length or diameter of 40-50 mm or 75 mm. Includes individual containers as well as trays, and may have proprietary names.

ABBREVIATION	DESCRIPTION
AHMS	Aboriginal Heritage Management System
CEMP	Construction Environmental Management Plan
DP&E	Department of Planning and Environment
EIS	Environmental Impact Statement
EPBC Act	Environment Protection and Biodiversity Conservation Act
LMP	Landscape Management Plan
MCoA	Minister’s Conditions of Approval
NPWS	National Parks and Wildlife Services
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PAD	Potential Archaeological Deposits
Roads and Maritime	Roads and Maritime Services
SPIR	Submissions/Preferred Infrastructure Report
TSC Act	Threatened Species Conservation Act
UDLP	Urban Design and Landscape Plan
WMP	Weed Management Plan
W2B	Woolgoolga to Ballina

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Figure 1: Artist's impression - the design on the approach to Coolgardie interchange signals the entry into Wardell township
(Note: Landscape shown at maturity)

EXECUTIVE SUMMARY

INTRODUCTION

The Pacific Highway upgrade is one of the largest road infrastructure projects in NSW. It connects Sydney and Brisbane, and is a major contributor to Australia's economic activity. The 155 kilometre upgrade between Woolgoolga to Ballina is the last highway link between Hexham and the Queensland border to be upgraded to four lanes. The project will duplicate the existing highway to two lanes in each direction from about six kilometres north of Woolgoolga (north of Coffs Harbour) to around six kilometres south of Ballina. The project bypasses the towns of Grafton, South Grafton, Ulmarra, Woodburn, Broadwater and Wardell.

The project Environmental Impact Statement (Roads and Maritime, 2012) divided the project into 11 Sections for assessment purposes. Sections 1 and 2 of the upgrade are under construction. Pacific Highway upgrades have also been completed at Glenugie (Section 3) and Devils Pulpit (Section 6A). This report covers:

- Richmond River to Coolgardie Road - Section 10
- Coolgardie Road to Ballina - Section 11.

COMPLIANCE REQUIREMENTS

This Urban Design and Landscape Plan (UDLP) is prepared as part of the Pacific Highway Upgrade Woolgoolga to Ballina Project, to address the requirements of the Minister's Conditions of Approval (MCoA) D20. It documents the design of Richmond River to Coolgardie Road - Section 10, and Coolgardie Road to Ballina - Section 11, located between Broadwater and Pimlico, and bounded by the Richmond River to the east and the Blackwall Range to the west. These sections sit within the floodplain of the Richmond River which extends parallel to the project in a north-south direction.

As part of this process, The Minister's Condition D20 clearly identifies the documents, conditions and commitments undertaken as part of the approval process and the ongoing design development for the project. Particular reference is given to compliance with the:

- *EIS - Urban Design, Landscape Character and Visual Impact Assessment* (Hassell, 2012)
- *Pacific Highway Upgrade Urban Design Framework – Urban Design Vision, Objectives and Design Principles for the Upgrade of the Pacific Highway from Hexham to Tweed Heads* (Roads and Maritime, 2013)
- *Beyond the Pavement – Urban Design Policy Procedures and Design* (Roads and Maritime, 2014)

- *Biodiversity Working Paper* (Roads and Maritime, 2012)
- Various design guideline documents by Roads and Maritime.

Key requirements for each document are summarised and the chapter where these elements are addressed within the report identified.

As part of the Conditions of Approval for the project, the *Ballina Koala Plan* (2016) and *Koala Management Plan* (2016) must be approved before building can start in the area known as Section 10, which starts at Broadwater and finishes at Coolgardie, south of Ballina.



Figure 2: Roads and Maritime Design Guidelines
(Source: Roads and Maritime, 2013)

CONSULTATION

A key element of the design development has been consultation and in particular the input of these findings into the project development of the design.

In order to ensure appropriate and meaningful engagement a community and stakeholder engagement strategy was developed and implemented to support the progress of the Woolgoolga to Ballina Pacific Highway upgrade with relation to the draft urban design landscape management plan. The strategy ensured appropriate levels of consultation with key stakeholders to manage expectations and minimise risk. A co-hosted consultation approach was adopted incorporating the Urban Design and Landscape Plan alongside the proposed design refinements for consideration as part of the detailed design development process, enabling an integrated understanding of the proposal as a whole.

Consultation activities undertaken included:

- April and May 2016 preliminary draft detailed design concepts for the Urban Design and Landscape Plan were available for public review and comment, with information sessions held

- From 1-29 August 2016 the draft Urban Design and Landscape Plan was released for public and agency review and comment, supported by media campaigns, public displays, online survey, feedback forms and, popup consultation sessions.

The feedback and responses as a result of community, agency and stakeholder consultation on the draft urban design and landscape plan are addressed in the Community Consultation Report for the Urban Design and Landscape Plans, February 2017. The Community Consultation Report, prepared in accordance with the community and stakeholder engagement strategy for the project, is contained in Appendix D of this report.

Consultation inputs have been included in the issue of the final report. The two key community inputs has been the provision of screen planting along the western edge of the highway south of Whytes Lane to the end of the project; and Koala Habitat Management. Koala Management has been the subject of a number of studies and plans including Koala Revegetation Strategy, Koala Habitat Planting Strategy and Connectivity Strategy. Continued engagement with Friends of the Koala and other interested parties is part of the ongoing projects delivery.



Figure 3: Artist's impression - the landscape design integrates with the adjoining vegetation communities (Note: Landscape shown at maturity)

Amongst the agency comments were responses to environmental and biodiversity requirements in order to ensure the protection of fauna and flora, as well as robust and viable landscape treatments for waterways and fauna crossings.

DESIGN VISION

The Pacific Highway Upgrade Urban Design Framework (RMS, 2013) has established a vision for the Pacific Highway which is:

“The upgrade should be a sweeping, green highway providing panoramic views to the Great Dividing Range and the forests, farmlands and coastline of the Pacific Ocean; sensitively designed to fit into the landscape and be unobtrusive; and characterised by simple and refined road infrastructure.”

DESIGN OBJECTIVES

The design objectives for the project were established as part of the EIS process and informed by the Pacific Highway Urban Design Strategy, these are:

- Provide a flowing road alignment that is responsive and integrated with the landscape
- Provide a well vegetated, natural road reserve
- Provide an enjoyable, interesting highway
- Value the communities and towns along the road
- Provide consistency-with-variety in road elements
- Provide a simplified and unobtrusive road design.

As part of the design development further refinement and focus is given to the development of objectives which address the specific issues of this portion of the corridor. The objectives are:

- Objective 1: To ensure that the town of Wardell is acknowledged on the Pacific Highway
- Objective 2: To provide consistency in design language through the overall Woolgoolga to Ballina upgrade and the Pacific Highway, and at the same time provide interest through location specific treatments where appropriate
- Objective 3: To ensure visual impact to rural residences are minimised
- Objective 4: To maintain key views from the highway
- Objective 5: To ensure major cut batters blend with surrounding landscape.

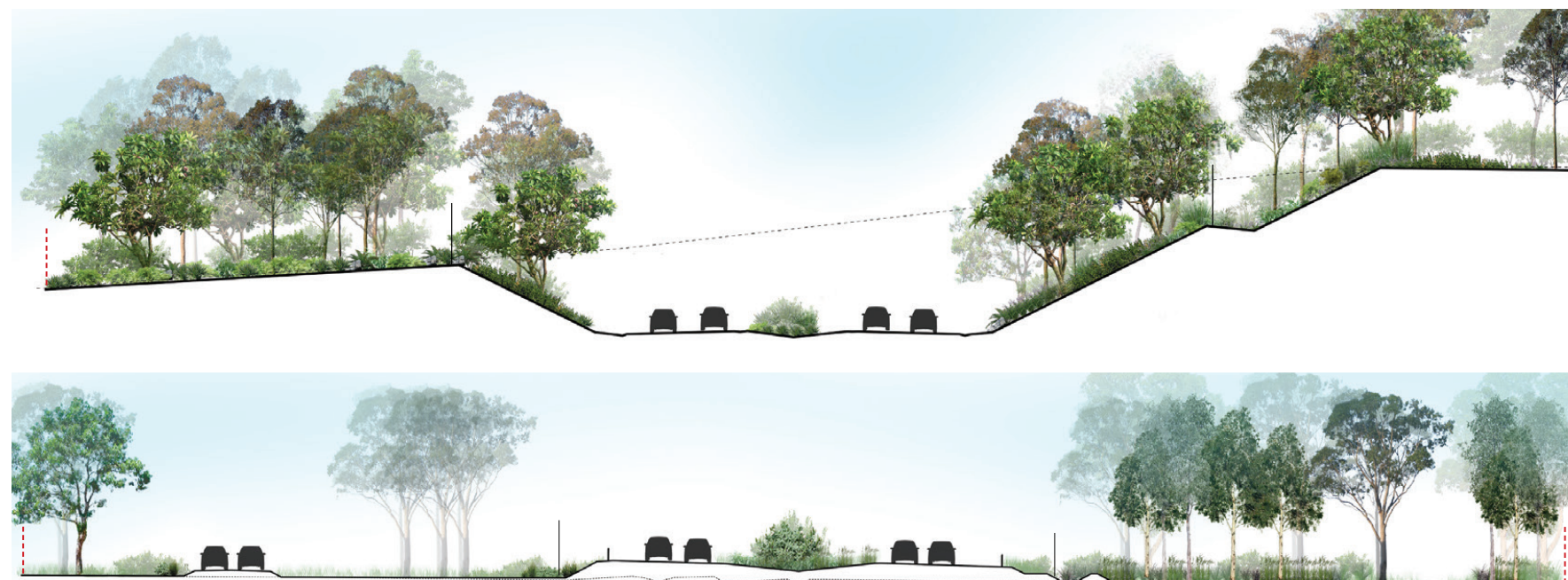


Figure 4: The route alignment passes through a variety of landscapes from enclosed forests (above) to flat open floodplains (below)

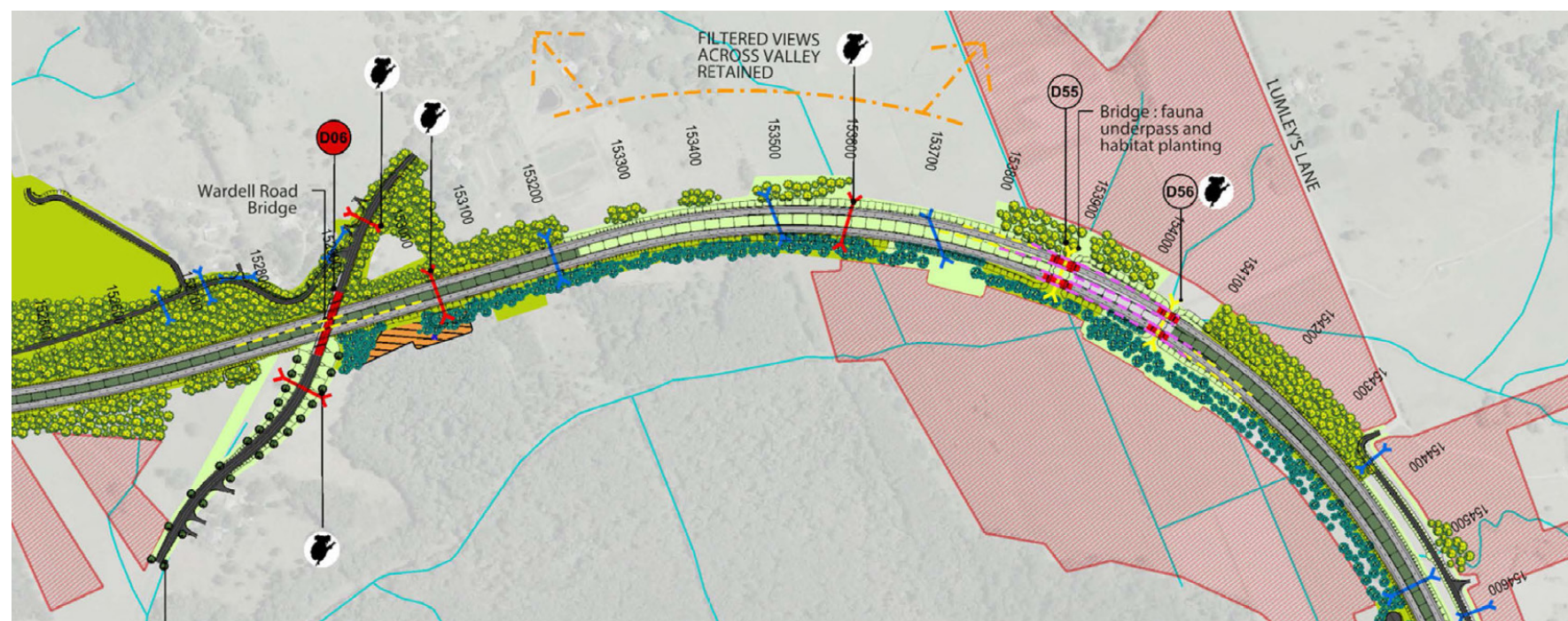


Figure 5: Landscape design approach within Richmond River to Coolgardie Road - Section 10 show vegetation strategy and areas of koala tree revegetation

These in turn have informed the development of an overall design strategy for Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11. This report demonstrates how the vision and objectives are achieved.

CONTEXTUAL ANALYSIS

Contextual analysis was undertaken to both validate the work to date and provide the basis for the design development. The analysis reflects the detailed nature of the design and identifies the primary constraints and inputs. The analysis included the assessment of key contextual elements and the manner in which they influence the design response.

DESIGN PRINCIPLES

Detailed design principles are outlined in Chapter 6 for Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 in relation to environmental values, heritage values, the urban design context, sustainable design and maintenance, and community amenity and privacy. The design principles refer mainly to the mitigation measures identified in the various technical reports in the EIS which are incorporated in the design. Also discussed is the overall project strategy for temporary works, ancillary facilities and access tracks. This reflects a project wide strategy aimed at minimisation of disturbance and rehabilitation in the operational phase of the project.

URBAN DESIGN AND LANDSCAPE RESPONSE

The urban and landscape design response describes the design and drivers experience in plans, cross sections, three dimensional images and text, from the Richmond River crossing through to Pimlico. It describes the key initiatives adopted to address the context of the road and impacts of the proposal, and in doing so addresses the minister's conditions. Highlights of the design are discussed below.

INTERCHANGE RESPONSE

The treatment of Wardell Road Bridge and the Coolgardie Road interchange are used to both define progress along the corridor, and also interpret the presence of the nearby town of Wardell.

Coolgardie interchange - the landscape design has responded to the landscape character of Wardell (adopting the Ficus tree which defines the main street of Wardell) and interprets this in combination with hedge planting within the corridor to provide an arrival sequence that informs the highway user of the approaching interchange. Figure 4 provides visualisations of the corridor.

Wardell Overbridge - the landscape response acts as a visual marker and helps define progression along the alignment and context for the road user.

KOALA REVEGETATION STRATEGY

The *Koala Revegetation Strategy* (2015) will establish 130 hectares of new forest cover. The connection of the landscape within the corridor to these plantations is adopted to facilitate fauna movement, reconnecting previously fragmented fauna and flora corridors and provides a landscape legacy for future generations. This is an important environmental initiative for the project and for the region. Figure 5 shows a landscape plan within Richmond River to Coolgardie Road - Section 10 indicating proposed Koala Management Tree Plantation.

GENERAL

- The vegetation communities adopted within the design respond to those adjoining the corridor, reinforcing the landscape character of the alignment and its broader setting within its context
- The strategies adopted for the integration of the earthworks associated with the road blend the civil works with the adjoining landform. Figure 4 illustrates the dominant forms and the design response
- Bridge structures are simple and elegant in design and adopt a consistent design approach across all Sections of the Woolgoolga to Ballina project
- Service roads are separated from the corridor and landscape used to limit the potential for headlight glare
- Visual screening is provided where the outlook of properties are altered by the construction of the road alignment
- Views are retained across valleys and floodplains to connect the highway alignment with the broader landscape.

LANDSCAPE CHARACTER ASSESSMENT

Included in the response is a review of the landscape character assessment and key viewpoints identified as part of the EIS process. The landscape character assessment revealed that there was no change in the overall landscape character assessment for the eight EIS precincts which make up or adjoin the corridor.

VISUAL ASSESSMENT

The visual assessment revealed a number of revisions to the assessment which resulted in an overall reduction in the impact of the proposal. Of the 15 sites assessed six were identified as having been improved by the proposed design through careful design and mitigations strategies. The changes in the design are predominantly in relation to the implications of the *Koala Revegetation Strategy* (2015). This strategy introduces 130 hectares of land to be revegetated with forest adjoining the corridor. The impact of this is assessed as reducing the overall sensitivity or magnitude of the proposal. Five of the seven 'moderate to high' impact ratings within this portion of works were mitigated to moderate. All other impacts are either 'moderate', or 'moderate to low'.

As a result of the changes to the visual assessment, some minor amendments were made to the mitigation measures associated with the works. The changes in measures have been summarised against those proposed in the EIS.

DETAILED RESPONSES TO DESIGN

Chapter 8 of the report details the specific responses to the design and methods of implementation/ management of the works. Items addressed include structures, interchange design, median and verge treatments, pedestrian and cycle network, fauna crossing, boundary and fauna fencing, lighting, planting, top soil management, drainage and water quality.

SUMMARY URBAN DESIGN AND LANDSCAPE PLAN

The report presents plans, cross sections, illustrative perspectives and supporting text to demonstrate the compliance and response to the key environmental conditions of the project. In doing so it:

- Clearly identifies the principles and standards adopted for the projects urban and landscape design response
- Defines the vegetation communities which occur within the corridor and the revegetation strategies to be adopted in response to these
- Details the approach to the management and revegetation of ancillary facilities
- Addresses planting in relation to heritage constraints
- Integrates the revegetation of disturbed sites within the overall revegetation strategy
- Addresses the issue of local access including lighting and signage and path connectivity
- Address the visual impacts of the project through the adoption of a range of mitigation measures consistent with the EIS
- Defines the ongoing maintenance of the works to ensure it establishes and achieves the design intent
- Illustrates the involvement of community and councils in the development of the plan
- Provides a high quality urban and landscape design that is consistent with the other upgrades of the Pacific Highway
- Delivers a project within a novel construction and delivery program to achieve operation for the benefit of the greater community.

The report is submitted by the applicant Roads and Maritime for construction approval in accordance with the Minister's Condition of Approval D20.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The Pacific Highway upgrade is one of the largest road infrastructure projects in NSW. It connects Sydney and Brisbane, and is a major contributor to Australia's economic activity. The road is a vital piece of the nation's infrastructure and is a key link in the National Land Transport Network. The Australian and NSW governments have been jointly upgrading the Pacific Highway since 1996.

An upgraded Pacific Highway must continue to service the needs of the travelling public and achieve transport efficiencies, while also ensuring ecological sustainability and meeting the needs of the coastal communities that live along the highway. Upgrading new sections and carrying out safety improvements to the existing highway have brought major improvements to road conditions. These improvements support regional development and provide:

- Safer travel
- Reduced travel times with improved transport efficiency
- More consistent and reliable travel
- Improved amenity for local communities.

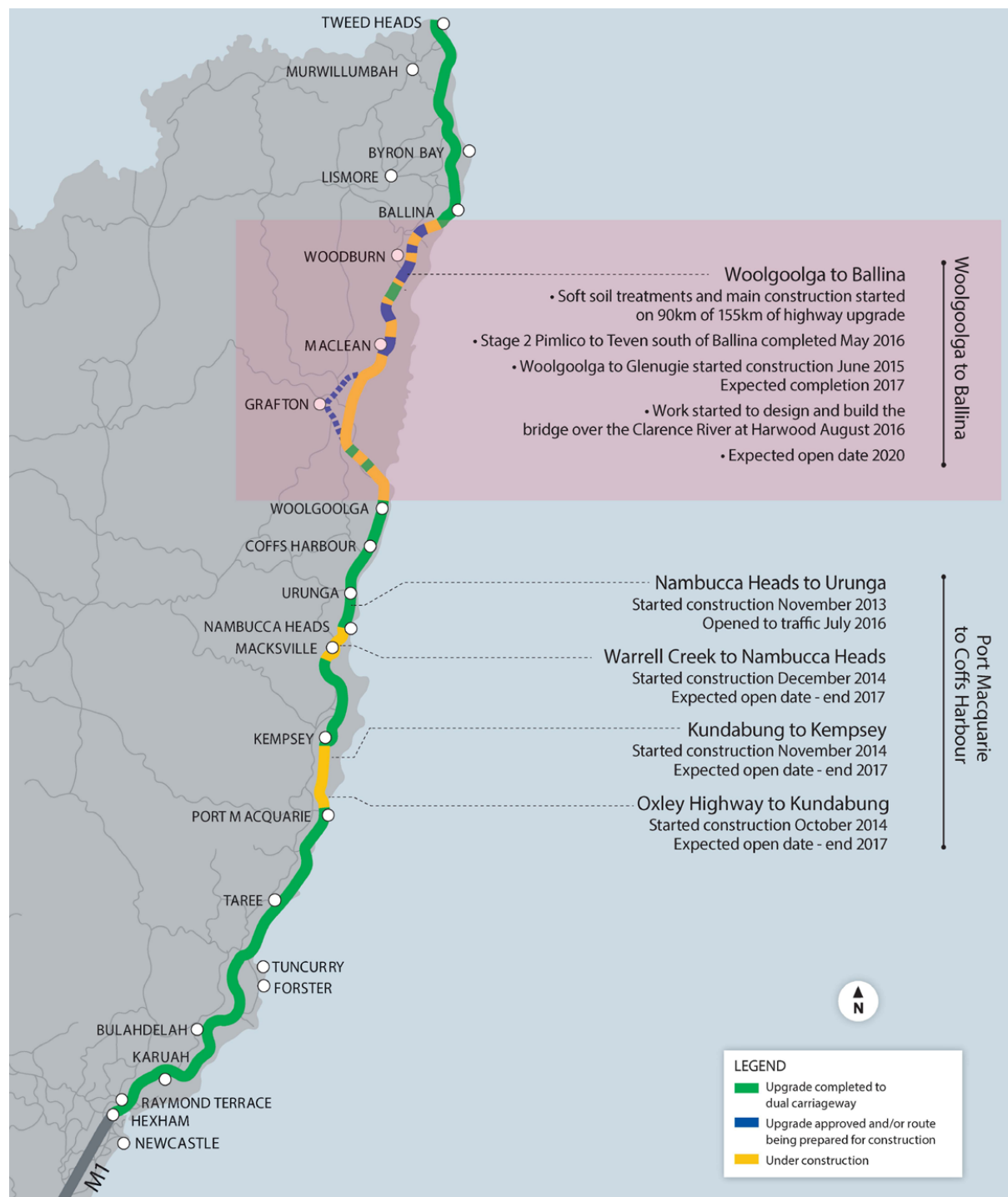


Figure 6: Woolgoolga to Ballina Upgrade project staging map (Source: Pacific Complete)



Figure 7: Woolgoolga to Ballina Upgrade division of sections for project delivery (Source: Pacific Complete)

1.2 OVERVIEW OF THE WOOLGOOLGA TO BALLINA UPGRADE

The 155 kilometre upgrade between Woolgoolga to Ballina is the last highway link between Hexham and the Queensland border to be upgraded to four lanes. The project will duplicate the existing highway to two lanes in each direction from about six kilometres north of Woolgoolga (north of Coffs Harbour) to about six kilometres south of Ballina.

The project bypasses the towns of Grafton, South Grafton, Ulmarra, Woodburn, Broadwater and Wardell. The project will include building new lanes and realigning the road.

Key features of the upgrade include:

- Duplicating 155 kilometres of the Pacific Highway to a motorway standard (Class M) or arterial road (Class A), with two lanes in each direction and room to add a third lane if required in the future
- Split-level (grade-separated) interchanges at Range Road, Glenugie, Tyndale, Maclean, Yamba/Harwood, Woombah (Iluka Road), Woodburn, Broadwater and Wardell
- Bypasses of South Grafton, Ulmarra, Woodburn, Broadwater and Wardell
- More than 100 bridges including major crossings of the Clarence and Richmond rivers
- Bridges over and under the highway to maintain access to local roads that cross the highway
- Access roads to maintain connections to existing local roads and properties
- Structures designed to safely encourage animals over and under the upgraded highway where it crosses key animal habitat or wildlife corridors
- Rest areas conveniently located at intervals to assist with reducing driver fatigue
- Heavy vehicle checking stations near Halfway Creek and north of the Richmond River
- Connections from the project to the local road network and other sections of the Pacific Highway
- Emergency stopping facilities, and U-turn bays
- Relocation of utilities and provision of roadside furniture, fencing (including wildlife exclusion fencing) and lighting.

1.3 PROJECT TYPE AND STAGING

The Pacific Highway Program Office is responsible for the 657 kilometre Pacific Highway upgrade program between Hexham and the Queensland border and is leading the wave of major infrastructure projects in NSW with an equally strong focus on delivery and leaving a positive legacy. A clear benefit of the program office is that it provides a single point of contact for the general public and key stakeholders while also offering an integrated and collaborative office tasked with developing and delivering the upgrade program.

In order to realise Roads and Maritime's vision of 'driving a better highway upgrade' the program office has adopted a delivery partner model for the Woolgoolga to Ballina upgrade.

The delivery partner model is based on the approach used to oversee construction of the London Olympics and supports collaboration and innovation by bringing business, workers, consumers and suppliers together. It encourages the best ideas and solutions from the private sector while also drawing on the Roads and Maritime's knowledge to ensure better engineering and design, customer outcomes and public value including:

- Greater access to resources and optimising resources from within the public and private sector
- Greater flexibility in resource use to better respond to delays and disruptive events
- Better customer outcomes through a consistent and coordinated approach
- Economies of scale and better access to competitive suppliers and subcontractors
- Direct engagement of design, management and construction skills to fast track the upgrade.

The delivery partner Pacific Complete, comprising Laing O'Rourke and WSP Parsons Brinckerhoff, is working closely with the Pacific Highway Program office to oversee the project and handle multiple contracts for professional services and building of the \$4.36 billion upgrade.

The project was divided into 11 sections in the Environmental Impact Statement (EIS) for assessment purposes, excluding the completed Glenugie and Devils Pulpit upgrades.

Sections 1 and 2 of the upgrade, between Woolgoolga and Glenugie, are being built and Sections 3-11 are being managed during design development in the following portions (refer Figure 7).

- Glenugie to Maclean (Sections 3 and 4)
- Maclean to Devils Pulpit (Sections 5 and 6)
- Devils Pulpit to Richmond River (Sections 7, 8 and 9)
- Richmond River to Ballina (Sections 10 and 11).

Design and construction of the bridges crossing the Clarence and Richmond Rivers is being managed separately.

1.4 PURPOSE OF THIS PLAN

This plan has been developed to address the requirements of the Minister's Conditions of Approval (MCoA) D20 and present an integrated urban design for the Woolgoolga to Ballina project. This plan specifically addresses Richmond River to Ballina (Sections 10 and 11) and demonstrates commitment to the mitigation and management measures identified in the Woolgoolga to Ballina Environmental Impact Statement, the Submissions/Preferred Infrastructure Report (SPIR, and other approved environmental management documentation).

The report is submitted by the applicant Roads and Maritime for construction approval in accordance with Ministers Condition of Approval D20.

1.5 URBAN AND LANDSCAPE DESIGN METHODOLOGY

The urban and landscape design methodology has been revised at each design stage. As the project has progressed through detailed design an integrated multidisciplinary design approach has been instilled to achieve urban design and landscape objectives which provide a holistic, yet varied and consistent design strategy.

1.6 URBAN DESIGN GUIDANCE

Urban design for the project is guided by three key documents:

- The overarching best practice urban design principles as set out in *Beyond the Pavement – Urban Design Policy Procedures and Design Principles* by Roads and Maritime Services' Centre for Urban Design, 2014
- The urban design framework for the Pacific Highway upgrade – *Pacific Highway Upgrade Urban Design Framework – Urban Design Vision, Objectives and Design Principles for the Upgrade of the Pacific Highway from Hexham to Tweed Heads*, Roads and Maritime, 2013
- The Urban Design report prepared as part of the EIS for the Woolgoolga to Ballina project – *Pacific Highway Upgrade Woolgoolga to Ballina Urban Design Report Landscape Character and Visual Impact Assessment*, Hassell, September 2012.



Figure 8: Urban design methodology process (Source: Roads and Maritime, 2013)

In addition, the UDLP has been prepared with reference to the following approval and policy guideline documents.

Approval documents:

- Project Approval Notice, dated 14 August 2014, and Modifications to the Project Approval, dated 15 January 2015, and 7 October 2015
- *The Woolgoolga to Ballina – Pacific Highway Upgrade – Environmental Impact Statement (EIS)*, Roads and Maritime 2012
- *Woolgoolga to Ballina Urban Design Report Landscape Character & Visual Impact Assessment*, Roads and Maritime 2012
- *The Woolgoolga to Ballina – Pacific Highway Upgrade – EIS Working Paper – Biodiversity Assessment*, Roads and Maritime, 2012
- *Upgrading the Pacific Highway – Design Guidelines*, Roads and Maritime, March 2015.

Guidelines documents:

- *Guideline for Batter Surface Stabilisation using vegetation*, Roads and Maritime, April 2015
- *Environmental Impact Assessment Practice Note: Guidelines for Landscape Character and Visual Impact Assessment* ("EIA No4 Guidelines"), Roads and Maritime, March 2013
- *Soils for Landscape and Garden Use*, Australian Standards AS 4419
- *Composts, Soil Conditioners and Mulches*, Australian Standards AS 4454
- Roads and Maritime construction specifications including R178 Vegetation and R179 Planting
- *Beyond the Pavement – Urban Design Policy, Procedures and Design Principles*, Roads and Maritime, 2014
- *Bridge Aesthetics – design guideline to improve the appearance of bridges in NSW*, Roads and Maritime, July 2012
- *Landscape Guidelines*, Roads and Maritime, April 2008
- *Shotcrete Design Guidelines*, Roads and Maritime, March 2016
- *Noise Wall Design Guidelines*, Roads and Maritime, March 2016
- *Biodiversity Guidelines – Protecting and Managing Biodiversity*, RTA, September 2011.



Figure 9: Roads and Maritime design guidelines (Source: Roads and Maritime, 2013)

1.7 DOCUMENT STRUCTURE

The structure and content of the Urban Design and Landscape Plan is presented in Table 1 below.

1.8 DESIGN DEVELOPMENT AND REPRESENTATIONS

The visualisations, artists’ impressions, design drawings, figures and images shown in this report accurately represent the detailed design at the time of publication. Design developments that occur during construction will be addressed in supplementary reports. Future design development may therefore occur that is not represented in the report. Artists’ impressions are intended to be indicative ideas of a possible future landscape at maturity.

Table 1: Structure and content of the Urban Design and Landscape Plan - Richmond River to Ballina (Sections 10 - 11).

TITLE		DESCRIPTION
Chapter 1	Introduction	Provides a broad overview of the project and identifies the purpose and structure of the Urban Design and Landscape Plan.
Chapter 2	Overview of the Pacific Highway upgrade	Provides a broad overview of the Pacific Highway upgrade.
Chapter 3	Consultation	Describes the consultation undertaken and identifies the corresponding issues raised and where they are addressed in the Urban Design and Landscape Plan.
Chapter 4	Project wide urban design and landscape objectives and principles	Describes the project wide urban design and landscape objectives and principles.
Chapter 5	Contextual analysis	Describes contextual analysis and associated landscape and urban design principles specific to Richmond River to Ballina (Sections 10 and 11).
Chapter 6	Landscape and urban design principles for Richmond River to Ballina (Sections 10 and 11)	Provides an overview of the Richmond River to Ballina (Sections 10 and 11) highway design and describes the landscape and urban design principles and strategies specific to Richmond River to Ballina (Sections 10 and 11).
Chapter 7	Landscape and urban design for Richmond River to Ballina (Sections 10 and 11)	Describes the landscape and urban design concept specific to Richmond River to Ballina (Sections 10 and 11). This chapter includes urban design and landscape drawings that present the integrated landscape and urban design solutions. This chapter also includes a landscape character and visual impact assessment that describes the impacts of the highway upgrade between Richmond River to Ballina (Sections 10 and 11) at Detailed Design stage on the landscape character precincts and key views identified in the EIS. The assessment at Detailed Design is compared to the EIS assessment. This chapter also identifies additional properties potentially affected by the project between Richmond River to Ballina (Sections 10 and 11). It provides a visual assessment and mitigation measures for those properties.
Chapter 8	Landscape and urban design concept detail for Richmond River to Ballina (Sections 10 and 11)	Detailed descriptions of all urban and landscape design elements for Richmond River to Ballina (Sections 10 and 11)
Chapter 9	Conclusion	Summary of design outcomes
Chapter 10	Bibliography	Catalogue of referenced and cited documents

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CHAPTER 2

COMPLIANCE WITH ENVIRONMENTAL APPROVAL DOCUMENTS

2.1 MINISTER’S CONDITIONS OF APPROVAL

The Woolgoolga to Ballina project has been approved as State Significant Infrastructure under Part 5.1 of the New South Wales Environmental Planning and Assessment Act 1979 (SSI-4963, approval dated 24 June 2014). The project is also approved under the Commonwealth Environment Protection and Biodiversity Act 1999 (012/6394 approval dated 14/08/14).

Ministerial Condition of Approval D20 relates to the preparation of a UDLP to be implemented before the start of permanent built work and/or landscaping. The specific requirements of MCoA D20 and where they are addressed in this plan are outlined in Table 2.

2.2 COMPLIANCE WITH EIS AND SPIR ENVIRONMENTAL MITIGATION MEASURES AND LANDSCAPE STRATEGIES

In the EIS a range of environmental outcomes and management measures were identified to avoid or reduce the impact the project has on the environment. These measures were further refined in the SPIR. Additional commitments were identified and conditions that had already been fulfilled were removed. Appendix A of this document outlines compliance with relevant environmental mitigation measures related to landscape and urban design specific to Richmond River to Ballina (Sections 10 and 11).

The EIS identified a range of strategies and management measures to minimise the visual impact and adverse changes to the landscape character by the project. This Urban Design and Landscape Plan has been developed based on the landscape character and visual assessment and landscape strategy prepared as part of the EIS and revised in the SPIR.

Table 2: Ministerial Condition of Approval - D20 requirements

MINISTERIAL CONDITION OF APPROVAL FOR URBAN AND LANDSCAPING (D20)	DOCUMENT REFERENCE
<p>The Applicant shall prepare and implement an Urban Design and Landscape Plan prior to the commencement of permanent built works and/or landscaping, unless otherwise agreed by the Secretary, to present an integrated landscape and design for the SSI. The Plan shall be prepared in accordance with the Roads and Maritime Services urban design and visual guidelines, the design principles outlined in the EIS, and the revegetation principles outlined in the EIS Working Paper—Biodiversity. The Plan shall be prepared by an appropriately qualified expert in consultation with the relevant council and community, to the satisfaction of the Secretary. The Plan shall include, but not necessarily be limited to:</p> <p>(a) identification of design principles and standards based on:</p> <ul style="list-style-type: none">(i) local environmental values,(ii) heritage values;(iii) urban design context;(iv) sustainable design and maintenance;(v) community amenity and privacy;(vi) relevant design standards and guidelines; and(vii) the urban design objectives outlined in Chapter 4.2 of the EIS Working Paper—<i>Urban Design Landscape Character and Visual Impact</i>	<p>Refer to Chapter 6, Sub-chapter 6.3 Sub-chapter 6.4 Sub-chapter 6.2 Sub-chapter 6.5 Sub-chapter 6.6 Chapter 4 Sub-chapter 6.6</p>
<p>(b) The location of existing vegetation and proposed landscaping (including use of indigenous and endemic species where possible). Details of species to be replanted/revegetated shall be provided, including their appropriateness to the area and habitat for threatened species;</p>	<p>Refer to Chapter 5, Sub-chapter 5.4 existing vegetation communities, Chapter 8, Sub-chapters 8.4 and 8.7</p>
<p>(c) A description of locations along the corridor directly or indirectly impacted by the construction of the SSI (e.g. temporary ancillary facilities, access tracks, watercourse crossings, etc.) and details of the strategies to progressively rehabilitate regenerate and/or revegetate the locations with the objective of promoting biodiversity outcomes and visual integration;</p>	<p>Refer to Chapter 6, Sub-chapter 6.8</p>
<p>(d) Take into account appropriate roadside plantings and landscaping in the vicinity of heritage items and ensure no additional heritage impacts;</p>	<p>Refer to Chapter 8, Sub-chapter 8.4.5</p>
<p>(e) A description of disturbed areas (including borrow sites) and details of the strategies to progressively rehabilitate, regenerate and/or revegetate these areas, including clear objectives and timeframes for rehabilitation works, procedures for monitoring success of regeneration or revegetation, and corrective actions should regeneration or revegetation not conform to the objectives adopted;</p>	<p>Refer to Chapter 6, Sub-chapter 6.8</p>
<p>(f) Location and design treatments for any associated footpaths and cyclist elements, and other features such as seating, lighting (in accordance with AS 4282-1997 Control of the Obtrusive Effect of Outdoor Lighting), fencing, materials and signs;</p>	<p>Refer to Chapter 8, Sub-chapter 8.2</p>
<p>(g) An assessment of the visual screening effects of existing vegetation and the proposed landscaping and built elements. Where properties have been identified as likely to experience high visual impact as a result of the SSI and high residual impacts are likely to remain, the Applicant shall, in consultation with affected landowners, identify opportunities for providing at-property landscaping to further screen views of the SSI. Where agreed with the landowner, these measures shall be implemented during the construction of the SSI;</p>	<p>Refer to Chapter 6, Sub-chapter 6.6 Chapter 7, Sub-chapter 7.3</p>
<p>(h) Graphics such as cross sections, perspective views and sketches for key elements of the SSI, including, but not limited to built elements of the SSI;</p>	<p>Refer to Chapter 7</p>
<p>(i) Strategies for progressive landscaping and other environmental controls such as erosion and sedimentation controls, drainage and noise mitigation;</p>	<p>Refer to Chapter 8</p>
<p>(j) Monitoring and maintenance procedures for the built elements, rehabilitated vegetation and landscaping (including weed control). including performance indicators, responsibilities, timing and duration and contingencies where rehabilitation of vegetation and landscaping measures fail; and</p>	<p>Refer to Chapter 8</p>
<p>(k) Evidence of consultation with the relevant council and community on the proposed urban design and landscape measures prior to its finalisation.</p>	<p>Refer to Chapter 3</p>

2.3 URBAN DESIGN AND LANDSCAPE COMPLIANCE WITH THE EIS

Chapter 11 of the EIS – *Urban Design, Landscape Character and Visual Impact Assessment* presented a summary of the landscape character and visual impact assessment carried out to assess the direct and indirect impact of the project. Overall, it was identified the project was expected to have a low to moderate impact on landscape character.

Table 3 identifies EIS landscape strategies related to landscape and urban design specific to Richmond River to Ballina (Sections 10 and 11). For locations of the viewpoints please refer to Chapter 7.

2.4 URBAN DESIGN AND LANDSCAPE COMPLIANCE WITH THE EIS WORKING PAPER - BIODIVERSITY

The *Woolgoolga to Ballina project EIS Working Paper: Biodiversity (W2BPA 2012b)* identified the potential biodiversity impacts of the project to be:

- Loss of vegetation, threatened species and wildlife habitat
- Wildlife mortality during construction
- Edge effects and weeds
- Habitat fragmentation, barrier effects and wildlife mortality during operation
- Impacts on aquatic habitats, changed hydrology and fish passage.

To ensure a consistent approach to the mitigation, management and offsetting of biodiversity for the project, an overarching management strategy was developed as part of the EIS, comprised of: a Mitigation Strategy, a Monitoring Strategy and an Offset Strategy. Table 5 identifies each of the vegetation and landscape design principles for connectivity measures as outlined in the EIS Biodiversity Connectivity Strategy, and where they are addressed in this report.

2.5 COMPLIANCE WITH THREATENED SPECIES MANAGEMENT PLANS

Threatened species management plans outline specific mitigation measures and monitoring identified for target threatened species before work, during major work and operation of the project.

The Threatened Species Management Plans for the Woolgoolga to Ballina project, and their applicability to the section, are outlined in Table 4.

This UDLP addresses the mitigation measures related to landscape and urban design stipulated in the threatened species management plans that are applicable to the area between Richmond River to Ballina (Sections 10 and 11). Appendix A provides further details about compliance with specific urban design and landscape requirements that are included in these management plans.

Table 3: Compliance with EIS urban design and landscape requirements

EIS COMPLIANCE	DOCUMENT
11.4.1 Urban Design and Landscape Strategy <ul style="list-style-type: none">▪ Retain the strong contrasting experience of driving through forest and open agricultural land as a feature of the Pacific Highway experience▪ Acknowledge and highlight the small and medium sized coastal towns that mark progress along the coastal Pacific Highway journey▪ Highlight numerous minor and major creek and river crossings across the Pacific Highway journey over the coastal floodplains Acknowledge and preserve the natural and cultural landscapes and landmarks identified along the full length of the Pacific Highway journey.	Chapter 6 and 7
Viewpoint mitigation measures for EIS viewpoints located in Sections 10 and 11	Chapter 7

Table 4: Threatened Species Management Plans for the Woolgoolga to Ballina project, and their applicability to Sections 10 and 11

THREATENED SPECIES MANAGEMENT PLAN	APPLICABLE TO RICHMOND RIVER TO BALLINA
<i>Coastal Emu Management Plan</i> (Roads and Maritime, 2015)	No
<i>Koala Management Plan</i> (Roads and Maritime, 2016)	Yes
<i>Rainforest Communities and Threatened Rainforest Plants Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Flora Management</i> (Roads and Maritime, 2015)	Yes
<i>Flora Translocation Strategy</i> (Roads and Maritime, 2016)	Yes
<i>Threatened Fish Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Frog Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Glider Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Invertebrate Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Mammal Management Plan</i> (Roads and Maritime, 2015)	Yes

Table 5: Vegetation and landscape design principles for connectivity measures identified in the Biodiversity Connectivity Strategy

DESIGN PRINCIPLE - VEGETATION/LANDSCAPING	ADDRESSED FOR PORTION BETWEEN RICHMOND RIVER TO BALLINA
Riparian corridors to be protected during construction works and any areas of riparian vegetation impacted by construction are to be rehabilitated to a pre-determined benchmark condition to be specified in the CEMP.	Chapter 8.6 Drainage and Water Quality
Revegetation actions around crossing structures should consider the height and density of vegetation so as not to screen the structure from view of relevant fauna, but also aim to provide some cover for fauna approaching and exiting the structure	Chapter 8.7 Fauna Crossings
Roadside plantings in emu crossing zones should not be within the first 40 metres of the road unless there is fauna exclusion fencing in place or as part of the exclusion barrier discussed above. In particular, common landscape species such as <i>Gahnia</i> , <i>Lomandra</i> and <i>Dianella</i> spp. represent food plants for emus and may attract them to the road edge and should avoid being planted.	No – No emu habitat identified in Section 10 and 11
Plantings under bridges in emu crossing zones including the approaches to the crossing are to use grasses or low ground covers and avoid dense plantings of trees including low trees such as <i>Acacia</i> or <i>Casuarina</i> . This is to leave the opening clear. Ground cover crops such as soybean and oats or rye grass could be used on disturbed ground around the approaches to the bridge to attract emus to the crossing zone	No – No emu habitat identified in Section 10 and 11
Plantings around dedicated and combined underpasses is to ensure that entrances to the structure do not obscure the structure and provide a clear line of sight	Chapter 8.7 Fauna Crossings
It is important for landscaping at entrances not to intrude / shadow the window of the entrances	Chapter 8.7 Fauna Crossings
Landscaping should use locally indigenous species and should target key fauna food resources to encourage usage either side of the structure and thus provide the habitat linkage to the structure.	Chapter 8.4 Revegetation

CHAPTER 3

CONSULTATION

3.1 OVERVIEW

A community and stakeholder engagement strategy was developed and implemented to support the progress of the Woolgoolga to Ballina Pacific Highway upgrade with relation to the draft urban design and landscape plan. The strategy ensured appropriate levels of consultation with key stakeholders to manage expectations and minimise risk.

The strategy outlined the:

- Level of engagement to be carried out
- Key stakeholders
- Potential issues and mitigation activities
- Consultation and communication activities to ensure effective, relevant and timely input from stakeholders and the community
- Communication protocols and responsibilities within the project team
- Evaluation activities.

The strategy recommended a co-hosted consultation approach incorporating the Urban Design and Landscape Plan alongside the proposed design refinements for consideration as part of the detailed design development process.

The desired outcomes of the stakeholder engagement and consultation included:

- Stakeholder understanding of the detailed design and urban design and landscape development processes
- Stakeholders making submissions which are captured and fed into the development of the final urban design and landscape management plan
- Development of comprehensive final urban design and landscape plans, which will guide and support major planning and investment decisions
- Early stakeholder participation in the planning of the urban design and landscape planning, which will encourage ongoing interest and commitment to its development and implementation
- Risk minimisation, and minimisation of negative media publication.

3.2 COMMUNITY CONSULTATION

Community feedback was sought on the draft urban design and landscape plan. The community was able to provide feedback from 1 August to 29 August 2016. Consultation activities during this time involved:

- Sending more than 500 letters to stakeholders with property within 750 meters of the project alignment
- Distributing a community update to more than 20,000 residents
- Staffed displays at 11 locations
- Static displays at 27 locations
- Updating the project website with the draft urban design and landscape management plans, community update as well as an online survey and collaborative mapping tool to capture feedback
- Emailing more than 1000 stakeholders registered in the project database
- Advertising in four local newspapers.

Community members and key stakeholders were encouraged to provide their feedback at staffed displays, by completing feedback surveys or providing a response by mail, email or phone. Feedback on the plans was accepted until 5.00pm, Monday 29 August 2016.

The community also provided feedback on proposed design refinements. These issues have been addressed in the proposed design refinement community consultation report, which will be made publicly available on the project website.

3.2.1 RICHMOND RIVER TO PIMLICO SECTIONS 10 AND 11

Three written responses were received, key issues raised include:

- Visual screening
- Vegetation type
- Koala management
- Visual amenity
- Community and stakeholder engagement.

Please refer to Appendix D the Woolgoolga to Ballina, Pacific Highway upgrade Community Consultation Report for the Urban Design and Landscape Plans, February 2017 for further information and the location of the responses in this report.

3.3 STAKEHOLDER CONSULTATION

Agency stakeholders identified in the Woolgoolga to Ballina Communications and Stakeholder Engagement Strategy were advised the draft UDLP would be available for review and comment.

Stakeholders who will be provided the UDLP to review include:

- NSW Environment Protection Agency
- NSW Department of Primary Industries – Fisheries
- Ballina Shire Council.

Please note a formal response from Ballina Shire Council is still pending although the UDLP was submitted in August 2016. We have informal response but no formal response.

Key issues raised during this review were:

- Early installation of riparian rehabilitation and landscape treatments
- Support for soft scour treatments in creek areas
- Support for locating fauna fencing as close to highway pavement as possible.

Further details of the issues raised and responses are included in Appendix E of this report.

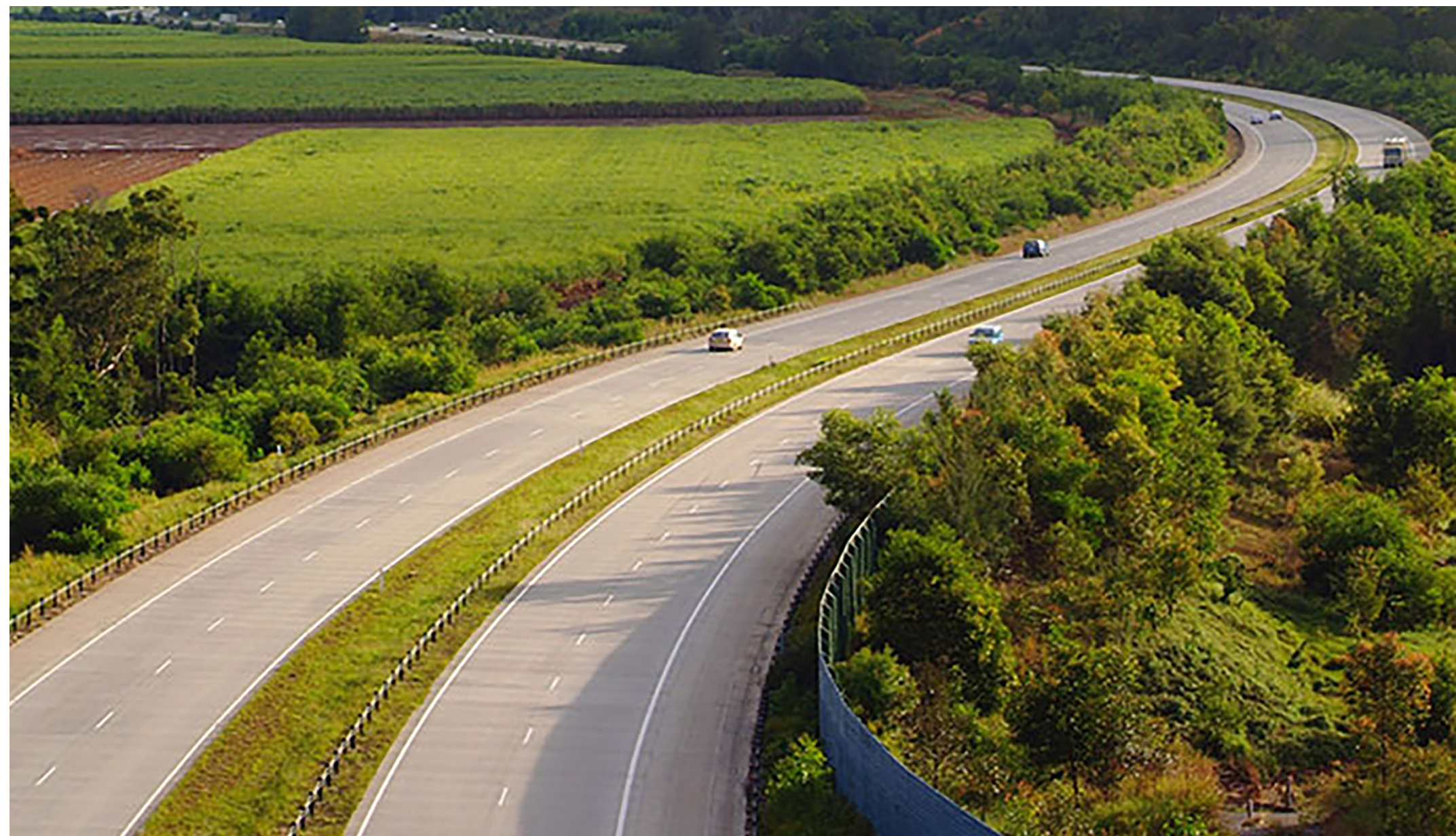


Figure 10: Flowing alignment of the Pacific Highway - Yelgun to Chinderah demonstrates the vision

CHAPTER 4

PACIFIC HIGHWAY URBAN DESIGN, LANDSCAPE OBJECTIVES AND PRINCIPLES

4.1 VISION

The *Pacific Highway Urban Design Framework* (Roads and Maritime 2013) has established the following vision for the Pacific Highway:

'The upgrade should be a sweeping, green highway providing panoramic views to the Great Dividing Range and the forests, farmlands and coastline of the Pacific Ocean; sensitively designed to fit into the landscape and be unobtrusive; and characterised by simple and refined road infrastructure.'

4.2 PACIFIC HIGHWAY URBAN DESIGN OBJECTIVES

In fulfilling this vision a number of key objectives have been developed by Roads and Maritime:

- Provide a flowing road alignment that is responsive and integrated with the landscape
- Provide a well vegetated, natural road reserve
- Provide an enjoyable, interesting highway
- Value the communities and towns along the road
- Provide consistency-with-variety in road elements
- Provide a simplified and unobtrusive road design.

4.3 URBAN DESIGN AND LANDSCAPE PRINCIPLES

Four key landscape and urban design principles were outlined in the project EIS :

- Retain the strong contrasting experience of driving through forest and open agricultural land as a feature of the Pacific Highway experience
- Acknowledge and celebrate the small and medium sized coastal towns that mark progress along the coastal Pacific Highway journey
- Highlight and celebrate the numerous minor and major creek and river crossings that punctuate the Pacific Highway journey across the coastal floodplains
- Acknowledge and preserve the natural and cultural landscapes and landmarks identified along the full length of the Pacific Highway journey.

To achieve these strategies, the project would incorporate urban design and landscape key objectives and design principles that are consistent with the key Roads and Maritime guiding documents – *Beyond the Pavement* (2014) and *Pacific Highway Urban Design Framework* (2013).

4.4 URBAN DESIGN AND LANDSCAPE STRATEGY

The project *EIS Working Paper Urban Design Report, Landscape Character and Visual Impact Assessment* (Hassell, 2012) outlined typical landscape and urban design strategies to be adopted for the length of the project.

The strategies were incorporated into the concept design and recommended mitigation strategies for the project at EIS stage and have been carried through the detailed design for the UDLP.

4.4.1 PROJECT WIDE LANDSCAPE AND URBAN DESIGN STRATEGIES

The project wide landscape and urban design strategies outlined in the project *EIS Working Paper Urban Design Report, Landscape Character and Visual Impact Assessment* (Hassell, 2012) are depicted in Figure 11 as follows:

Built environment, landscape character and land use

- Highlight major towns on-route with distinctive landscape treatments
- Highlight creek and river crossings.

Views

- Ensure open or filtered views to pastureland are retained
- Provide screen planting on batters to specifically mitigate the visual impact of the project to adjacent residences.

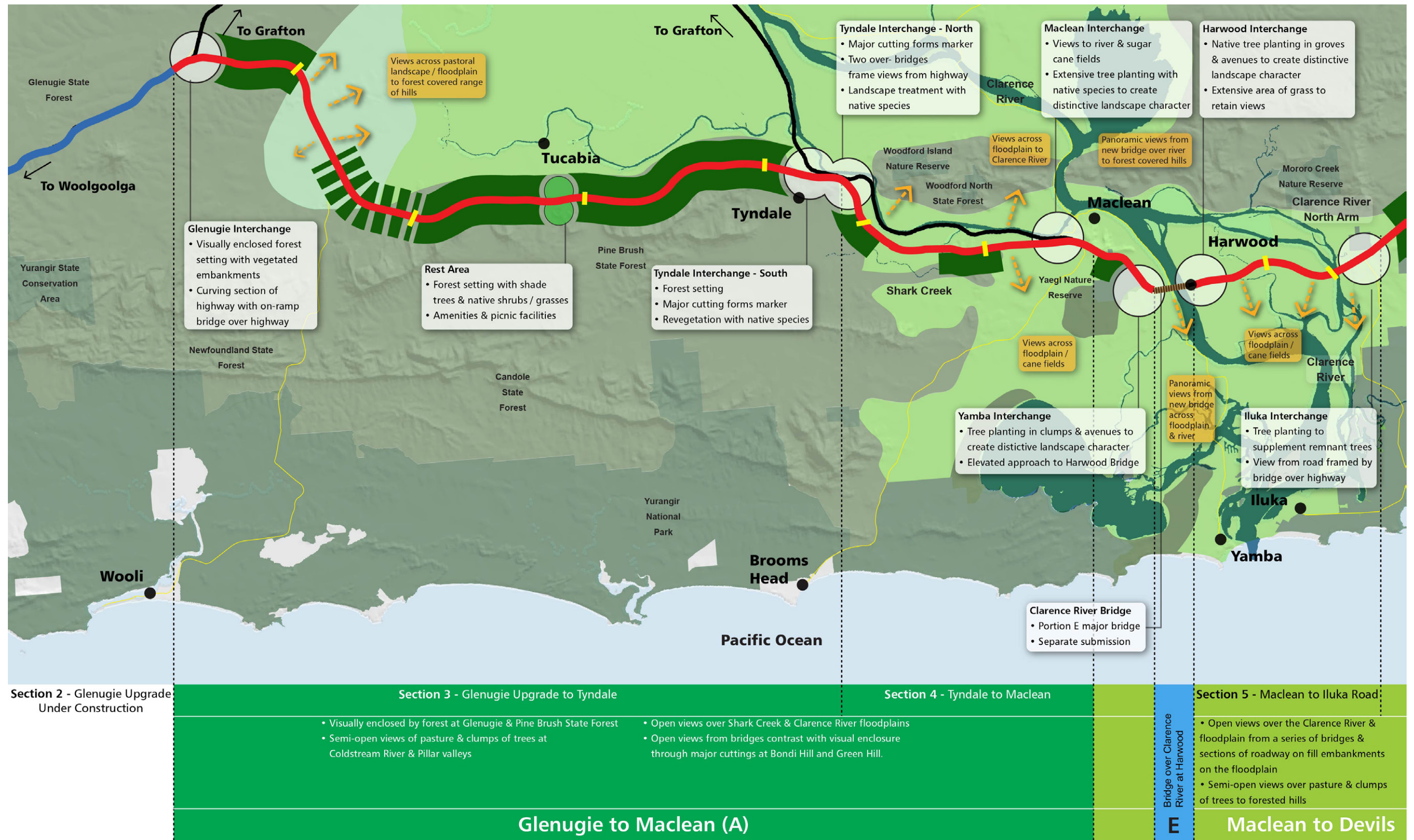
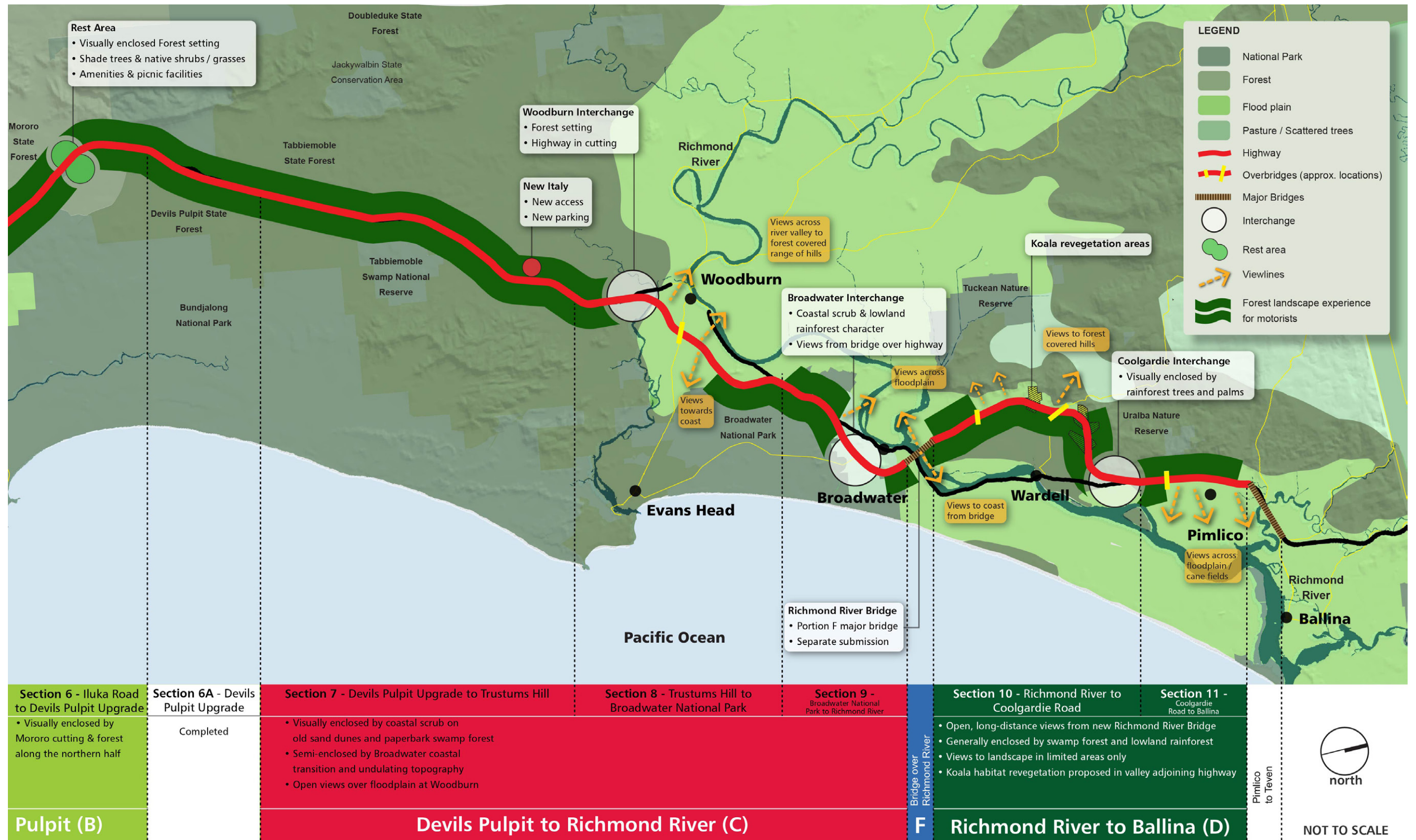


Figure 11: The Strategy Plan for the Woolgoolga to Ballina Pacific Highway upgrade



Ecology

- Reinstatement of disturbed areas of riparian vegetation where possible and comply with core riparian zone requirements
- Maximise riparian vegetation under creek crossings to encourage wildlife connectivity along creek lines
- Use local and endemic species on batters to complement existing vegetation patterns and reduce the visual impact of earthworks. This is particularly important for disturbed areas on prominent ridge lines
- Adhere also to ecological requirements outlined in specialist reporting.

Landscape treatment

- Install large size plant stock at interchanges and near townships to maximise impact and mitigation at project outset
- Lay back the top batter of cuttings and tie back into the existing landform. Revegetate the top of the profile to blend with the existing landscape
- Where competent rock is encountered, steepen batter grades (1V:0.25H) and expose rock faces
- Avoid use of shotcrete at all cutting locations. If shotcrete is to be used at cutting locations then any treatments and pigmentation must blend with the surrounding vegetation and rock setting
- Provide frangible planting within clear zones
- Where possible reinstate agricultural land uses
- Provide functional and safe rest areas with high landscape amenity
- Provide planting in the medians to reduce headlight glare.

Built elements

- Minimising both the use and scale of noise walls and ensuring they are recessive in the landscape, or transparent, where they are required
- Minimise the road furniture that is required in the project and ensure that road furniture proposed is an integrated and cohesive set of elements
- All materials and finishes of the built infrastructure are to be of high quality for durability and appearance.

4.4.2 RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11) SPECIFIC LANDSCAPE AND URBAN DESIGN STRATEGIES

In addition to the overarching urban design objectives for the Pacific Highway, supplementary objectives for the Woolgoolga to Ballina upgrade are outlined within the EIS Chapter 11 - *Urban Design, Landscape Character and Visual Impact Assessment* (Hassell, 2012). These are used as a basis for the development of objectives specific for Richmond River to Ballina (Sections 10 - 11) as follows:

Objective 1: To ensure that the town of Wardell is acknowledged on the Pacific Highway

Design Principles:

- 1) The landscape design of the Coolgardie interchange provides a distinctive treatment that is place specific, which adds to the suite of legibility indicators and decision points along the corridor
- 2) Elements of the final interchange design are introduced within the alignment on approach to the interchange providing a stronger connection with the township.

Objective 2: To provide consistency in design language through the overall Woolgoolga to Ballina upgrade and the Pacific Highway, and at the same time provide interest through location specific treatments where appropriate

Design Principles:

- 1) Landscape treatments are designed to reflect the character of the precinct through which the project passes retaining open landscapes where traversing pasture and crop lands, and enclosed landscape treatments where passing through forests
- 2) Interchanges are signalled in the design response both at the interchange and also on its approach reinforcing the signage strategy for these elements
- 3) Landscape palettes while specific to the area are co-ordinated with other Sections to provide consistency in building techniques.

Objective 3: To ensure visual impact to rural houses are minimised

Design Principles:

- 1) Retention of existing vegetation in and around residential properties next to the alignment is maximised
- 2) Focused screen planting is provided where a direct impact is experienced either as part of property work or as part of the overall alignment design
- 3) Shrub as well as tree planting is utilised as a means of achieving screen planting in order to ensure a connection is still maintained to the adjoining landscape context from the alignment.

Objective 4: To maintain key views from the highway

Design Principles:

- 1) Landscape treatments respond to the existing view opportunities, reinforcing the sense of enclosure or responding to panoramic or focused views
- 2) Views across the floodplain at Pimlico are emphasised to highlight the interface between the mountain ranges and the flat of the floodplain.

Objective 5: To ensure major cut batters blend with surrounding landscape

Design Principles:

- 1) Transitional slopes are provided at the start and end of cuttings to ensure an integrated profile
- 2) Rounding to the top of cuttings is provided so a smooth gradual interface is achieved
- 3) If vertical cuttings are used planting is provided at the base of cut to soften the interface.

In delivering these objectives, it is a project requirement to be consistent with the intentions, requirements and approach of the EIS and Submissions Reports/Preferred Infrastructure Report to achieve:

- Building approval from DP&E on-program
- Building deadlines
- Efficient effective landscape outcomes.

CHAPTER 5

CONTEXTUAL ANALYSIS FOR RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11)

5.1 CHARACTER PRECINCTS

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 are located between Broadwater and Pimlico, is bounded by the Richmond River to the east and Blackwall Range to the west. It sits within the floodplain of the Richmond River which extends parallel to the project in a north-south direction.

These Sections dissect predominantly rural and agricultural land used for grazing and agricultural purposes. They are interrupted by dense areas of forest, rising topography and the wide sweeping form of the Richmond River. The settlements within the area predominantly consist of scattered and small clusters of houses, and a number of small towns which include Broadwater and Wardell with populations around 500-700 people. Broadwater to the south of Richmond River to Coolgardie Road - Section 10 is the centre of the sugar industry and its sugar mill on the Pacific Highway provides a key landmark to the area. Wardell is a small, picturesque town along the existing Pacific Highway and Richmond River. It has a local store, a pub and a few streets with large Fig trees (*Ficus microcarpa* 'Hillii'), and is bypassed by Richmond River to Coolgardie Road - Section 10 works.

As part of the approval requirement (in D20) the design is required to respond to local values and characteristics. This chapter of the UDLP defines these values which are then used to inform the design response for the project. Landscape Character is defined as, 'The combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place' in the Guideline for Landscape Character and Visual Impact Assessment (Roads and Maritime, 2013).

The EIS identified a total of 54 landscape character precincts for the entire project. Within the region from Richmond River to Ballina (Sections 10 and 11), eight precincts were identified. These are illustrated in Figure 12 and listed below:

RICHMOND RIVER TO COOLGARDIE ROAD - SECTION 10

- 47 - Tuckean Broadwater
- 48 - Cabbage Tree Island and floodplain
- 49 - Bagotville floodplain & Lumleys Hill
- 50 - Bingal Creek
- 51 - Wardell township
- 52 - Blackwall Range

COOLGARDIE ROAD TO BALLINA - SECTION 11

- 52 - Blackwall Range
- 53 - Pimlico
- 54 - Emigrant Creek

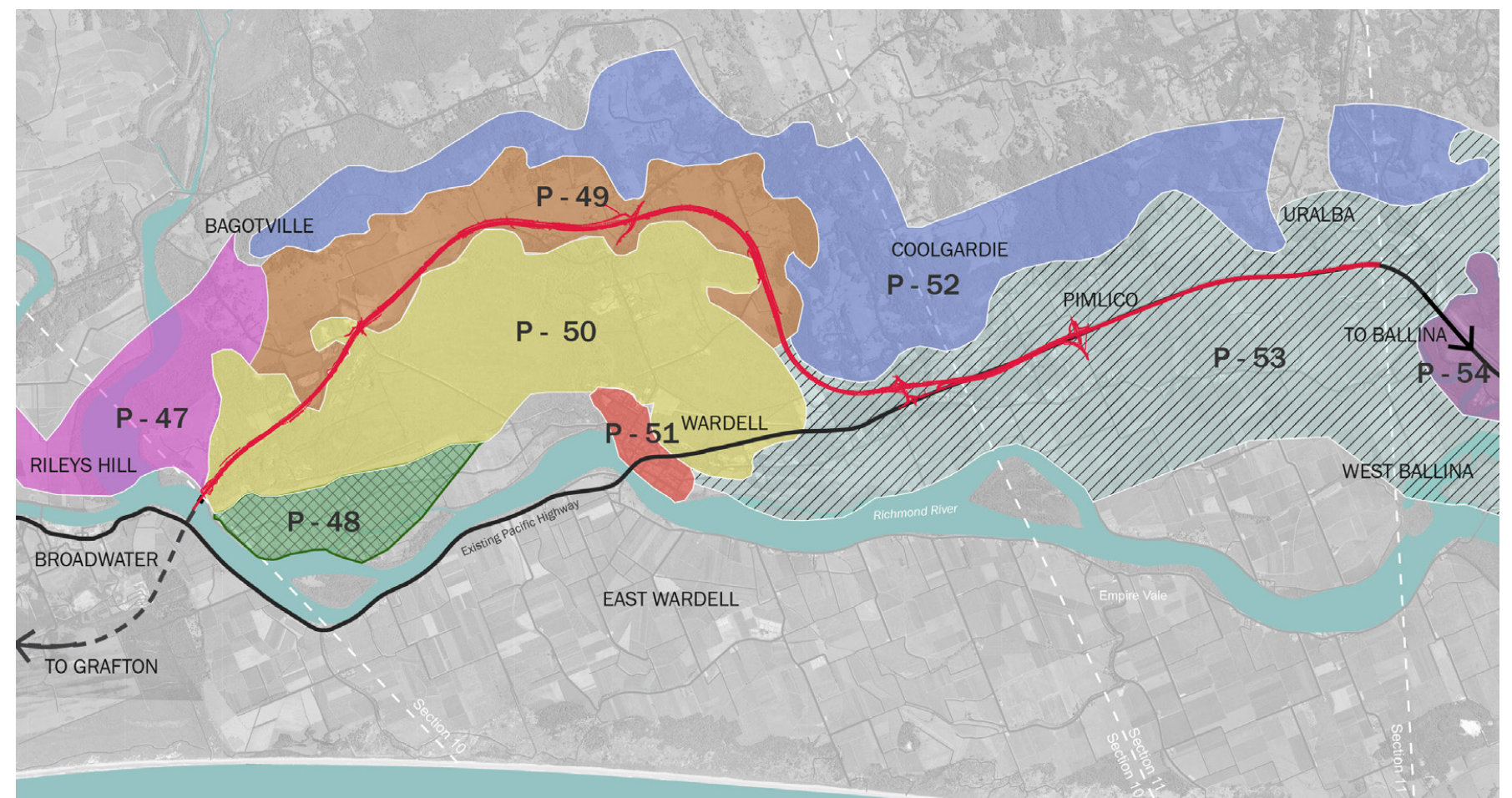


Figure 12: Richmond River to Ballina (Sections 10 and 11) Landscape Character precincts

Key

Section 10 - Richmond River to Coolgardie Road

- P - 47 Tuckean Broadwater
- P - 48 Cabbage Tree Island and floodplain
- P - 49 Bagotville floodplain & Lumleys Hill
- P - 50 Bingal Creek
- P - 51 Wardell township
- P - 52 Blackwall Range

Section 11 - Coolgardie Road to Ballina

- P - 52 Blackwall Range
- P - 53 Pimlico
- P - 54 Emigrant Creek

- Pacific Highway upgrade Richmond River to Ballina (Sections 10 and 11)
- Existing Pacific Highway

5.1.1 CHARACTER PRECINCT 37 - TUCKEAN BROADWATER

This precinct, comprised of an area of the floodplain of the Richmond River, is visually contained by three dominant hills, including part of the Blackwall Mountain Range and Alleys Hill. Dense mangroves along the water's edge contain views beyond the immediate vicinity limiting potential views to the proposal and the sugarcane beyond. An abrupt and strong edge is formed between the sugarcane landscape of the floodplain and the heathland vegetation to the west associated with the elevated lands of the Blackwall Mountain Range and Alleys Hill.

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities
- Address topographic impacts and integrate alignment with landform.

5.1.2 CHARACTER PRECINCT 48 - CABBAGE TREE ISLAND AND FLOODPLAIN

Located within the Richmond River, this precinct occurs east of the alignment and is visually disconnected from it by the Bingal Creek woodland and ridge. It occurs on the floodplain of the Richmond River which physically divides the precinct. Despite the rivers presence it is not the visually dominant element. This is largely due to limited views of the river from within the precinct where dense mangroves screen the water on the western side, and on the eastern side intermittent views are soon lost inland to views of sugarcane.

DESIGN CONSIDERATIONS

This precinct is located beyond the alignment with no immediate interface. No specific actions are required to address impacts on the character of the precinct.



Figure 13: Aerial view of the Richmond River and floodplain within Character Precinct 48, looking west

5.1.3 CHARACTER PRECINCT 49 - BAGOTVILLE FLOODPLAIN & LUMLEYS HILL

Located to the west of the proposed alignment and the Bingal Creek Woodland, it runs from Old Bagotville Road through to just north of Lumleys Road. This precinct combines elements of the lower foothills of the Blackwall Mountain Range and the agrarian floodplains. The rolling terrain emphasises the transition from the mountains to the floodplain. The dense woodland of the hills is offset by the lush cane fields and open grasslands of the valley and creates an attractive, high quality landscape.

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities
- Retain views across valley to Blackwall Range
- Respond to isolated dwellings by screening alignment and controlling views.

5.1.4 CHARACTER PRECINCT 50 - BINGAL CREEK

Located predominantly to the east of the approved alignment, this precinct consists of a raised vegetated ridge characterised by diverse vegetation communities which range from dense mature forest to Banksia heath forest (Figure 13 to 20) that have experienced limited disturbance. This is a scenic undulating landform with an enclosed landscape character.

A number of shallow quarries are located just off Old Bagotville Road which provide a point of disturbance within the otherwise intact body of this zone. The approved alignment of the road passes through this break in the canopy. Some distant views to Blackwall Range can be gained from the margins and clearings on the higher points within the forested landscape.



Figure 14: View of low grazing land and backdrop of Wardell Mountain from Thurgates Lane within Character Precinct 49

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities
- Revegetate quarried sites, acquired as part of the project works
- Maintain and reinforce forested character of precinct.

5.1.5 CHARACTER PRECINCT 51 - WARDELL TOWNSHIP

This precinct is remote from the approved road alignment, being located to its east, and is defined by the extent of urban development of Wardell. The township is divided by the existing Pacific Highway and perhaps because of this historic division there is no one central core to the township. The post office, police station and other emergency services are separate from shops



Figure 15: View of edge heathy open forest typical of central section of Precinct 50



Figure 16: Main street of Wardell with hotel and feature Fig trees in the foreground and Richmond River beyond, Character Precinct 51

and other commercial/retail outlets. To its west the Bingal Creek Woodland defines its limits whereas to the north, forest and sugarcane intermingle creating an informal edge to its limits. The heritage listed Richmond River Bridge on the highway is a landmark within the town as well as a visual marker on the highway.

DESIGN CONSIDERATIONS

This precinct is located beyond the alignment with no immediate interface. Despite this it is the main urban centre adjoining the corridor which should be captured in the design.

- The design of Coolgardie interchange should signal the entrance into Wardell
- Planting design should capture the landscape character or landscape elements of Wardell
- Respond to adjoining vegetation communities.



Figure 17: Blackwall Mountain range within Character Precinct 52 in the background and the sugarcane fields of Character Precinct 53 in the foreground



Figure 18: Sugarcane fields within Character Precinct 53

5.1.6 CHARACTER PRECINCT 52 - BLACKWALL RANGE

This precinct is located to the west of the alignment, and extends along its length within Richmond River to Ballina (Sections 10 and 11) and is defined by the Blackwall Range. The Blackwall Range forms a clear and distinct limit to the visual catchment transitioning from the floodplain of the valley to steep, wooded slopes. The rolling terrain emphasises the transition from the mountains to the floodplain. The dense woodland of the hills is offset by the lush cane fields and creates an attractive, high quality landscape. This precinct is technically beyond the corridor but within its view catchment.

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities
- Retain views across valley to Blackwall Range where not impacting properties
- Close views to isolated dwellings by providing screening along alignment and controlling views.



Figure 19: Emigrant Creek within Character Precinct 54

5.1.7 CHARACTER PRECINCT 53 - PIMLICO

This character precinct, part of Coolgardie Road to Ballina - Section 11, dominates the character and feel of this end of the corridor. Its character is defined by the land-uses of the Richmond River, which are dominated by the sugarcane industry. These fields create an attractive high quality landscape which experiences seasonal change with the harvesting of the crops. The landscape, part of the floodplain is flat to slightly undulating terrain, with the ridge of the Blackwall Range located to the west of the alignment (Figure 17). The current alignment of the highway provides expansive views across the floodplain. Isolated houses are located both on the floodplain and within the foot slopes and tops of the adjoining ridgelines.

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities, in particular the agricultural focus of the floodplain
- Close views to Blackwall Range to screen properties. Respond to isolated dwellings by screening alignment and controlling views.

5.1.8 CHARACTER PRECINCT 54 - EMIGRANT CREEK

Located at the northern most end of Coolgardie Road to Ballina - Section 11 and associated with the Pimlico to Teven Works, Emigrant Creek is characterised by the winding path of the creek, which feeds into the Richmond River. The precinct is defined by the heavily vegetated edges of the Creek, which form a transitional landscape between the extensive floodplain of the Richmond River and the township of Ballina.

DESIGN CONSIDERATIONS

This precinct is located beyond the alignment with no immediate interface. No specific actions are required to address impacts on the character of the precinct.

5.2 LAND USE AND COMMUNITIES

5.2.1 RURAL LAND

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 traverses mainly rural land, which is used for either grazing or agricultural purposes. The southern region of the alignment, Richmond River to Coolgardie Road - Section 10, intersects extensive grazing land, associated with dairy farming and beef production.

The agricultural land largely occurs in the northern region, Coolgardie Road to Ballina - Section 11, and is generally used for sugar production. There are also some small parcels of land in this area being used for horticultural purposes such as avocado, fruit, nuts, coffee and herbal plant production. This crop and horticultural land according to the *Northern Rivers Farmland Protection Project* (Department of Primary Industries, 2005) is identified as regionally significant farmland. Additional land uses close to Richmond River to Ballina (Sections 10 and 11) include extensive forested areas, which although not zoned, comprise land for environmental conservation.

5.2.2 URBAN SETTLEMENT

Wardell is the largest urban settlement between Richmond River to Ballina (Sections 10 and 11), located on the banks of the Richmond River with an approximate population of 650 (Australian Bureau of Statistics, 2011). It has a village character with largely single storey, low density houses and a large number of open space areas for public recreation. The new alignment will bypass Wardell, which will help to improve the amenity of the town by reducing traffic noise and improving local air quality.

Outside of Wardell, there are a number of scattered rural properties located near the project and are generally single storey houses on large blocks ranging from one acre to 100 hectares. There are clusters of houses along Wardell Road, Coolgardie Road and Pimlico Road.

There is an Aboriginal community on Cabbage Tree Island affiliated with the Bundjalung people. It has existed since the 1880s where the community was self-sufficient before it became a reserve and later a station. Today the island is home to a number of families, a school and areas of agricultural land primarily used for sugarcane production.

Furthermore, the project impacts around 10 hectares of land currently used for a quarry, extracting shale (sand) near Old Bagotville Road (NSW Roads and Maritime, 2012).

5.2.3 FUTURE DEVELOPMENT

There are no urban release areas identified for future residential or employment land directly impacted by the project. However, the project will support future development across the region through improved access and connectivity to major regional centres such as Coffs Harbour and Ballina as well as areas outside of the region such as south east Queensland.

On a broader level, the *Northern Rivers Regional Plan 2013 - 2016* identifies continued population and economic growth within the region. The major growth industries include tourism, building and property development, wholesale and retail trade, recreational and cultural industries, and health and community services (Regional Development Australia - Northern Rivers NSW, 2013).

5.2.4 ROAD NETWORK

The Pacific Highway is the key transport link of the region connecting Sydney to Brisbane, as well as local residents to Ballina and Byron Bay, neighbouring towns and places of work. After the completion of Richmond River to Ballina (Sections 10 and 11), accessibility and connectivity of the region will be improved. Within the area from Coolgardie Road to Ballina - Section 11, direct access from the highway to some existing local roads will be removed resulting in local residents using the Coolgardie interchange to access these local roads.

5.2.5 PUBLIC TRANSPORT

A number of regional, local and school bus services operate in the area. Regional buses also operate between Sydney and Brisbane via the Pacific

Highway. There are also bus connections to the railway in Casino operating seven days a week. Two school bus services operate during the week and a local bus route 660 connecting Broadwater to Ballina via Wardell along the Pacific Highway. Furthermore, there is a daily bus service from Cabbage Tree Island to Ballina.

One bus stop within Richmond River to Coolgardie Road - Section 10, will be affected due to its proximity to the building site, therefore, will require relocation after consultation with the bus operator.

After completion of the alignment from Richmond River to Ballina (Sections 10 and 11), it is anticipated the bus operators will update their bus services to use the upgraded Pacific Highway.

5.2.6 CYCLE AND PEDESTRIAN PATHS

There are a number of existing cycle and pedestrian paths within Ballina. In the rural areas, close to the project area, there is an existing on-road cycle path along Pacific Highway though Broadwater and Wardell, which extends almost to Pimlico. There are a number of Roads and Maritime planned cycle paths connecting to the existing paths along Pacific Highway to Ballina and Broadwater.

After the completion of Richmond River to Ballina (Sections 10 and 11), pedestrian and cyclist access and connectivity within Wardell will be improved due traffic separation resulting in a safer cyclist and pedestrian friendly environment.

DESIGN CONSIDERATIONS - LAND USE AND COMMUNITIES

- The landscape design frames and reveals views to rural land uses
- The planting design on the approaches leading to Coolgardie interchange signal the entry to Wardell township.



Figure 20: View of low agricultural land from Lumley's Lane



Figure 21: Pacific Highway at Pimlico

5.3 LANDFORM AND HYDROLOGY

5.3.1 LANDFORM

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 traverses the largely flat topography of the coastal plain situated between the Coral Sea to the east and rising topography of the Blackwall Range to the west. The Richmond River and its floodplain run in a similar orientation to the alignment from south to north. Typically within the alignment the elevation varies from one to five metres above sea level with a number of small hills ranging from 10 – 55 metres predominately in the southern region between Broadwater and Wardell. The higher peaks occur on the Blackwall Range, to the west of the alignment, and range from 170 – 195 metres above sea level.

Slopes are predominantly flat to gently sloping (0 – 2 per cent), however, there are areas of gentle to moderate slopes, such as the foot slopes of the Blackwall Range.

DESIGN CONSIDERATIONS

- Fill embankments are the dominant form of the proposed highway structure. Care is taken to ensure these relate and integrate with the surrounding low lying lands through limiting height
- The design of cuttings is carefully considered and integrated with the form and character of the terrain and to ensure slopes are suitable for revegetation
- Bridges are predominantly underbridges and therefore do not present a visual constraint. Overbridges however occur at Coolgardie Road, Wardell Road and Whytes Lane and have considered their impact on views along the corridor.



Figure 22: The rising topography of the Blackwall Range

5.3.2 HYDROLOGY

The Richmond River and its tributaries dominate the hydrology of the area. Drainage lines generally flow in an easterly direction. There are a number of aquatic environments and receiving waters within the alignment. These include:

Richmond River to Coolgardie Road - Section 10

- Richmond River
- Tuckean Swamp
- Tuckean Broadwater including SEPP 14 Wetland No. 119
- Saltwater Creek
- Bingal Creek and its unnamed tributaries.

Coolgardie Road to Ballina - Section 11

- Randles Creek
- Emigrant Creek including SEPP 14 Wetland No. 95
- Duck Creek including SEPP 14 Wetland No. 108.

Much of the area associated with the floodplain is affected by a relatively high water table. Within this landscape precinct the area is dominated by sugarcane and its associated requirement for cane drains. The drainage design response needs to address the impact on cane drains in line with the overall design strategy for this element.



Figure 23: View of Richmond River and existing bridge at Wardell

DESIGN CONSIDERATIONS

- Flooding within the low lying lands is an issue which is addressed in the setting of the alignment level and the location and number of culverts and bridges
- Three dedicated creek and floodplain bridges and a further seven underbridges which function as both fauna underpasses and drainage structures are provided. These are supported by numerous culverts as part of the upgrade
- The design of the bridges and culverts addresses the hydraulic as well as the ecological requirement of the site
- The waterway crossing(s) is designed with reference to relevant guidelines (including *Why do fish need to cross the road? Fish passage requirements for water way crossings*, Fairfull and Witheridge, 2003) and where feasible and reasonable, is consistent with the guidelines specified under CoA B38. In doing so, the design of the diversions has sought to mimic the characteristics of the original waterway.



Figure 24: Richmond River near Broadwater, looking north

Key

Land uses

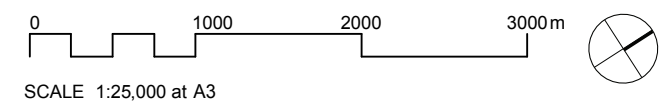
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- Rural/ Low Density Residential
- Tree and Shrub
- Cropping
- Grazing
- Wetland
- River and Drainage
- Conservation
- Horticulture
- Mining and Quarrying
- Special Category

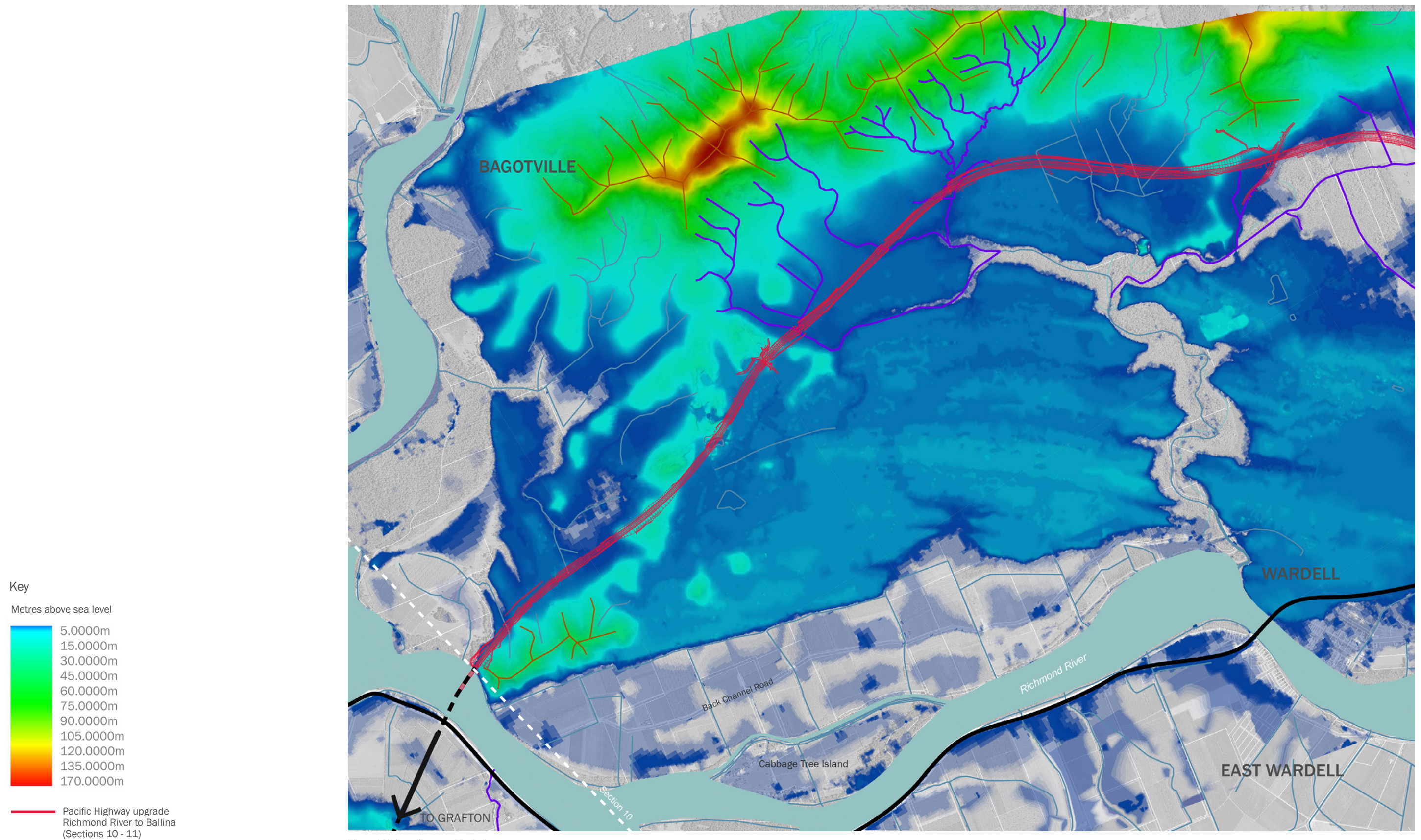
Transport

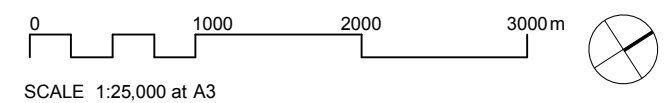
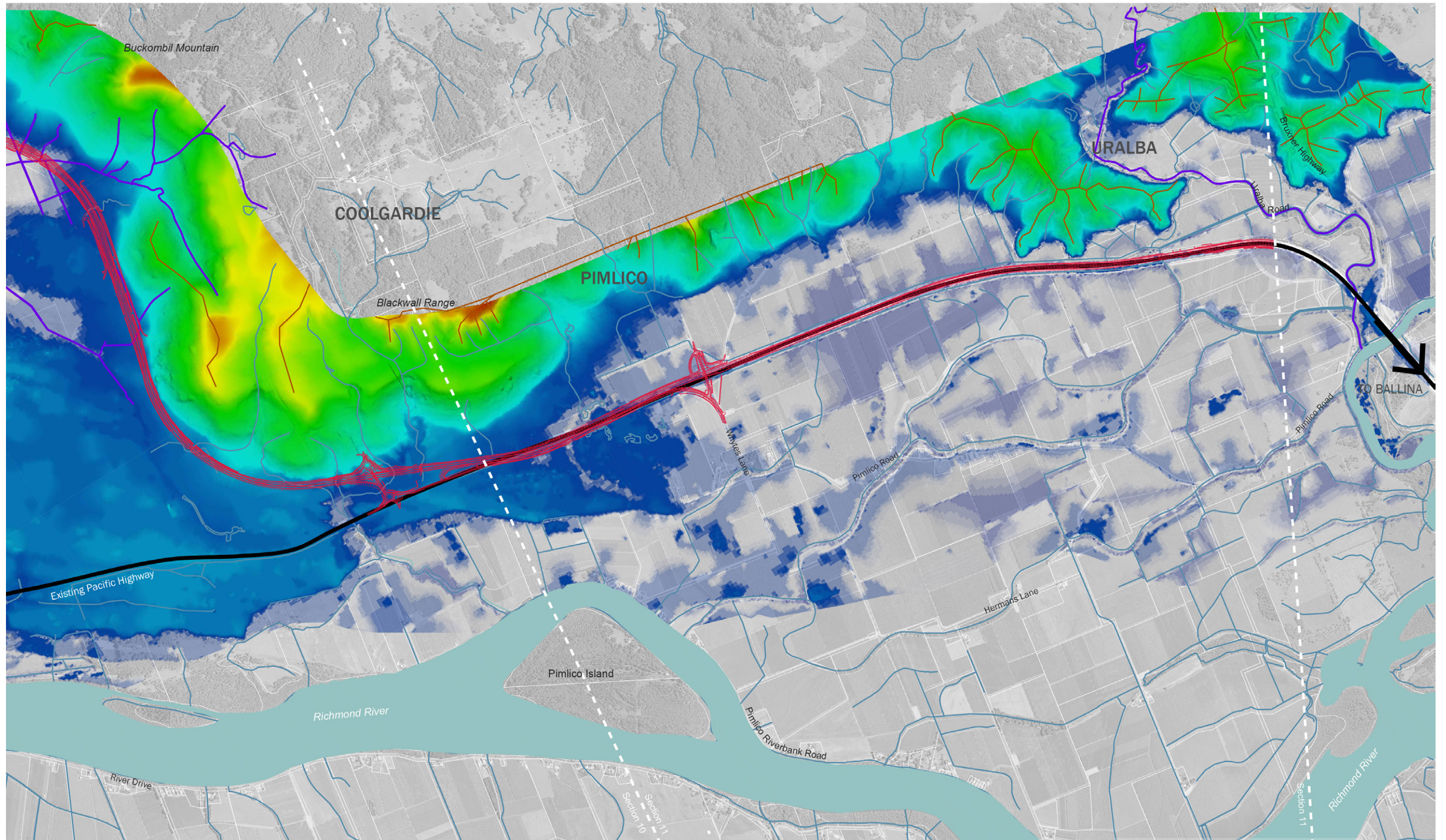
- Existing School Bus Route
- Existing Bus Route
- B Existing Bus Stop
- Existing Cycle Route
- Pacific Highway upgrade
Richmond River to Ballina
(Sections 10 - 11)



Figure 25: Existing land use and transport routes







5.4 FLORA AND FAUNA

5.4.1 FLORA

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 are located in the NSW North Coast Bioregion, which is one of the most ecologically diverse bioregions in NSW. The variety of ecosystems within the bioregion include sub-tropical and warm temperate rainforests, a wide variety of wet and dry sclerophyll eucalypt forests, heathland, paperbark swamps, and freshwater and estuarine wetlands and waterways. According to NSW Office of Environment and Heritage (OEH) it comprises more than 202 flora species. Of these, 108 are endangered, 89 are vulnerable and five are considered extinct in the bioregion (NSW NPWS, 2001).

The nine vegetation types that dominate Richmond River to Ballina (Sections 10 and 11) include:

- Dry sclerophyll open forests and woodlands
- Wet sclerophyll forests
- Swamp forests
- Floodplain forests
- Rainforests
- Freshwater wetlands
- Estuarine wetlands
- Heathlands
- Modified habitats.

These vegetation types are classified into 57 plant communities and 24 biometric vegetation types (Gibbons et al., 2008) based on the dominant canopy and understorey flora, landscape position and geographic location.

Of these communities seven are listed under the *Threatened Species Conservation Act 1995* and include:

- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin & South East Corner Bioregions
- Subtropical coastal floodplain forest of the NSW North Coast Bioregion
- 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
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Lowland Rainforest of Sub-tropical Australia
- Coast Cypress Pine shrubby open forest of the North Coast Bioregion.

The vegetation communities are summarised in Table 6.

There are a number of national parks and reserves located within the NSW North Coast Bioregion. These are managed by the NSW National Parks and Wildlife Service. There are four national parks and reserves within the general region of Richmond River to Ballina (Sections 10 and 11). All are beyond the project boundary but have representative samples of communities that occur within Richmond River to Ballina (Sections 10 and 11). These are identified in Table 7.

The vegetation from Richmond River to Ballina (Sections 10 and 11) is divided into seven fauna habitat types:

- Dry forest
- Wet and riparian forest and floodplain eucalypt habitat
- Swamp forest habitat
- Wetland habitat
- Wet and dry heath habitat
- Lowland Rainforest
- Cleared and modified habitats.

Dominant amongst these habitat types within Richmond River to Ballina (Sections 10 and 11) are – Wet and riparian forest and floodplain eucalypt habitat, Swamp forest, Dry forest, and Lowland Rainforest.

Seven threatened flora species listed under the TSC Act and EPBC Act have been confirmed as occurring within Richmond River to Ballina (Sections 10 and 11) and are detailed in Table 8.

Table 6: Summary of vegetation communities from Richmond River to Ballina (Sections 10 - 11)

VEGETATION COMMUNITY	LISTING		SECTION
	TSC ACT	EPBC ACT	
Swamp Mahogany Swamp Forest of the Coastal Lowlands of the North Coast	Swamp Sclerophyll Forest on Coastal Floodplains (Endangered)		10 and 11
Paperbark Swamp Forest of the Coastal Lowlands of the North Coast	Swamp Sclerophyll Forest on Coastal Floodplains (Endangered)		10
Swamp Oak Swamp Forest of the Coastal Lowlands of the North Coast	Swamp Oak Floodplain Forest of NSW North Coast (Endangered)		10
White Booyong – Fig Subtropical Rainforest of the North Coast	Lowland Rainforest on Coastal Floodplains (Endangered)	Lowland Rainforest of Subtropical Australia (Critically endangered)	10
Blackbean – Weeping Lilly Pilly Riparian Rainforest of the North Coast	Lowland Rainforest on Coastal Floodplains (Endangered)	Lowland Rainforest of Subtropical Australia (Critically endangered)	10
Forest Red Gum – Swamp Box	Subtropical Coastal floodplain Forest on Coastal Floodplains (Endangered)		10
Mangrove – Grey Mangrove Low Closed Forest of the NSW Coastal Bioregion*			10
Coastal Cypress Pine Shrubby Open Forest of the North Coast Bioregion	Coastal Cypress Pine Forest in NSW North Coast Bioregion (Endangered)		10
Blackbutt Grassy Open Forest of the Lower Clarence Valley of the North Coast			10

Note: TSC Act – NSW Threatened Species Conservation Act 1995

EPBC Act – Commonwealth Environment Protection and Biodiversity Conservation Act 1999

*Note: Protected as Marine Vegetation under Fisheries Management Act 1994



Figure 27: Lowland Rainforest community

Table 7: National Parks in proximity to Richmond River to Ballina (Sections 10 - 11)

PROJECT SECTION	NATIONAL PARK OR RESERVE NAME	DESCRIPTION	TOTAL AREA (HECTARES)	APPROXIMATE DISTANCE FROM PROJECT (KM)
10-11	Uralba Nature	Located to the west of the project just south of Ballina, on the Blackwall Range. The reserve protects remnants of sub-tropical rainforest known as 'Big Scrub' - State Heritage Significance	155	1
10-11	Victoria Park Nature Reserve	Located on the Alstonville Plateau to the west of the project/ Also a 'Big Scrub' remnant	17	4
10-11	Little Pimlico Island Nature Reserve	In the Richmond River west of Wardell, the reserve supports wetlands and littoral rainforest of state significance. It also contains rainforest elements representative of the 'Big Scrub' at their southern limit.	6	1.5
11	Richmond River Nature Reserve	Located east of Duck Creek, near Ballina, on the north facing bank of the Richmond River estuary. The reserve contains significant wetland and coastal vegetation communities that provide significant habitat for birds, including those protected under international conservation agreements	253	6.5

(Source: Roads and Maritime, 2012)

Table 8: Threatened flora species

PROJECT SECTION	SCIENTIFIC NAME	COMMON NAME	STATUS	DISTRIBUTION AND ABUNDANCE
10	<i>Arthraxon hispidus</i>	Hairy-joint Grass	Vulnerable (TSC Act) Vulnerable (EPBC Act)	Several large populations between Coolgardie Road and Lumley's Lane. The known area of occupation of the species is 20.8 hectares
10	<i>Archidendron hendersonii</i>	White Laceflower	Vulnerable (TSC Act)	Eleven individuals in subtropical rainforest north of Coolgardie Road
10	<i>Cryptocarya foetida</i>	Stinking Cryptocarya	Vulnerable (TSC Act) Vulnerable (EPBC Act)	A total of 17 individuals were confirmed in and around the project boundary in Section 10 north of Coolgardie Road.
10	<i>Endiandra hayesii</i>	Rusty Rose Walnut	Vulnerable (TSC Act) Vulnerable (EPBC Act)	Confirmed north of Coolgardie Road comprising a total of five larger individuals and three juveniles
10	<i>Endiandra muelleri subsp. bracteata</i>	Green-leaved Rose Walnut	Endangered (TSC Act)	Confirmed to the west of the project boundary at Maclean and in Section 10
10 + 11	<i>Macadamia tetraphylla</i>	Rough-shelled Bush Nut	Vulnerable (TSC Act)	Confirmed to the west of the project boundary at Maclean, in proximity to the project boundary
10	<i>Maundia triglochinoxoides</i>	Maundia	Vulnerable (TSC Act)	Several tributaries that cross the highway north of New Italy
10	<i>Oberonia titania</i>	Yellow Flowered King of the Fairies	Vulnerable (TSC Act)	14 individuals just beyond the boundary ch152,000 to 153,000 in Section 10

(Source: Roads and Maritime, 2012)



Figure 28: Eucalypt forest off Backchannel Road (Richmond River to Coolgardie Road - Section 10)

Key

General

- Pacific Highway upgrade
Richmond River to Ballina
(Sections 10 - 11)
- - - Project boundary
- ▨ Endangered Ecological Community (EEC)
- ▨ SEPP 14 Wetland

Vegetation Community

- ▨ Blackbutt - Pink Blackwood shrubby open forest of the coastal lowlands of the North Coast
- ▨ Blackbutt grassy open forest of the lower Clarence Valley of the North Coast
- ▨ Narrow-leaved Red Gum woodlands of the lowlands of the North Coast
- ▨ Paperbark swamp forest of the coastal lowlands of the North Coast
- ▨ Scribbly Gum - Needlebark Stringbark heathy open forest of the coastal lowlands of the North Coast
- ▨ Swamp Mahogany swamp forest of the coastal lowlands of the North Coast
- ▨ Tuckeroo - Riberry - Yellow Tulipwood littoral rainforest of the North Coast
- ▨ White Booyong - Fig subtropical rainforest of the North Coast
- ▨ Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregions

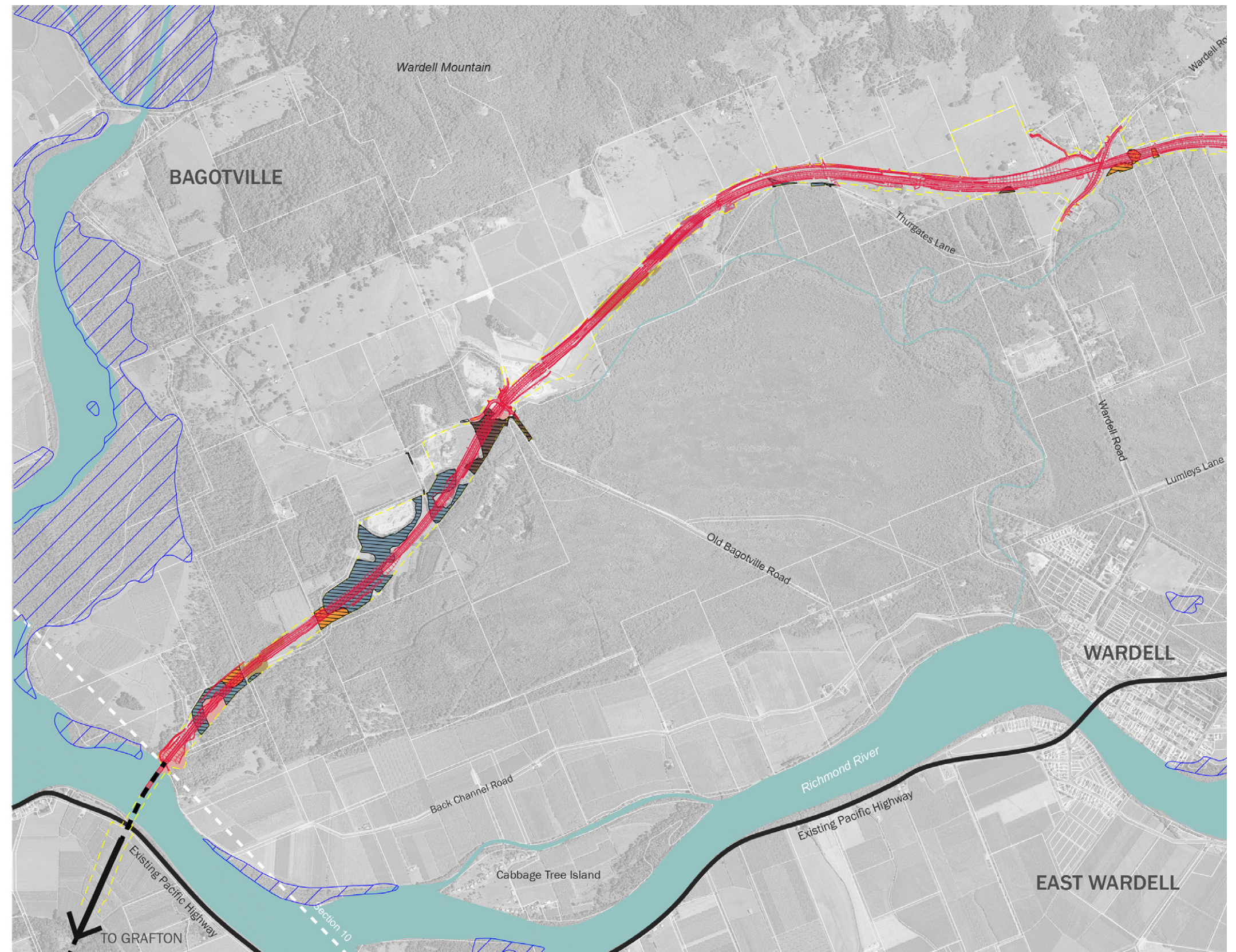
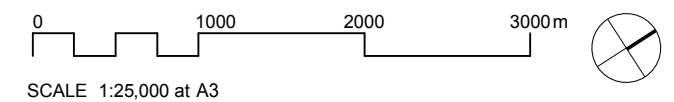
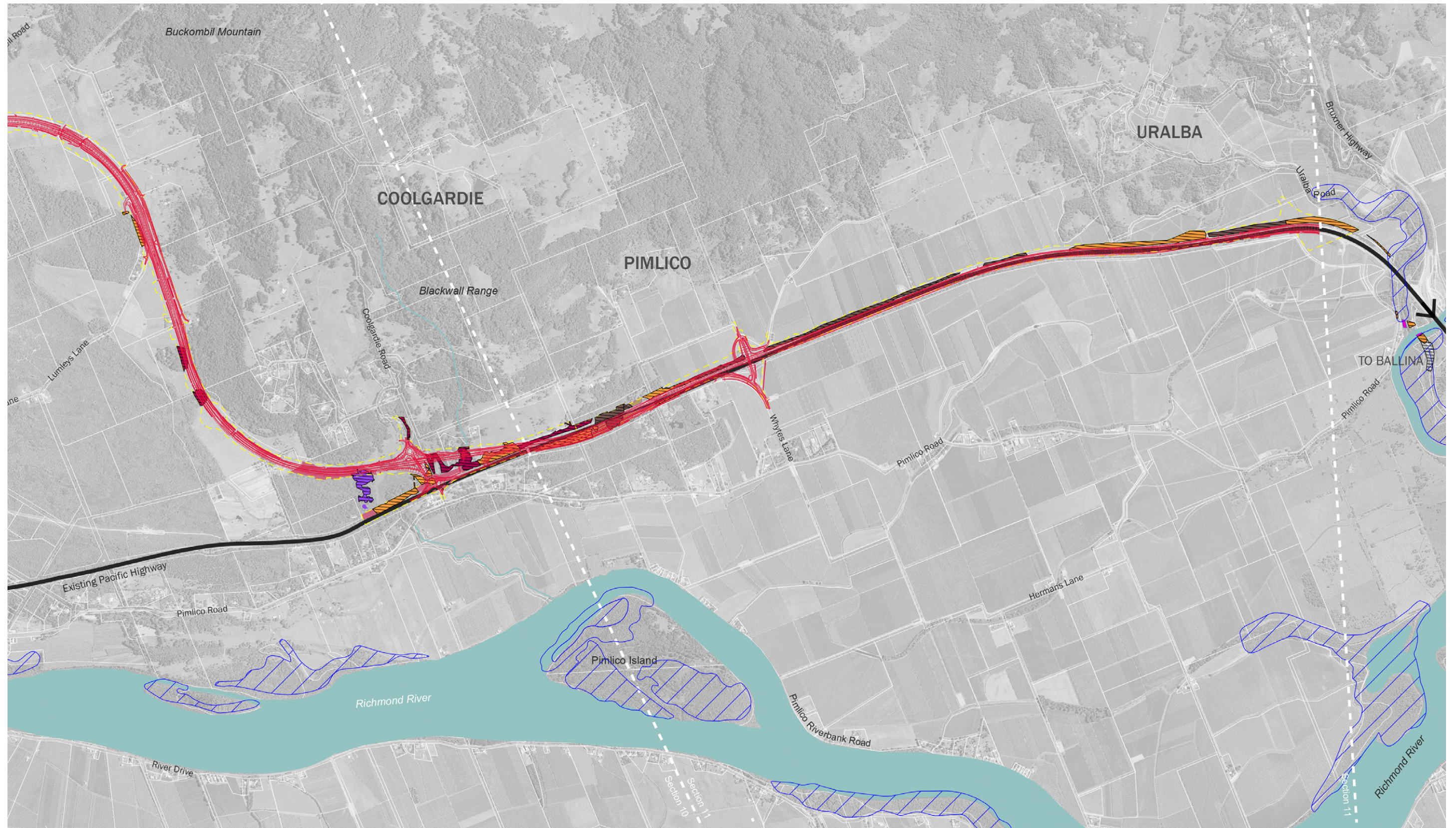


Figure 29: Vegetation communities



5.4.2 FAUNA

From Richmond River to Ballina (Sections 10 and 11) a number of threatened fauna species were identified as occurring in or nearby the alignment. These are divided into Terrestrial and Aquatic species and are as follows.

Terrestrial Species include:

- | | |
|----------------------------------|-----------------------------------|
| ▪ Koala* | ▪ Greater Broadnosed Bat |
| ▪ Glossy-black Cockatoo* | ▪ Golden-tipped Bat |
| ▪ Mangrove Honeyeater | ▪ Eastern Cave Bat |
| ▪ Eastern Osprey | ▪ Squirrel Glider* |
| ▪ Rose-crowned Fruit Dove | ▪ Wallum Froglet* |
| ▪ Masked Owl* | ▪ Pink Underwing Moth* |
| ▪ Little Bentwing Bat | ▪ Atlas Rainforest Ground Beetle* |
| ▪ Eastern Freetail-bat | ▪ Long-Nosed Potoroo* |
| ▪ Southern Myotis | ▪ Pied Oystercatcher |
| ▪ Eastern Longeared Bat | ▪ Olongburra Frog |
| ▪ Common Blossom-bat | ▪ Black Flying-fox. |
| ▪ Yellow-bellied Sheath-tail Bat | |

Note: Those indicated with an asterisk (*) are considered particularly sensitive to fragmentation within their habitat.

In addition to the threatened terrestrial species present, three distinct fauna corridors intersecting Richmond River to Ballina (Sections 10 and 11) are identified (Figure 30) as part of the Biodiversity Assessment (Roads and Maritime, 2012) and include:

- Alstonville Plateau Link is a moist corridor west of the alignment, utilised by focal species including Rose-crowned Fruit Dove and Pouched Frog
- Ballina is a coastal corridor, whose focal species include Grey-headed Flying-fox and Rose-crowned Fruit Dove
- Uralba-Tuckean Swamp, a coastal corridor whose focal species comprise the Albert's Lyrebird and koalas.

The landscape response is cognisant of these crossings and optimises revegetation and treatments to maximise the effectiveness of the crossings in the short to long-term.

Aquatic species include:

- Three threatened fish species Eastern (Freshwater) Cod, Black Cod and Estuary Cod are potentially in Richmond River to Coolgardie Road - Section 10. These are listed under the *Fisheries Management Act 1994* and/or *Environment Protection and Biodiversity Conservation Act 1999* and are known to occur in the Richmond River
- From Coolgardie Road to Ballina - Section 11 waterways are generally degraded and consequently the occurrence of threatened freshwater aquatic species is unlikely; however, Eastern (Freshwater) Cod potentially

occurs in the upstream estuary of Emigrant Creek (which is outside of Richmond River to Ballina - Sections 10 and 11)

- No suitable habitat was identified for Oxleyan Pygmy Perch in Sections 10 and 11.

DESIGN CONSIDERATIONS

- Clearance of vegetation associated with the highway corridor is minimised to reduce habitat fragmentation and maintain connectivity
- Management of threatened species considers augmentation of habitat as well as translocation of identified plant species
- Vegetation is retained within project corridor between boundary and construction footprint. This is reflected in the clearing and soil plans
- Revegetation mixes that are responsive to the communities through which the alignment passes
- Design responds to the overall proposed *Koala Revegetation Strategy* (2015) for Richmond River to Coolgardie Road - Section 10 by ensuring linkages to fauna structures and compliance with fencing clearances.
- Revegetation within the road corridor is required to augment the habitat for the Pink Underwing Moth and Atlas Ground Beetle
- Lighting at the Coolgardie interchange and its management needs to consider the close proximity of habitat for the Pink Underwing Moth. Light spill should be minimised and managed through selection of light fittings and landscape response in order to minimise impacts on lighting within the adjoining vegetation.

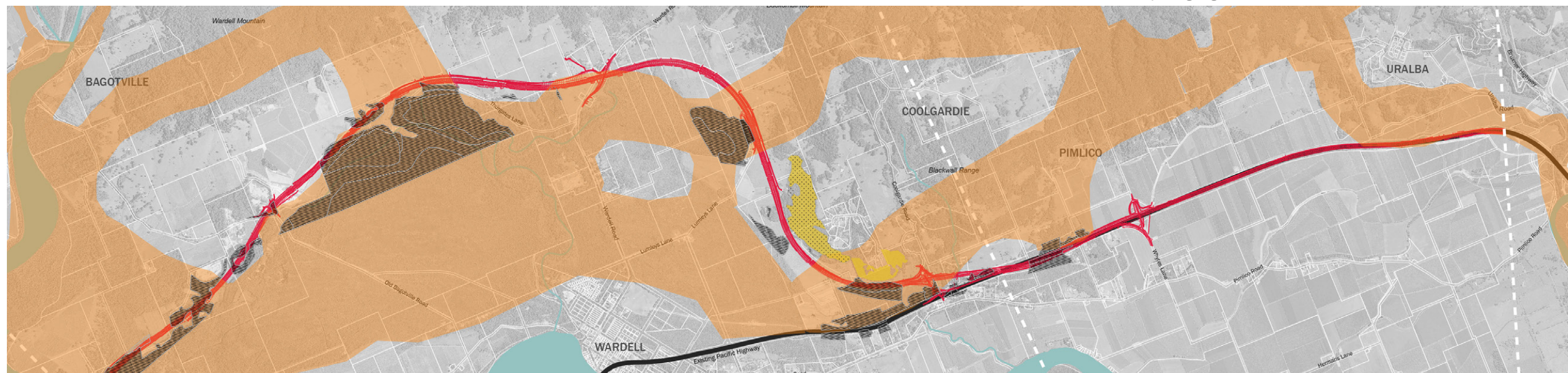


Figure 30: Regional fauna corridors

- Key
- Regional fauna corridor
 - Southern pink underwing moth habitat
 - Key koala habitat
 - Atlas beetle habitat

0 500 1000 1500m
SCALE 1:45,000 at A3



5.5 HERITAGE

5.5.1 ABORIGINAL

Before European colonisation, the lower Richmond area is thought to have supported one of the densest Aboriginal populations in Australia (Collins, 2005). Communities were concentrated along the coast as well as the river. Three Aboriginal language groups are represented between Woodburn (south of Broadwater) and Ballina, which are Bundjalung, Nyangbal and Yaegl (Yaygir).

Eleven Aboriginal cultural places have been identified between Woodburn and Ballina however, their exact locations were not identified due to their cultural sensitivity (Roads and Maritime, 2012). One place involves a massacre of Aboriginal people and is considered to have high significance on a regional scale. Two are also considered to have moderate-high significance involving an area used for camping and ceremonies, and the other a spiritual site inhabited by a vengeful spirit. The remaining eight were classified to have moderate or low-moderate overall significance and include a meeting place, pathway connection point, and a waterhole.

The EIS identified that there are 18 Aboriginal heritage sites recorded close or within the approved project corridor on the Aboriginal Heritage Information Management System (AHIMS) (Roads and Maritime, 2012). These include seven scarred trees and a number of sites containing stone artefacts (Figure 31).

The impacts on the identified Aboriginal heritage sites have been assessed as part of the overall environmental impact assessment for the project. Mitigation of impact is being undertaken in accordance with all relevant heritage-related management requirements. This includes a clearance process involving further detailed inspection of each site, recording of relevant details and salvage of heritage material where considered appropriate in consultation with Registered Aboriginal Parties. The clearance process includes identification of any specific measures to be established such as temporary exclusion fencing on the Approved Project Boundary during construction for sites that extend beyond the boundary. The clearance process will be completed for all identified sites prior to commencement of construction.

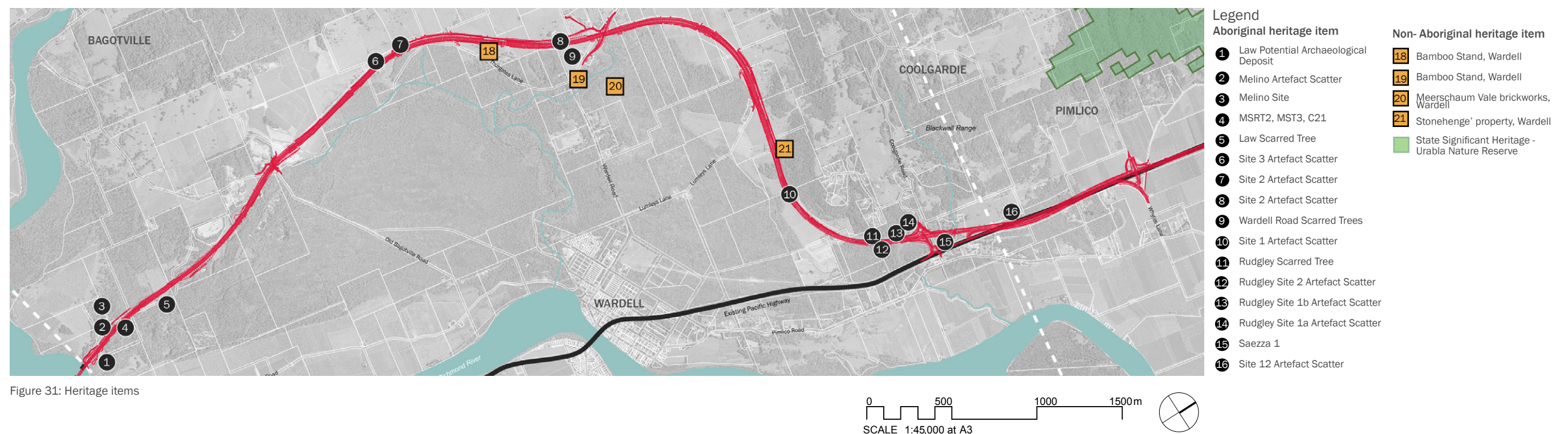
5.5.2 NON-ABORIGINAL

There is one State heritage listed item about one kilometre from Coolgardie Road to Ballina - Section 11 which is Uralba Nature Reserve, stated as High Conservation Value Old Growth Forests. The forests contain ecologically mature eucalypts showing few signs of human disturbance. Closer to the alignment are a number of items which are considered to be of local heritage value, and are not on the State Heritage Register (Figure 31).

The main residence of the Stonehenge' property and part of the drainage system are being demolished as a result of the project while the remaining buildings, such as the 1940s dwelling, will be retained (Roads and Maritime, 2012). In addition, there is potential for destruction of subsurface archaeological deposits of the Meerschaum Vale Brickworks while the Bamboo stands, associated with Chinese gambling and Aboriginal people, will be not be impacted.

DESIGN CONSIDERATIONS

- Design responds to the cultural associations of Wardell at the Coolgardie interchange to reinforce the presence of this urban centre and its access routes.



5.6 GEOLOGY AND SOILS

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 traverse the Clarence-Moreton Basin, an extensive Mesozoic age sedimentary basin extending from south Queensland to the NSW North Coast and comprising sedimentary rocks 2.5 to four kilometres thick.

The most common soil landscapes from Richmond River to Ballina (Sections 10 and 11) comprise the erosional, transferral and alluvial types. These soils are highly erodible and have low bearing strength.

Within the corridor three main geological types occur. These are

- Undifferentiated alluvial deposits/floodplain and swamp deposits
- Coarse-grained conglomerates
- Dune sand and sand sheets.

The higher western portions of the terrain beyond the alignment are composed of:

- Basalt
- Metabasalt.

The landform from Richmond River to Ballina (Sections 10 and 11) present a predominantly level terrain typified by the Richmond River floodplain between Broadwater and Coolgardie and bounded by the Blackwall Range to the west. In this area, there are some isolated low rises of 20 metres maximum elevation which occur at the southern end of the approved alignment. Slope stability issues are not considered likely from Richmond River to Ballina (Sections 10 and 11) as these areas traverse flat, low lying areas.

Richmond River to Coolgardie Road - Section 10 is a transferral landscape type that is associated with undulating rises, low hills, foot-slopes, drainage plains and fans. Slopes are in the order of 0 – 10 per cent and soils are highly acidic, sodic erodible and of low bearing strength due to seasonal water logging. It has some undulating terrain that has been disturbed by human activity, which can give rise to subsidence, poor drainage and presence of toxic materials.

Coolgardie Road to Ballina - Section 11 is an alluvial landscape that is associated with level to very gently undulating alluvial plains, floodplains and river back plains. Slopes are in the order of 0-6 per cent and soils are typically highly acidic, erodible and of low bearing strength and subject to hazards. Coolgardie Road to Ballina - Section 11 also has some soils that are typically saline and are subject to regular flooding and are also prone to water erosion.

DESIGN CONSIDERATIONS:

- A detailed soil survey has been undertaken to inform the design as to the specific issues and risks associated with soils within the area from Richmond River to Ballina (Sections 10 and 11)
- Topsoil from cleared areas is to be stripped, stockpiled and reused in the revegetation of the corridor. Details of methods for this are discussed in Chapter 8.

5.7 KEY VIEWS

There are a number of significant views, identified in the EIS, from Richmond River to Ballina (Sections 10 and 11). These include wide, sweeping views of the Richmond River and of the flat agricultural floodplain on the north side of the river (Figure 32). Travelling further north along the alignment views open to the west across the rural grazing and cropping lands to the foothills and ridge lines of the mountain ranges beyond (Figure 33). These include Wardell Mountain rising to around 175 metres above sea level, followed by Blackwall Range and Buckombil Mountain located closer to the Richmond River to Ballina and more immediate in view.

The views to the east begin in the south as primarily closed views of densely forested areas. Between Wardell and West Ballina views open to primarily sugarcane plantations on both sides of the alignment. The back drop of mountain ranges on the western side also extends along this northern region (Figure 34).

The impacts of the proposed *Koala Management Plan* (2016) plantations will alter the spatial quality of the valley and limit the distance of views. Despite this the sense of the open valley with the ranges beyond will be maintained along significant portions from Richmond River to Ballina (Sections 10 and 11).

DESIGN CONSIDERATIONS:

- Retention of views from the alignment to the adjoining area is a critical element in achieving a design that relates to the context, providing a sense of progression and identity for each community along the corridor
- Minimisation of views from individual houses is to be considered as part of the alignment development and ensures screening is provided where appropriate
- Responding to the changing spatial qualities of the valley associated with the development of plantations within the valley to address the requirements of the *Koala Management Plan* (2016).



Figure 32: View of Blackwall Range across agricultural land



Figure 33: Views of Blackwall Range and sugarcane (in foreground)



Figure 34: Typical view of sugarcane within the Coolgardie Road to Ballina - Section 11

CHAPTER 6

RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11) DESIGN PRINCIPLES



Figure 35: Artist's impression - the design on the approach to Coolgardie interchange signals the entry into Wardell township
(Note: Landscape shown at maturity)

This Chapter outlines detailed design principles for Richmond River to Ballina (Sections 10 and 11) in relation to environmental values, heritage values, the urban design context, sustainable design and maintenance, and community amenity and privacy as required in Section D20 of the *Urban Design and Landscaping of the Minister's Conditions of Approval* (October 2015). The design principles outlined here refer mainly to the mitigation measures identified in the various technical reports in the EIS and in *Appendix G – Changes made to the mitigation and management measures of the EIS* (Roads and Maritime, 2015), and the contextual analysis presented in Chapter 5.

6.1 DESCRIPTION

This section of the Woolgoolga to Ballina project covers Richmond River to Ballina (Sections 10 and 11). The alignment traverses a relatively flat to undulating agricultural valley which runs to the west of the township of Wardell before connecting with the existing highway alignment at Coolgardie Road.

6.2 URBAN DESIGN CONTEXT

6.2.1 LAND USE AND PROPERTY

Chapter 16 of the project EIS Main Volume 1B provides a summary of the land use and property impact of the project on the area. This is discussed further in Sub-chapter 5.3 and 5.11 of this report.

Urban Design principles in relation to land use and property are:

- The reconfiguration of acquired lands, include grazing, cropping and urban land uses, for reuse is in line with the Remnant Land and Property Strategy (Chapter 5 of *Working Paper – Land Use and Property*; SKM 2012a). This includes the use of acquired lands as part of the biodiversity offset strategy and in particular the *Koala Management Plan* (2016)– revegetation strategy. Property adjustments to acquired lands including adjustments to access, fencing, farm infrastructure and relocation of ancillary facilities are to be undertaken in consultation with impacted property owners
- Onsite use of spoil is explored as a preferred option, where possible and appropriate.

6.2.2 TRAFFIC AND TRANSPORT

Chapter 14 of the EIS Main Volume 1B provides a summary of the Traffic and Transport impact of Richmond River to Ballina (Sections 10 and 11) on the area. This is discussed further in Sub-chapter 5.2 of this report.

Urban design principles in relation to traffic and transport are:

PUBLIC TRANSPORT

- The relocation of the bus stop within Richmond River to Coolgardie Road - Section 10 considers safe and convenient access for school students and other public transport users.

PEDESTRIAN AND CYCLIST CONNECTIVITY

The project provides pedestrian and cyclist facilities at these locations:

Pedestrians

- For safety reasons, no pedestrian access would be provided to the motorway class sections of the main carriageways
- Pedestrians are permitted to utilise the shoulders of A Class roads
- Pedestrian access across the project would be provided via overpasses and underpasses which are listed in Table 9
- Pedestrian footways would be provided on overpasses where warranted based on safety and future demand and agreed with council and stakeholders, in accordance with Table 9.

Shared paths

- Consultation with councils and local communities in relation to future provisions for shared paths connections across the Pacific Highway has been completed
- The project will provide for future shared path provisions as agreed with council and stakeholders
- Cyclist / shared paths and footpaths beyond the project corridor are not in the scope of the project and will be provided by councils.

Cyclists

- Current NSW legislation permits cyclists to use the project's road shoulders, including across bridges
- Cyclists would also be able to use service roads, where there would be less traffic
- Cyclist access would be provided across the project in accordance with Table 9.

6.3 LOCAL ENVIRONMENTAL VALUES

6.3.1 HYDROLOGY AND FLOODING

Extensive flood modelling has been undertaken for the upgrade. Roads and Maritime has re-formed flood focus groups for the Woolgoolga to Ballina Pacific Highway upgrade. The groups exist for sections of the upgrade not currently in major work where the design is currently being finalised. The focus group meetings address the upgrade's potential flood impacts; review updated flood models and any changes as part of the detailed design development process; review the upgrade's proposed waterway structures, and review flood impact maps.

The latest flood modelling reflects the final design of the project as shown in the UDLP. The results of the flood modelling, any impacts and associated mitigation measures and the outcomes of the community and landowner consultation process will be reported in the project's Hydrological Mitigation Report which will be submitted to the Department of Planning & Environment for review in early 2017. Once finalised, information will be made available through the project website.

Relevant documentation is available at:

<http://www.rms.nsw.gov.au/W2B>.

Refer to chapters 8 and 11 for information on the landscape design responses to flood modelling.

6.3.2 SOILS, SEDIMENT AND WATER

Chapter 9 of the EIS Main Volume 1B provides a summary of the Soils, Sediment and Water assessment of the area. This is discussed further in Sub-chapter 5.6 of this report.

Principles arising from mitigation measures identified are:

- Batter slopes are designed using appropriate slope gradients to minimise erosion of selected topsoil
- Where not increasing clearance extents, bench cuttings are diverted onto contours and surface flow drainage paths designed to spread flow at the source in preference to concentrating the flow and treating it further downstream
- Exposed areas will be progressively rehabilitated. Preference will be given to establishment of permanent revegetation
- Topsoil will be stockpiled separately and inspected for noxious and or environmental weed seedlings at regular intervals as part of the management of stockpiles and when identified controlled with herbicide as required.

These design principles have informed the developed design and are incorporated into the landscape documentation.

Table 9: Cyclist and pedestrian facilities for the Woolgoolga to Ballina upgrade

SECTIONS	BRIDGE NAME	PEDESTRIAN/CYCLIST ACCESS
3 and 4	Glenugie Southbound entry ramp overpass	Shoulder
3 and 4	Eight Mile Lane overpass	Shoulder
3 and 4	Old Six Mile Road overpass	Shoulder
3 and 4	Avenue Road overpass	Shoulder
3 and 4	Wooli Road overpass	Shoulder
3 and 4	Firth Heinz Road overpass	Shoulder
3 and 4	Bostock Road overpass	Shoulder
3 and 4	Twin Bridges at Somervale Road	Cyclists on shoulder
3 and 4	Crowley's Road overpass	Shoulder
3 and 4	Tyndale interchange (south)	Shoulder
3 and 4	Bondi Hill Road overpass	Shoulder
3 and 4	Southbound Exit Ramp overpass	Cyclists on shoulder
3 and 4	Byron's Lane overpass	Shoulder
3 and 4	McIntyres Lane overpass	Shoulder - widened following Council consultation
3 and 4	Maclean interchange Bridge	Shared use path provided under Jubilee Street and past Maclean interchange
3 and 4	Twin Bridges over Jubilee Street	
5 and 6	Koala Drive underpass	Shoulder
5 (E)	Existing Harwood Bridge	Shared use path on western side
5 (E)	Bridge over Clarence River at Harwood	Cyclists to use Harwood bridge
5 and 6	Serpentine Channel Road North overpass	Shoulder
5 and 6	Chatsworth Road overpass	Shoulder
5 and 6	Iluka Road interchange overpass	3.0m Footpath northern side
7, 8 and 9	Woodburn interchange overpass	3.0m Footpath southern side
7, 8 and 9	Woodburn-Evans Head Road overpass	3.0m Footpath southern side
7, 8 and 9	Broadwater Evans Head Road overpass	3.0m Footpath northern side
9 (F)	Bridge over Richmond River	Cyclists on shoulder
10 and 11	Old Bagotville Road underpass	Shoulder
10 and 11	Wardell Road overpass	Shoulder
10 and 11	Coolgardie Road interchange overpass	3.0m Footpath northern side
10 and 11	Whytes Lane overpass	1.8m Footpath southern side
Pimilco to Tavern (Ballina)	Smiths Drive bridge	3.0m Footpath - Construction deferred

6.3.3 BIODIVERSITY

Chapter 10 of the EIS Main Volume 1B provides a summary of the Biodiversity assessment of the area. This is discussed further in Sub-chapter 5.4 of this report.

Principles arising from mitigation are:

- All fauna connectivity structures including the landscape response in association with these structures have been developed in line with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity, Biodiversity and the Supplementary Biodiversity Report in Appendix J of the Submissions/Preferred Infrastructure Report
- Opportunities for improved connectivity for koala and long-nosed potoroo have been further investigated between the Richmond River and Bridge D51. The landscape design forms an important part of this response ensuring the appropriate vegetation community is established to reinforce this intent
- Specific details for the re-establishment of native vegetation on batters, cut faces, surrounding sediment basins and other areas disturbed during building are provided as part of the design documentation. This includes details for the appropriate removal and restoration of temporary creek crossings
- Opportunities to strengthen threatened communities and species through establishment of appropriate environmental conditions and reuse of soil seed banks has been incorporated into the detailed design
- Disturbance and clearing of vegetation has been minimised, by the adoption of the following initiatives:
 - Avoiding and minimising vegetation removal wherever possible through the detailed design process. This process has involved the review of siting of all elements including: fencing, drainage lines, and optimization of earthworks to minimise the environmental impact
 - Woody debris and bushrock will be re-used on site for habitat improvement and are be detailed in the relevant management plans in line with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a)
 - A Weed Management Plan has been developed as part of the CEMP, in line with the Roads and Maritime Biodiversity Guidelines (RTA, 2011) and the Introductory Weed Management Manual (Richards, 2004).



Figure 36: Artist's impression - Coolgardie interchange travelling north along the alignment (Note: Landscape shown at maturity)

6.4 HERITAGE VALUES

6.4.1 ABORIGINAL HERITAGE

Chapter 12 of the EIS Main Volume 1B provides a summary of the Aboriginal heritage of the area. This is discussed further in Sub-chapter 5.5 of this report. The area in general comprises several sites ranging from 'highly sensitive and culturally significant' to places of lesser significance (Roads and Maritime, 2012). The project has to date been refined to avoid or minimise impact on several of these sites and mitigation of impacts is being undertaken in accordance with all relevant heritage-related management requirements. This includes a clearance process involving further detailed inspection of each site, recording of relevant details and salvage of heritage material where considered appropriate in consultation with Registered Aboriginal Parties.

Urban design principles in relation to Aboriginal heritage are:

- Landscape design to respond to Aboriginal heritage sites of high importance through appropriate soft and hard treatments after appropriate consultation with the relevant communities

- Retain and avoid impact to scarred trees through clear identification during the design stage and adequate protection during building
- The Gumi Scarred tree will be removed and the trunk will be relocated to an agreed location. Access to the site is provided for the local Aboriginal people for teaching purposes
- 'Welcome to country' signage is to be located as part of the development of the Business Signage and Tourism Strategy in consultation with the relevant Aboriginal parties.

6.4.2 NON-ABORIGINAL HERITAGE

Chapter 13 of the EIS Main Volume 1B provides a summary of the non-Aboriginal heritage of the area. This is discussed further in Sub-chapter 5.5 of this report.

Urban design principles in relation to non-Aboriginal heritage are:

- Interchanges /intersections should reflect the cultural heritage values of the area.

6.5 SUSTAINABLE DESIGN AND MAINTENANCE

Sustainability in any road project needs to give regard to social, environmental and economic considerations now and for future generations. These considerations include increased asset life, decreased maintenance costs, increased accessibility and reduction in adverse effects on the natural and man-made environments. Cost effectiveness and constructability need to be considered at the same time.

Sustainability aspects are considered throughout the design phase, with regard to the future building and operation in order to identify opportunities for improved performance and avoid problems at the end of the project.

Considerations have included:

- The type, volume, sourcing and application of resources, materials and services
- Climate change, social factors, and environmental impact
- Economic factors, including life-cycle cost and maintenance requirements
- Demolition, waste disposal, reuse and recyclability
- Energy efficiency and reduction in carbon emissions.

Key sustainability opportunities incorporated into the project are:

- Minimising vegetation clearance
- Reducing impact on environmentally sensitive area(s)
- Avoidance, or where this is not practicable, reduction of impact on identified and potential Aboriginal and non-Aboriginal heritage items
- Avoidance/minimising impact on properties and businesses related to both permanent and temporary work
- Minimisation of fill levels
- Reuse of materials.

Landscape and urban design responses in relation to these issues are in Table 10.

MAINTENANCE

Details of maintenance activities are addressed in Sub-chapter 8.4.10. The period of maintenance as part of the contractual work is for three years from completion of construction. After this time maintenance will be handed back to Roads and Maritime and Ballina Shire Council. As part of this process ongoing maintenance and monitoring activities will be required to ensure stability within the vegetation communities and the effectiveness of the infrastructure, including fences, drainage lines etc.

6.6 COMMUNITY AMENITY AND PRIVACY

6.6.1 VISUAL AMENITY, URBAN DESIGN AND LANDSCAPE

Chapter 11 of the project EIS Main Volume 1B provides a summary of the visual amenity, urban design and landscaping of the area. This is discussed further in Chapter 5 of this report.

Principles arising from mitigation measures are:

- Measures to mitigate visual impact to viewpoints are implemented, as identified in Table 11-42 and Working Paper – *Urban Design, Landscape Character and Visual Impact Assessment*. Design development has sought to reduce the number of moderate-high, or high, impact and changes in assessment and are reflected in Chapter 7
- Specific mitigation measures responsive to areas where moderate-high or high impacts are identified include provision of screen planting within the corridor. This has included the addition of screen planting along the western edge of the alignment from just north of the Coolgardie interchange through Whytes Lane precinct to the northern end of Portion D. This work has been undertaken in response to community concerns from those living in the footslopes of the Blackwall Range to screen the highway from view. Similarly screening of the Pacific Highway from the Buckmobile Mountain Range Road area has been considered and is addressed by corridor planting and the planting of trees beyond the corridor as part of the *Koala Revegetation Strategy* (2015).
- Revegetation of the corridor is done progressively to ensure early stabilisation and minimisation of impact of road building
- Urban development and its connection to the highway is highlighted through appropriate strategies at interchanges. Particular emphasis is placed on the use of culturally significant vegetation to act as a marker of this contrasting land use. This includes the use of *Ficus macrocarpa* ‘hillii’ at Coolgardie interchange and *Araucaria cunninghamii* at Wardell Road.

6.6.2 VISUAL AND PRIVACY IMPACT

Chapter 11 of the project EIS Main Volume 1B provides a summary of the Urban Design and Landscape impact of the project on the area.

- The built form of the project, including consideration of the height, bulk, scale, materials and finishes of structures and road furniture are designed in line with the Pacific Highway Guidelines and the design principles identified in EIS Chapter 11
- The landscape design provides plant screening to mitigate visual and privacy impacts where these are identified. A high level assessment of the potential visibility of the project from houses was undertaken to determine extent of influence of the proposed work and likely need for screening.

It should be noted that the EIS was undertaken prior to the formulation of the *Koala Revegetation Strategy* (2015). This strategy has seen the introduction of a significant areas of reforestation adjoining the alignment. With this revegetation there will be a reduction in the overall visibility of the alignment from the adjoining area. The design response reflected in this plan reflects the mitigation provided by the Koala Revegetation Works and whether additional screening or planting is required to address the visual impacts.

Table 10: Landscape and urban design responses to environmental sustainable initiatives

ENVIRONMENTAL SUSTAINABLE INITIATIVES	URBAN AND LANDSCAPE DESIGN RESPONSE	LOCATION WITHIN UDLP
MATERIAL SOURCING	Materials considered include: <ul style="list-style-type: none">▪ Soil salvage and reuse▪ Mulch salvage and reuse▪ Seed and plant materials including reuse for translocation/soil seedbank or local collection of seed	Addressed in Chapter 8, Sub-chapters 8.3.2, 8.5.2, 8.5.3, 8.4.9
THREATENED SPECIES	Design is responsive to Threatened Species Management Plans including: <ul style="list-style-type: none">▪ Minimisation of vegetation clearance▪ Revegetation responsive to adjoining communities using indigenous species▪ Vegetation responsive to connectivity initiatives including fauna crossings, fencing, etc	Addressed in Chapter 6, Sub-chapter 6.3.3 Chapter 8, Sub-chapters 8.4.1, 8.4.2, 8.4.3, and 8.7
PROTECTION OF WATERWAYS	<ul style="list-style-type: none">▪ Minimisation of disturbance▪ Replication of natural profile characteristics and hydrological regimes▪ Staged revegetation as part of erosion and sediment control	Addressed in Chapter 6, Sub-chapter 6.3.1 and Chapter 8, Sub-chapter 8.6
WEED MANAGEMENT	<ul style="list-style-type: none">▪ Control of weeds during and post construction	Addressed in Chapter 8, Sub-chapter 8.4.10
PROTECTION OF HERITAGE	<ul style="list-style-type: none">▪ Minimisation of disturbance▪ Design of interchanges captures part of the cultural heritage identity of the adjoining township	Addressed in Chapter 8, Sub-chapters 8.4.5 and 8.6.4

6.6.3 NOISE IMPACT

Potential noise impacts have been assessed against road traffic noise criteria recommended by the NSW Government's Road Noise Policy (RNP) and mitigation requirements have been guided by the Roads and Maritime Noise Criteria Guideline (NCG, 2015) and Noise Management Guidelines.

Operational noise was considered in the Operational Noise Management Report: Woolgoolga to Glenugie Pacific Highway Upgrade - Main report, November 2015, refer to:

<http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/project-documents.html>

Noise modelling has been carried out as part of the detailed design and has confirmed:

- There are no noise walls required within this section of the works
- The range of noise mitigation measures are consistent with the EIS, including the locations of low noise road surfaces
- Mitigation details will be determined through consultation with affected property owners.

An assessment of potential construction related noise is available Construction Noise and Vibration Management Plan, Appendix B3, October 2015, refer to:

<http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/>

- Latest noise modelling on the detailed design of the project indicates that there are no noise mitigation structures required for the project. Noise modelling reports will be submitted to the Department of Planning & Environment for review in early 2017.

6.6.4 LIGHTING

Lighting on the project, where required, will be provided to comply with AS4282-1997 Control of the Obtrusive Effect of Outdoor Lighting.

Urban design principles in relation to lighting are:

- The design of lighting incorporates low light spill fittings to ensure nearby properties are not impacted
- The impact of lighting on sensitive fauna species, i.e Pink Underwing Moth, is considered in terms of the extent and control of light with a focus on minimising spill (see RL01 Street Lighting report for further details).

6.7 LOCAL AMENITY AND PUBLIC DOMAIN

6.7.1 REST AREAS

Three new rest areas are provided along the overall Woolgoolga to Ballina Pacific Highway upgrade. Richmond River to Coolgardie Road - Section 10 has a future rest area either side of Old Bagotville Road near Richmond River. There is no immediate requirement for this rest area at the start of operations of the road. To ensure the rest area is feasible, a concept has been developed and bulk earthworks outlined in order to minimise disruption when it is constructed. The design of the rest area follows the principles as set out in the Rest Area Best Practice Design Guide (Roads and Maritime, 2004).

Key issues considered are:

- Access and egress
- Provision of facilities
- Environmental considerations in Design
- Rest area layout
- Aesthetics
- Comfort
- Signposting
- Maintenance and lifecycle cost.

The landscape treatment as part of this initial stage of development seeks to integrate the revegetation treatment with the adjoining and proposed landscape. Its response is consistent with the adjoining community.

6.8 TEMPORARY WORK, ANCILLARY FACILITIES, ACCESS TRACKS AND WATERCOURSE CROSSINGS

The Woolgoolga to Ballina Pacific Highway project will require ancillary facilities to support the construction activities associated with the project. The Project Approval defines Ancillary Facility as, "Temporary facility for construction, including for example an office and amenities compound, construction compound, batch plant (concrete or bitumen), material crushing and screening, materials storage compound, maintenance workshop, testing laboratory or material stockpile area".

In line with the Minister's Conditions of Approval (MCoA) D21, Pacific Complete has prepared an Ancillary Facilities Management Plan which outlines how ancillary facilities will be assessed and managed during construction of the project. The Management Plan provides details of the approval pathway, environmental impact assessment, and includes details of all ancillary facilities approved for the project.

Ancillary facilities covered by the Management Plan include:

- Office compounds – including the main site compounds, site offices, sheds, workshops and storage, satellite compounds – small site offices
- Minor ancillary facilities - including lunch sheds, office sheds, and portable toilet facilities
- Bridge site compounds – site office to allow for easy access to major bridge sites
- Batch plants – for the production of concrete and asphalt
- Crushing plants and material processing sites – plant and equipment for the processing, crushing and screening of excavated material for use onsite
- Plant workshops – for the storage and maintenance of plant and equipment
- Stockpile sites – for the stockpile and storage of excavated material, mulch and spoil
- Material storage (laydown areas) – for the storage of materials delivered to site for construction
- Display centres and visitor parking.

The ancillary facilities associated with the Woolgoolga to Ballina Pacific Highway upgrade include areas that are located within the existing or proposed highway corridor that are directly or indirectly impacted by the construction work, in addition to locations nearby or separate to the construction activities. As outlined in the MCoA definitions, all ancillary facilities are temporary and can only be used for the Woolgoolga to Ballina

Pacific Highway upgrade. MCoA B76 of the Project Approval outlines the rehabilitation requirements of these sites, “*The land on which ancillary facilities are located shall be rehabilitated to at least their pre-construction condition or better, unless otherwise agreed by the landowner*”.

BORROW SITES

The Woolgoolga to Ballina Pacific Highway project will also require a number of borrow sites to be used to source material for construction of the project. MCoA D22 of the Project Approval requires the preparation of a Borrow Sites Management Plan for each of the borrow sites proposed for the project. The Plan needs to identify details of the site, assessment of impact resulting from the borrow operations, and rehabilitation details of the borrow site. The rehabilitation details are to include future landform and use of the borrow site, landscaping and revegetation, and measures to be implemented to minimise or manage the ongoing environmental effects of the site.

GENERAL LOCATION AND SIZE

The temporary ancillary facilities utilised during the highway construction phase will vary in their size and configuration, depending on the nature of use and nearby construction activities. There is likely to be a combination of larger main construction compounds in addition to smaller satellite compounds located within each section of the project. The specific locations of the ancillary facilities to be used for the project are not fully known at the time of preparation of the UDLP, and as a result are not detailed in the Plan. Temporary ancillary and borrow sites are located on two different categories of land that include:

- 1) Land owned by Roads and Maritime for the purposes of the project
- 2) Private properties leased for the construction period of the highway.

All ancillary facilities will be managed for the project in line with the approved Ancillary Facility Management Plan. It is anticipated that each ancillary facility will be developed and rehabilitated in line with the following principles.

Ancillary and borrow site rehabilitation principles are:

- 1) Establish landowner requirements and identify rehabilitation objectives
- 2) Consideration of the location context and amenity requirements
- 3) Integrate rehabilitation with adjacent landform, topography
- 4) Consider fauna connectivity and wildlife corridors and enhance where possible
- 5) Apply landscape treatments consistent with the project UDLP to ensure an integrated outcome.

COMMITMENT TO SITE REHABILITATION

The intention with all temporary construction sites is to rehabilitate them as soon as possible after they are no longer required for the highway construction operations.

- On Roads and Maritime owned sites used for temporary construction that are to be sold, and are located within or near native vegetation communities, the area impacted within those properties will be revegetated with species compatible with the remnant vegetation or the previous landuse. Where appropriate the revegetation will enhance wildlife habitat values. The rehabilitation work is to include maintenance until the vegetation is well established
- On Roads and Maritime owned sites used for the extraction of construction material the rehabilitation work may include disposal of soil material classified as ‘unsuitable’ generated by the highway work, regrading to create landforms compatible with adjoining areas and the establishment of a stable revegetation cover. Reuse of this material is subject to all relevant waste and planning approval requirements
- On privately owned land the rehabilitation work will be in line with an agreement to be reached with the property owner. The rehabilitation work is to meet all relevant environmental requirements.

6.9 EARTH MOUNDS

The SPIR Requirements for the W2B project includes:

UD14 - Earth mounds

The mounding profile of any earth mound will blend suitably into the existing landscape setting. Any mounding to be landscaped will be compacted in 1.5 metre layers with 1:3 maximum batter slopes where reasonable in consideration of constraints within the project corridor. Where feasible and reasonable, permanent mounds will be treated with ameliorants and overlaid with topsoil to minimum 150 millimetres to ensure suitable planting conditions are achieved.

Earth mounds will be required in some locations along the road alignment to allow disposal of surplus spoil in order to avoid the need to transport it long distances from the site. Generally the earth mounds will be designed to form part of the landscape works.

The technical landscape drawings indicate possible sites for earth mounds. However, the need for these mounds and their size will be depend on the volume of surplus spoil that needs to be disposed of.

Design of the earth mounds will respond to local conditions and where possible their margins will be graded to blend with existing adjoining landforms. Under most circumstances stand-alone earth mounds will have slopes no steeper than 3H: 1V to assist successful establishment of vegetation and to create a natural appearance.

Where a mound is designed as a false-cut the gradient is to be consistent with the slope from which it extends. The radius at the top of the mound and transitions will be rounded to 10 metres minimum and up to 100 metres for the large mounds, where possible.

Earth mounds will be revegetated by seeding with selected native species of trees, shrubs and grasses. Supplementary planting of trees and tall shrubs will be carried out at some locations where rapid revegetation is required to achieve a desirable outcome.

CHAPTER 7

RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11) URBAN DESIGN AND LANDSCAPE DESIGN

7.1 URBAN DESIGN AND LANDSCAPE DESIGN

This chapter describes the urban and landscape design response between Richmond River to Ballina (Sections 10 and 11). This is reflected at a strategic level (Figure 37) and at a detailed concept level in plans Figure 38, 39, 40, and 41.

7.1.1 RICHMOND RIVER TO OLD BAGOTVILLE ROAD: CHARACTER PRECINCTS P-47 AND P-50

Precinct P-47 of the southernmost limit within Richmond River to Coolgardie Road - Section 10 and is the northern bank of the Richmond River - a defined edge of mangrove forest which transitions to agricultural lands beyond. The only work occurring here is the abutment to the Richmond Bridge. This region of the alignment rises quickly from the floodplain and is heavily forested. The design response reflects this forested landscape and seeks to reinforce the sense of enclosure that this community creates.

Key elements include:

LANDSCAPE STRATEGY

- Reflects the forested landscape character of Precinct P-50 as its dominant influence
- Responds to the need to visually minimise the impact on this forested margin
- Addresses the requirements of the biodiversity strategy associated with Threatened Species Management Plans and in particular *Koala Management Plan* (2016) and *Koala Revegetation Strategy* (2015).

PROPOSED KOALA REVEGETATION STRATEGY

- The *Koala Revegetation Strategy* (2015) identifies a number of disturbed sites within this area of the alignment to be reforested to enhance the viability of the population and its connectivity to a broader home range for koala movement. The design responds to these enhancing connectivity.

CUT AND FILL EMBANKMENTS

- The alignment through this zone is benched into the ridge. As a product of this slightly elevated position the alignment is characterised by a combination of cut and fill embankments. One of the largest within the corridor occurs just north of the Richmond River crossing and is illustrated in Figure 38. These are carefully integrated into the landform and have considered the ability to revegetate in their design.

FAUNA PASSAGEWAYS

- There are several fauna crossings in this zone edged closely by informal dense closed canopy of Wet Sclerophyll Forest. Details of revegetation in response to fauna crossings are discussed in Sub-chapter 8.7.

7.1.2 OLD BAGOTVILLE ROAD TO WARDELL ROAD: CHARACTER PRECINCTS P-49 AND P-50

Extending from Old Bagotville Road through to Wardell Road (Figure 38), the design in this region is responsive to Character Precinct P-49, the broad valley landscape but also to that of Character Precinct P-50. The alignment is located to the western edge of Character Precinct P-50 at the forest / agriculture interface. The design response seeks to establish a balance between screening the alignment from isolated farmhouses and a connection to the scenic qualities of the valley for road users.

Key elements include:

OLD BAGOTVILLE ROAD PRECINCT

- Old Bagotville Road underpass is set largely within a forested landscape typical of Character Precinct P-50
- The landscape associated with this structure adopts the drier forested communities including the native cypress pine, *Callitris columellaris* as a formal planting adjoining the alignment
- Two fauna crossings, located either side of the underpass, are screened by closed canopy forest
- Rest area.

SERVICE ROADS

The design response to service roads on either side of Thurgates Lane:

- Provide a degree of vertical separation and a landscaped visual buffer reducing risk of headlight glare and impact on surroundings. This is achieved by the establishment of a shrub layer with scattered trees (Figure 38)
- Provide the motorist with a connection to the ranges to the west while minimising views from adjoining properties and blocking glare from headlights.

WARDELL ROAD PRECINCT

The design is comprised of a number of elements. Including:

- Cutting of the ridgeline at Ch. 152,875 which occurs in close proximity to the houses of Wardell Road. The design response is to revegetate the cut embankment with both canopy and understorey vegetation providing a sense of enclosure and a staged level of visual screening as the landscape develops. This revegetated community also provides the opportunity to enhance fauna connectivity
- Cutting at Ch. 152,875 beyond the alignment boundary has been identified as a significant site for new materials for the highways construction. The treatment of this borrow site will be reshaped and revegetated extending the extent of revegetation beyond the immediate motorway boundary
- Provision of a new service road (off Hill Road) cut behind the ridge offset from the main alignment is screened from view of the alignment and across the valley from Wardell Road by the landscape response which includes shrub and tree seeding and planting
- Wardell Road Overbridge is flanked by a formalised avenue planting of *Araucaria cunninghamii* (Hoop pine). This provides a visual marker along the alignment as well as a clear distinction between the cultural and natural landscapes of the valley (Figure 39).

PROPOSED KOALA REVEGETATION STRATEGY

A number of sites throughout these precincts were acquired as part of the acquisition of land for the project alignment. Where this land has been surplus to the alignment requirements it has been assessed for suitability for and inclusion within the proposed *Koala Revegetation Strategy* (2015) identified in the *Ballina Koala Plan* (2016). Sites include small clearings adjoining the alignment within the forested lands as well as broader areas of the valley associated with Thurgates Lane and Wardell Road. The later areas reduce the openness of the valley shortening the view field.

The design responds to these plantations by providing for revegetation of the cleared area beyond the fauna fencing but within the alignment boundary. Offset of these trees from fauna fencing is a minimum of 3m to minimise the opportunities for koalas to gain access to the highway corridor. The objective of this revegetation is to enhance the resource and connections to fauna crossings.

7.1.3 WARDELL ROAD TO COOLGARDIE INTERCHANGE: CHARACTER PRECINCTS P-49 AND P-53

Running from Wardell Road these precincts cover the northern half of Richmond River to Coolgardie Road - Section 10 and start of Coolgardie Road to Ballina - Section 11 as the alignment traverses the valley to the north before crossing over Coolgardie Road. Like the preceding precincts, the alignment follows the edges of landscape units i.e. forest and farmland on a slightly elevated alignment. A critical influence on the character of the alignment is the proposed *Koala Revegetation Strategy* (2015) which proposes significant areas of revegetation around Lumleys Lane to either side of the alignment. The landscape design response has sought to respond both to the sequence of openness and sense of enclosure by responding to these new plantings and the adjoining forest communities.

Key elements include:

PROPOSED KOALA REVEGETATION STRATEGY

- Similar to the preceding section a number of properties acquired as part of the alignment requirements are surplus to the needs and have been incorporated into the proposed koala revegetation strategy. The most significant of these areas is just north of Lumleys Road as the valley turns to the east.
- Cleared areas within the alignment area but beyond the fauna fencing are being revegetated to integrate with these new forests enhancing the resource available and connectivity to fauna crossings across the highway.
- Within the fauna fencing which defines the road alignment zone is planting of non-koala foraging trees to improve safety for koalas and motorists.

THE COOLGARDIE ROAD INTERCHANGE

The interchange is marked by a number of design responses, including:

- Signalling the arrival of the interchange through the use of *Ficus hillii* and hedge planting that will contrast with the natural communities and provide a visual cue as to the approach of the interchange. The use of *Ficus hillii* is used as a link to Wardell town and its main street plantings
- The spacing of the trees intensifies as one approaches the interchange from the south highlighting the changing character. Hedge planting between the fig trees maintains the visual continuity and contrast with natural communities
- The approach to the interchange from the north is signified by continuous hedge planting create a visual lead up to the interchange
- The entry and exit ramps create an avenue effect with fig trees and/or hedging lining either side of the ramp. This emphasises the entry/exit ramps as the connection to the urban precinct and the main alignment as part of the broader landscape system
- The design standard of the bridge structure at the interchange is the same as adopted for other highway overpasses on the upgrade. The interchange design utilises the foot-slopes to enable the transition on to the overbridge to reduce the need for filling and better integrate the bridge with its surrounds
- Vegetation communities within the interchange are dominated by the Rainforest which characterises the steeper foot slopes of the adjoining ranges. Wet Sclerophyll forest occurs to the eastern side of the interchange along the existing Pacific Highway alignment and flatter lands adjoining the corridor
- The vegetation communities contain a diversity of flora and fauna with much of it of environmental significance containing species or communities protected under the TSC and EPBC Acts, to which the landscape design responds. Options for translocation or propagation of this material are being reviewed
- Planting associated with the interchange itself adopts a formal planting to the entry/exit ramps while integrating and celebrating the rainforest community within the space between them and the alignment
- Vegetation is to be provided to reinforce the habitat of the Southern Pink Underwing Moth and assist in the control of light spill into the adjoining habitat areas.

7.1.4 COOLGARDIE INTERCHANGE TO END OF SECTION 11: CHARACTER PRECINCT P-53

Covering the northern end of the corridor Precinct P-53 is dominated by the Richmond River floodplain and the agricultural uses of the floodplain i.e. predominantly sugarcane production. This landscape provides expansive views, which extend from the ranges (Precinct P-52) to the west and as far as can be seen to the east towards the coast.

Key elements include:

LANDSCAPE STRATEGY

- The design response is to maintain this landscape character, with revegetation work characterised by the establishment of a grassland community
- Visual screening to the properties to either side of the alignment are considered as part of this response with planting proposed to provide separation from the alignment in response to these views
- Revegetation of the western side of the alignment is proposed to provide visual screening to adjoining houses replacing the landscape cleared as part of the preparation for the proposed works.

HEADLIGHT SCREEN

- Headlight screening is required between the highway and a service road between the Coolgardie interchange south bound exit-ramp and Whytes Lane. This is to consist of a vegetated screen composed of planting installed at a variety of scales to ensure both initial control but also its enhancement over time. The minimum width of this planting is five metres, which the proposed screens achieve for much of its length with a minor non-conformance in an isolated section.

WHYTES LANE OVERPASS AND APPROACH

- The southern approach to Whytes Lane is flanked by forested wetland which screens the adjoining houses from this new elevated structure
- To the north the impact of the bridge is also moderated by the proposed establishment of copses of forested wetland as the landscape opens up revealing views across the floodplain.

7.1.5 RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11) STRATEGY PLAN

The Strategy Plan in Figure 37 provides an overview of the design approach and strategies adopted to achieve the above objectives between Richmond River to Ballina (Sections 10 and 11).

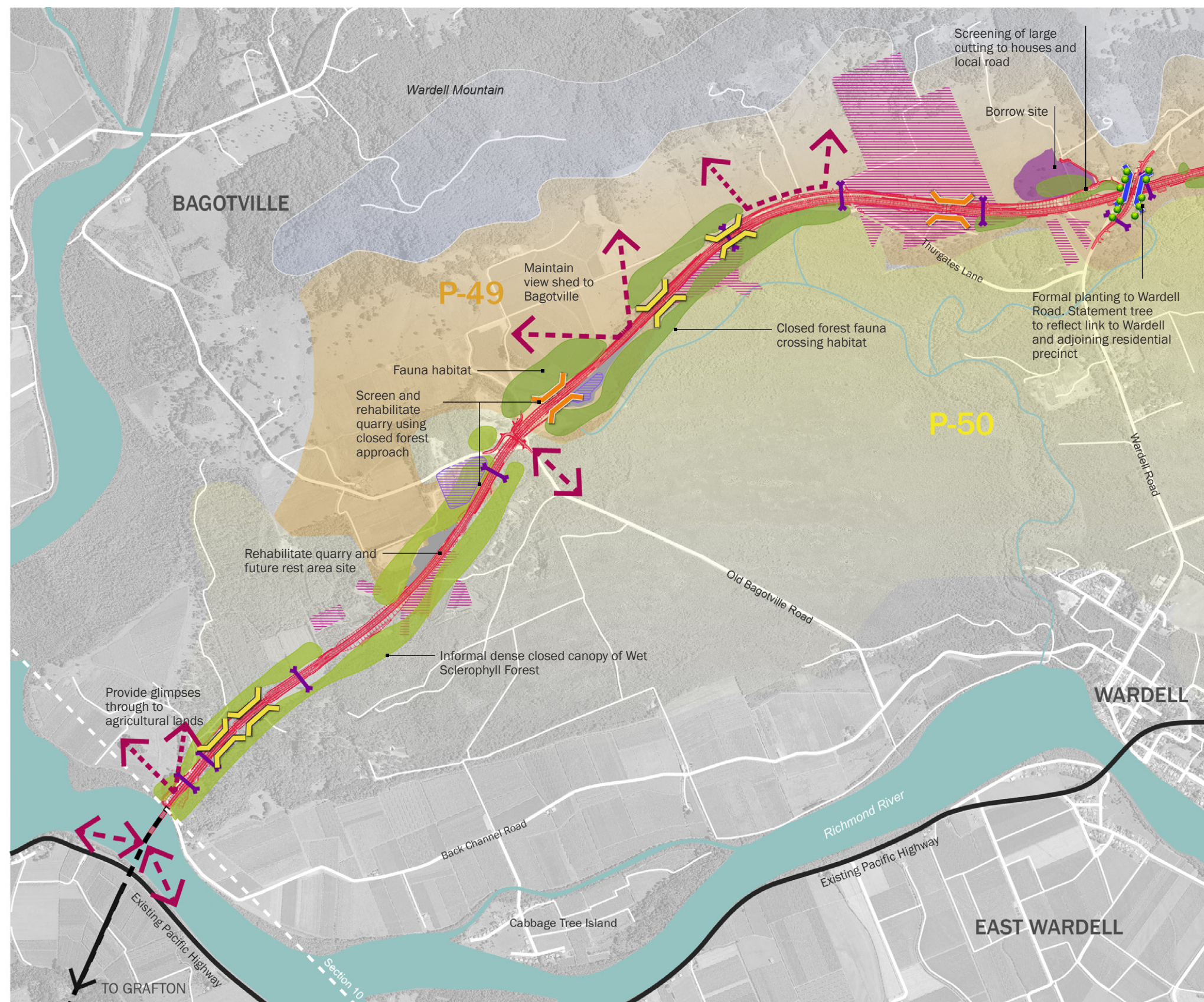
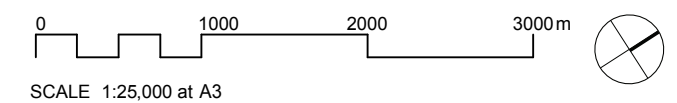
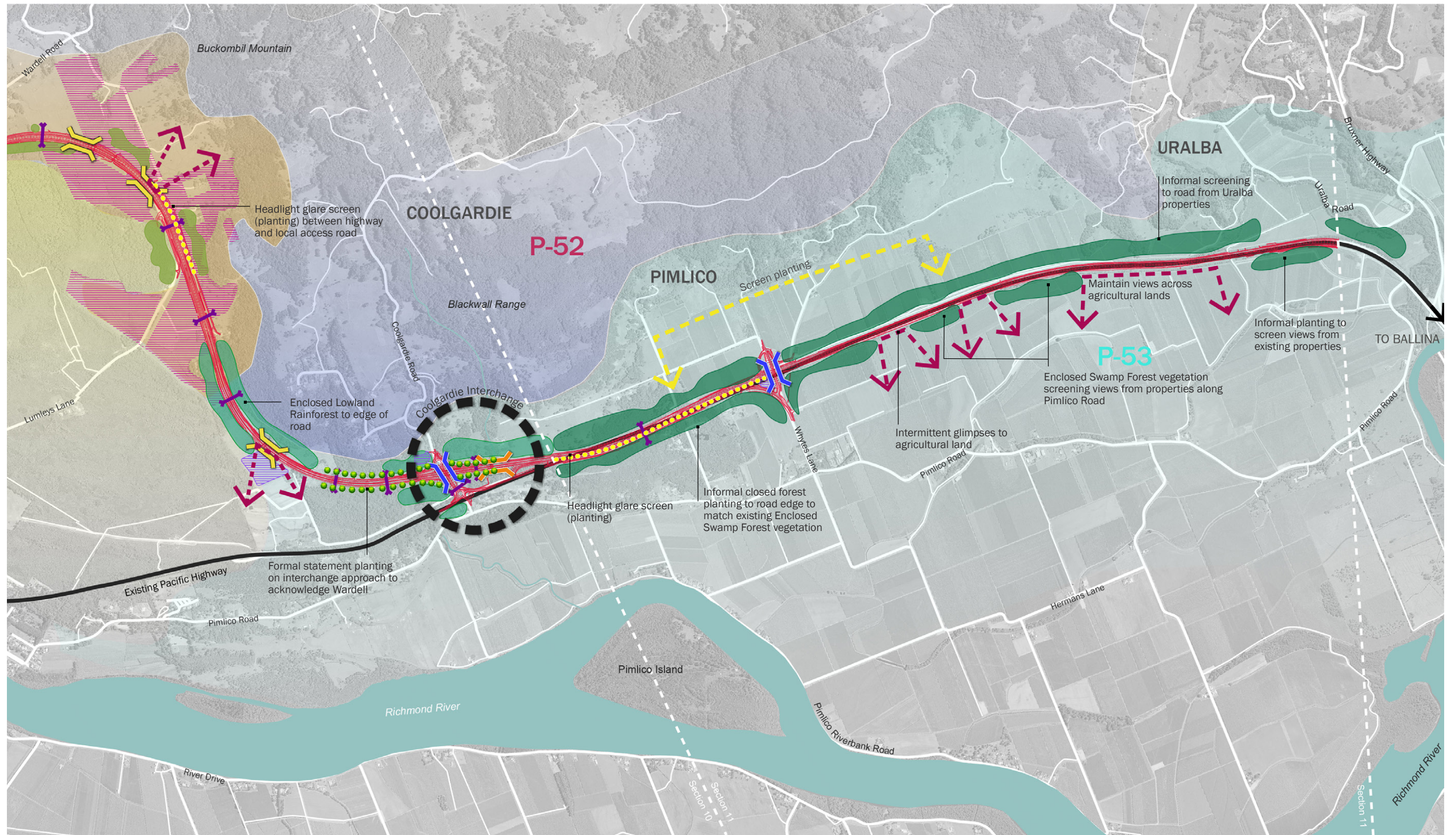


Figure 37: Strategy plan for Richmond River to Ballina (Sections 10 - 11)



7.1.6 LANDSCAPE PLANS

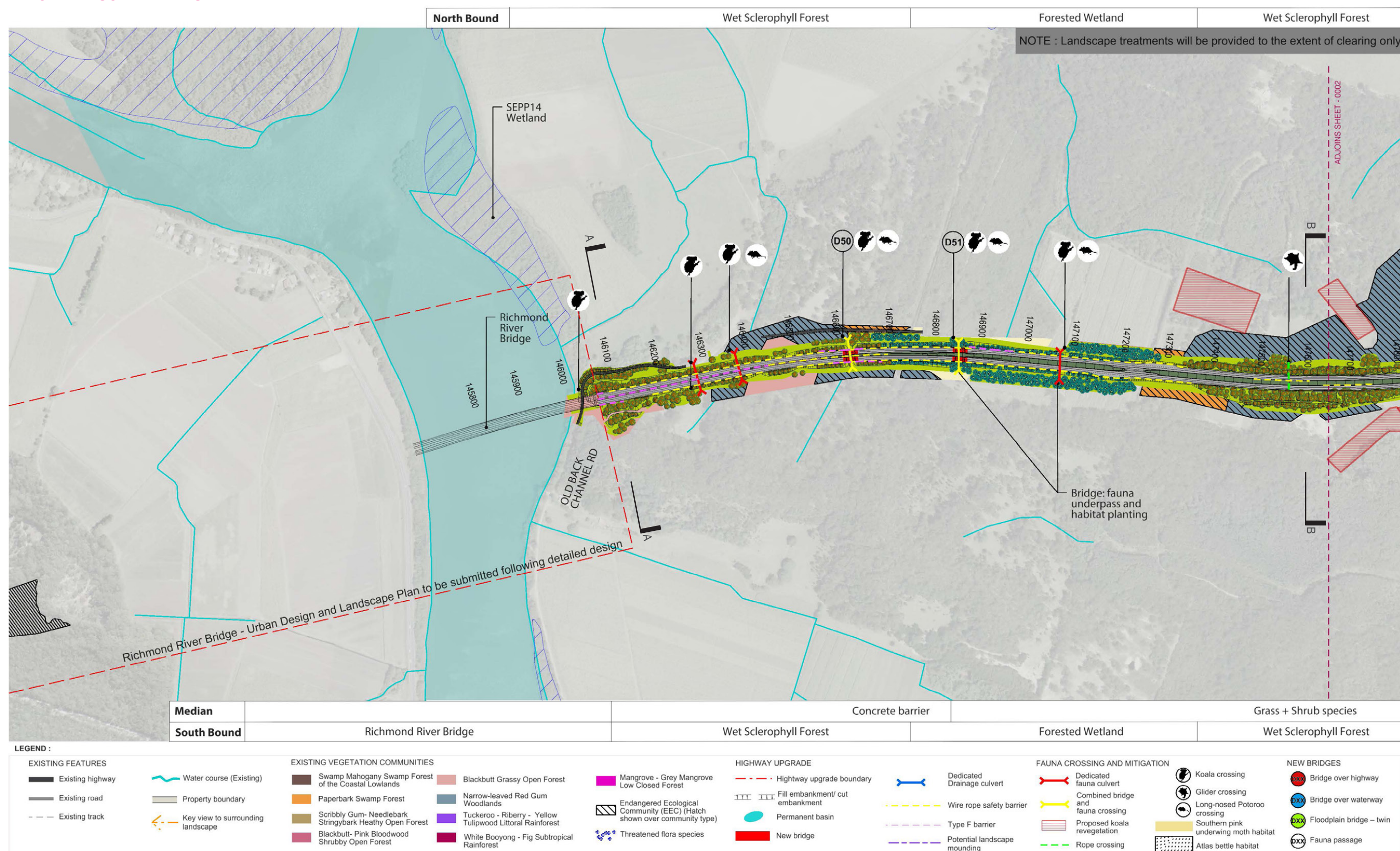
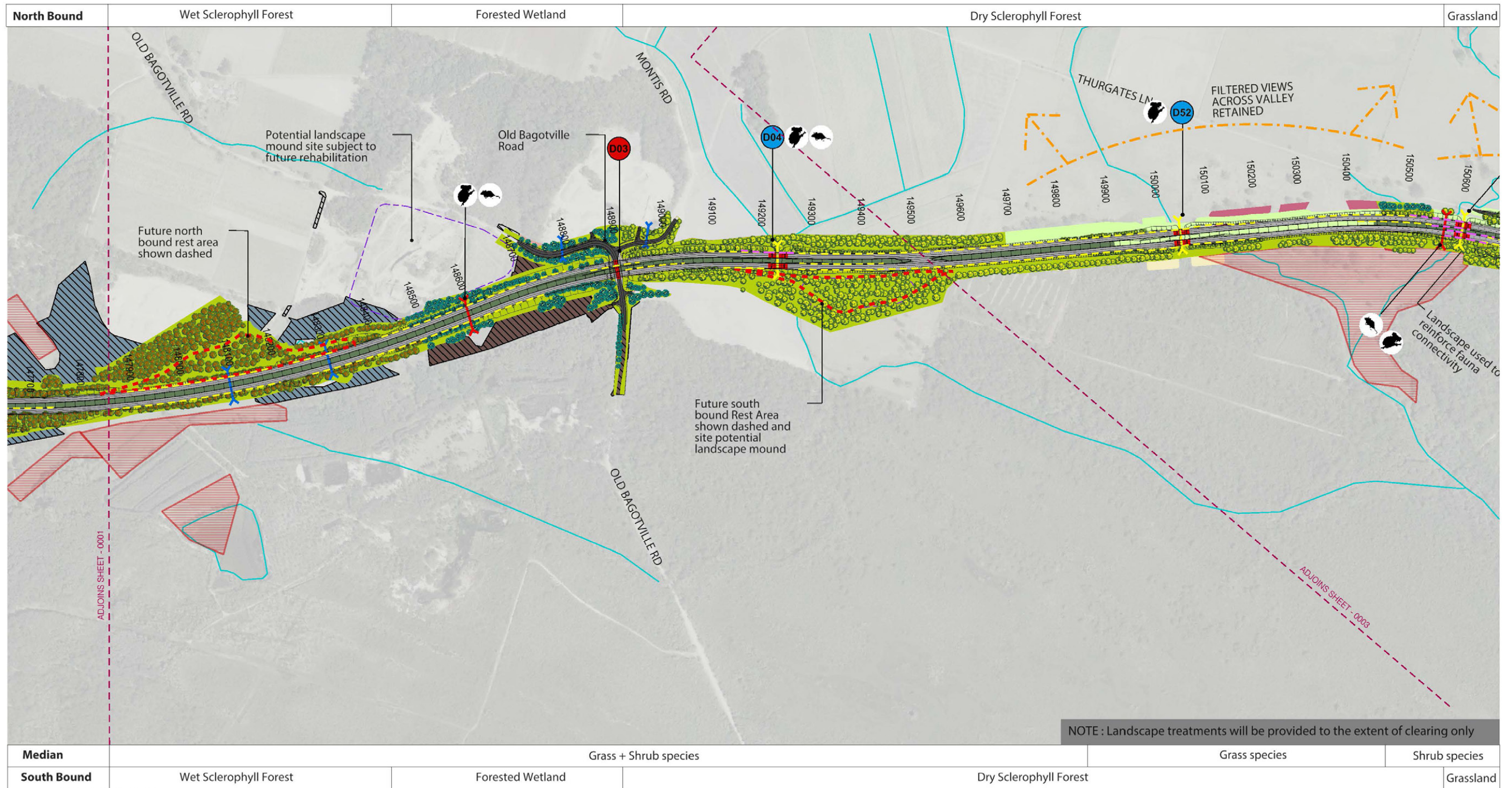


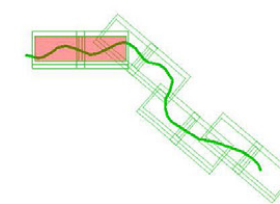
Figure 38: Urban and landscape design plan - Sheets 1 and 2 (Scale 1:8000)



- LANDSCAPE TREATMENTS**
- VEGETATION COMMUNITY**
- Forested Wetland
Refer to Appendix E for indicative species list
 - Dry Sclerophyll Forest
Refer to Appendix E for indicative species list
 - Wet Sclerophyll Forest
Refer to Appendix E for indicative species list
 - Rainforest
Refer to Appendix E for indicative species list

- REVEGETATION METHOD**
- Planting bed - 75mm mulch over improved topsoil over cultivated subgrade
 - Hydroseed (mix to reflect vegetation community) over site soil over cultivated subgrade
 - Median - Grassland (margins)/shrubland (core) hydroseed or direct seed over site soil over cultivated subgrade
 - Grassland (mix to be native/exotic grasses only) hydroseed over site soil over cultivated subgrade

- FEATURE TREES**
- Feature tree planting
 - Relocated cabbage tree palms



Drawing and design subject to further development, number of trees / elements shown is indicative only.

0 100 200 m
SCALE 1:8,000 at A3

Sheet 1-2 of 8

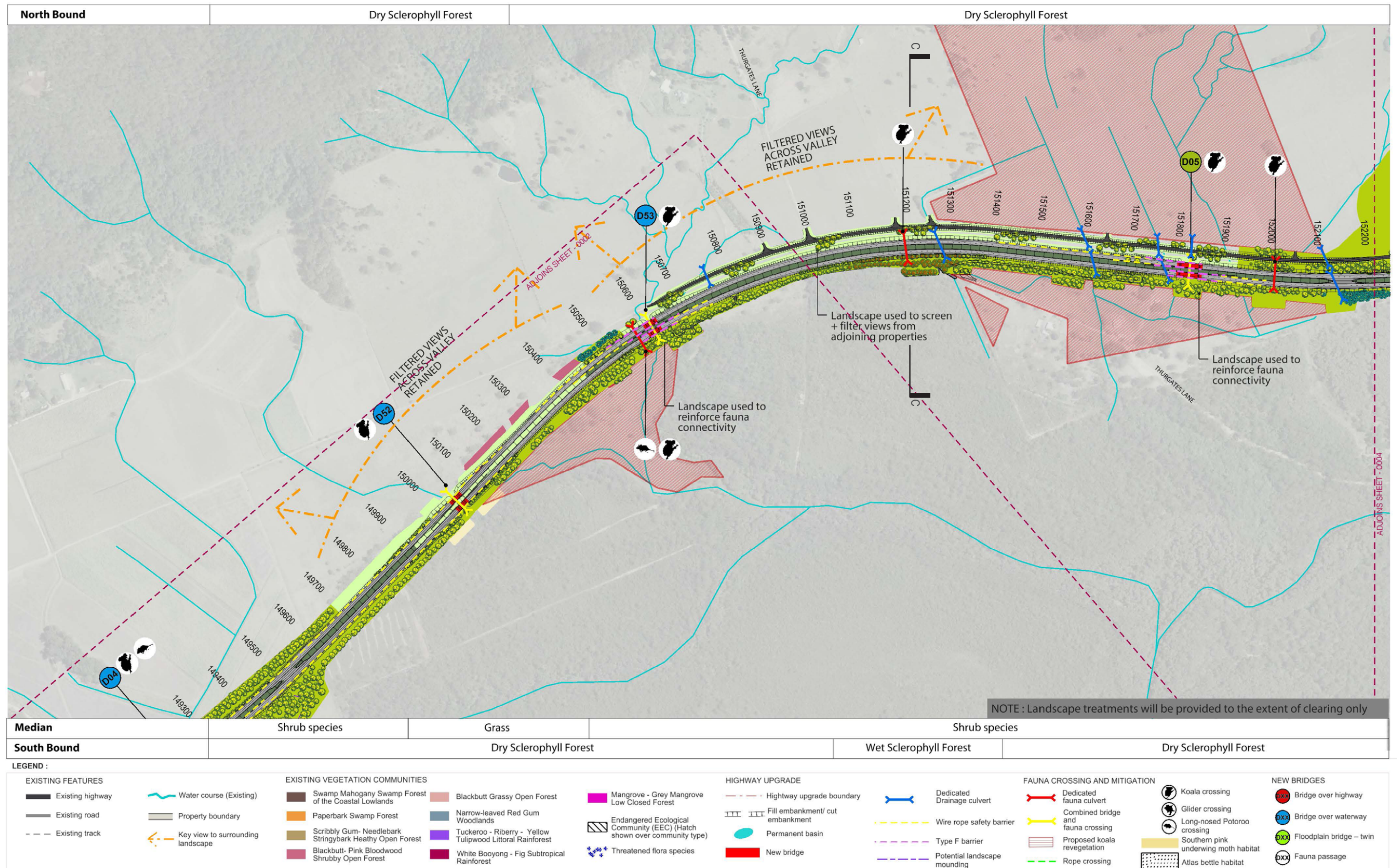
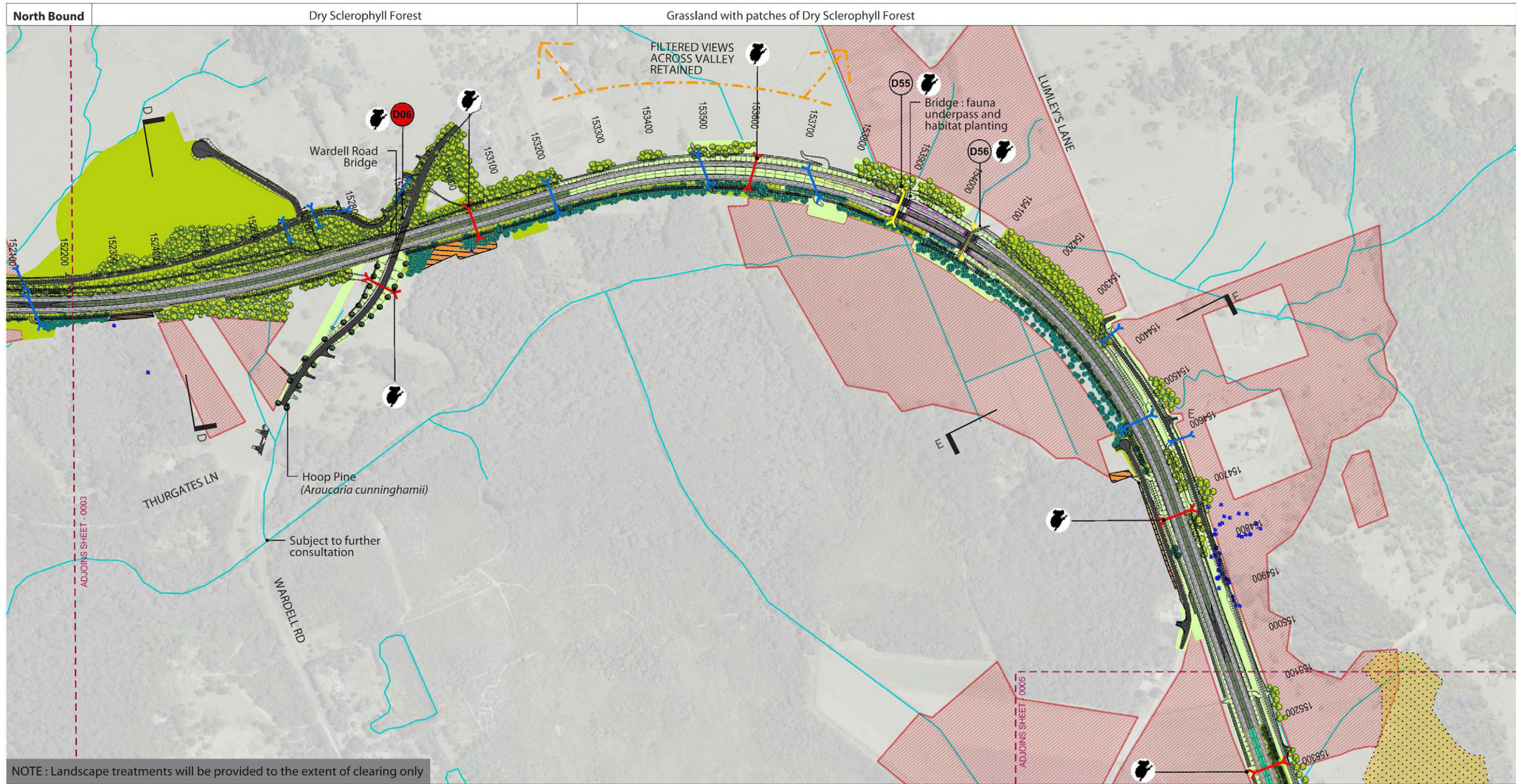


Figure 39: Urban and landscape design plan - Sheets 3 and 4 (Scale 1:8000)



NOTE: Landscape treatments will be provided to the extent of clearing only

Median	Grass + Shrub species	Grass species	Shrub species
South Bound	Dry Sclerophyll Forest	Forested Wetland	

LANDSCAPE TREATMENTS

VEGETATION COMMUNITY

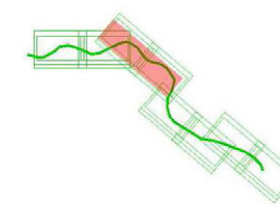
- Forested Wetland
Refer to Appendix E for indicative species list
- Dry Sclerophyll Forest
Refer to Appendix E for indicative species list
- Wet Sclerophyll Forest
Refer to Appendix E for indicative species list
- Rainforest
Refer to Appendix E for indicative species list

REVEGETATION METHOD

- Planting bed - 75mm mulch over improved topsoil over cultivated subgrade
- Hydroseed (mix to reflect vegetation community) over site soil over cultivated subgrade
- Median - Grassland (margins/shrubland (core) hydroseed or direct seed over site soil over cultivated subgrade
- Grassland (mix to be native/exotic grasses only) hydroseed over site soil over cultivated subgrade

FEATURE TREES

- Feature tree planting
- Relocated cabbage tree palms



Drawing and design subject to further development, number of trees / elements shown is indicative only.

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SCALE 1:8,000 at A3

Sheet 3-4 of 8

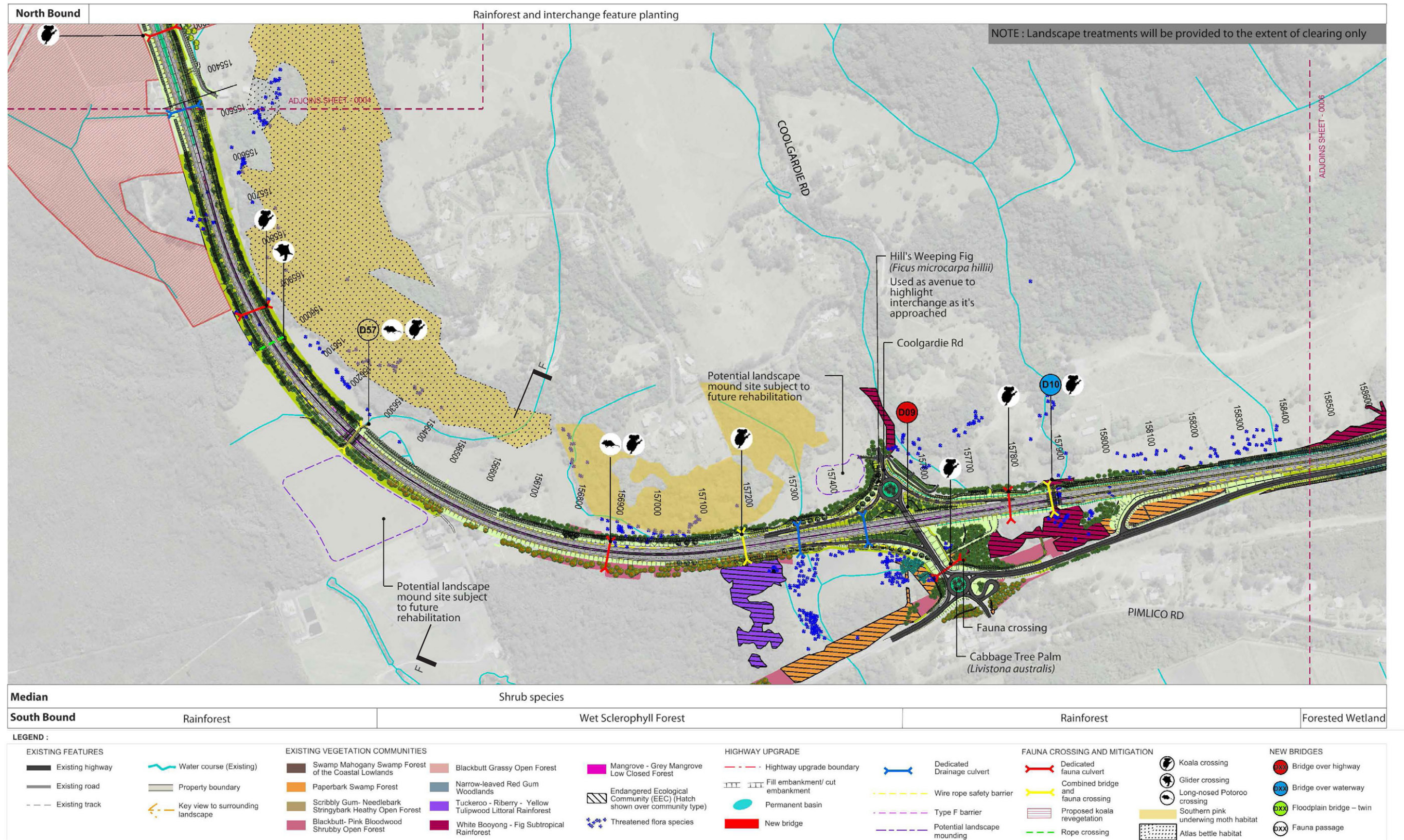


Figure 40: Urban and landscape design plan - Sheets 5 and 6 (Scale 1:8000)



LANDSCAPE TREATMENTS

VEGETATION COMMUNITY

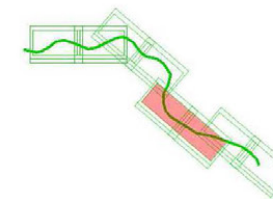
- Forested Wetland
Refer to Appendix E for indicative species list
- Dry Sclerophyll Forest
Refer to Appendix E for indicative species list
- Wet Sclerophyll Forest
Refer to Appendix E for indicative species list
- Rainforest
Refer to Appendix E for indicative species list

REVEGETATION METHOD

- Planting bed - 75mm mulch over improved topsoil over cultivated subgrade
- Hydroseed (mix to reflect vegetation community) over site soil over cultivated subgrade
- Median - Grassland (margins)/shrubland (core) hydroseed or direct seed over site soil over cultivated subgrade
- Grassland (mix to be native/exotic grasses only) hydroseed over site soil over cultivated subgrade

FEATURE TREES

- Feature tree planting
- Relocated cabbage tree palms



Drawing and design subject to further development, number of trees / elements shown is indicative only.

0 100 200 m
SCALE 1:8,000 at A3

Sheet 5-6 of 8

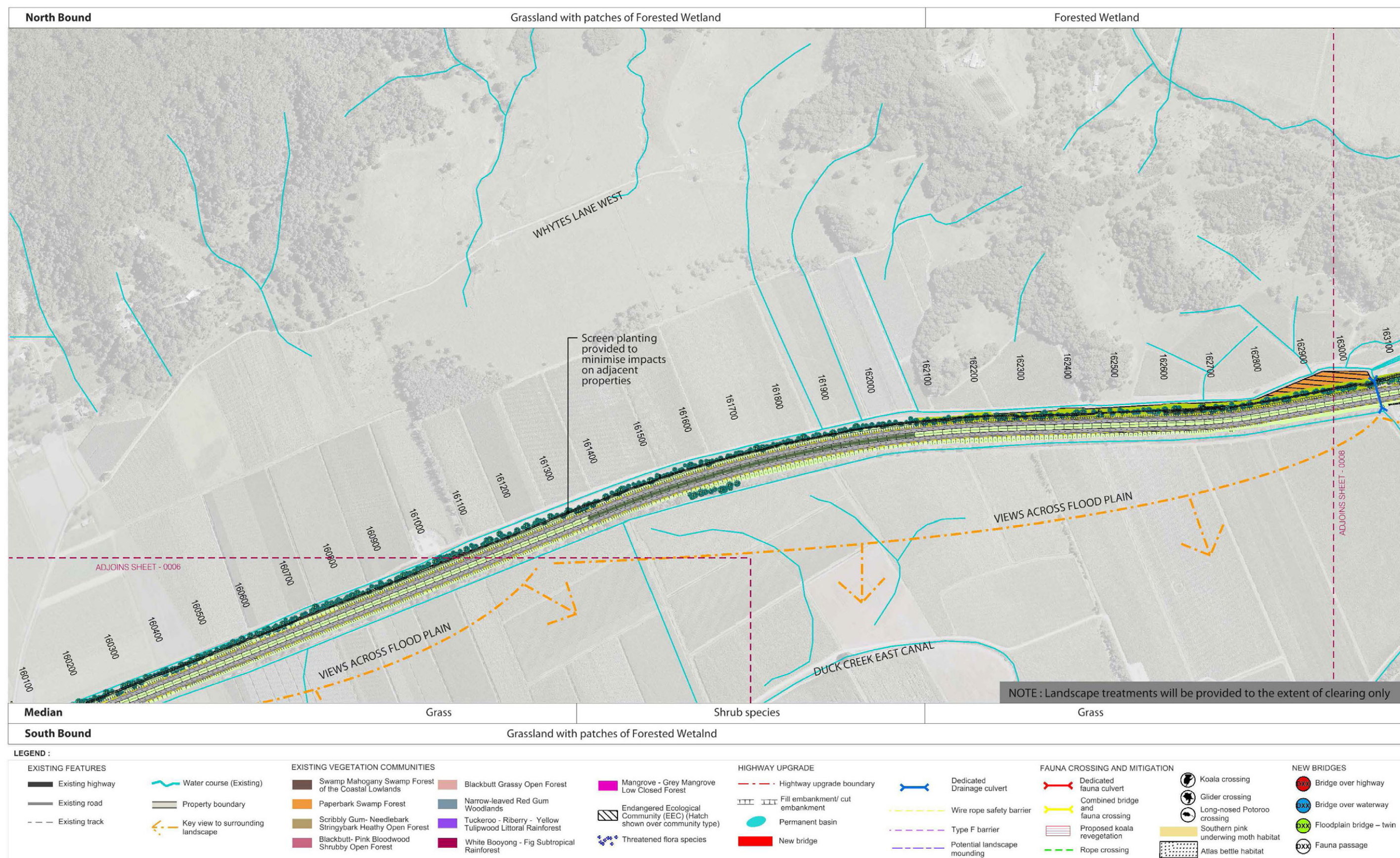
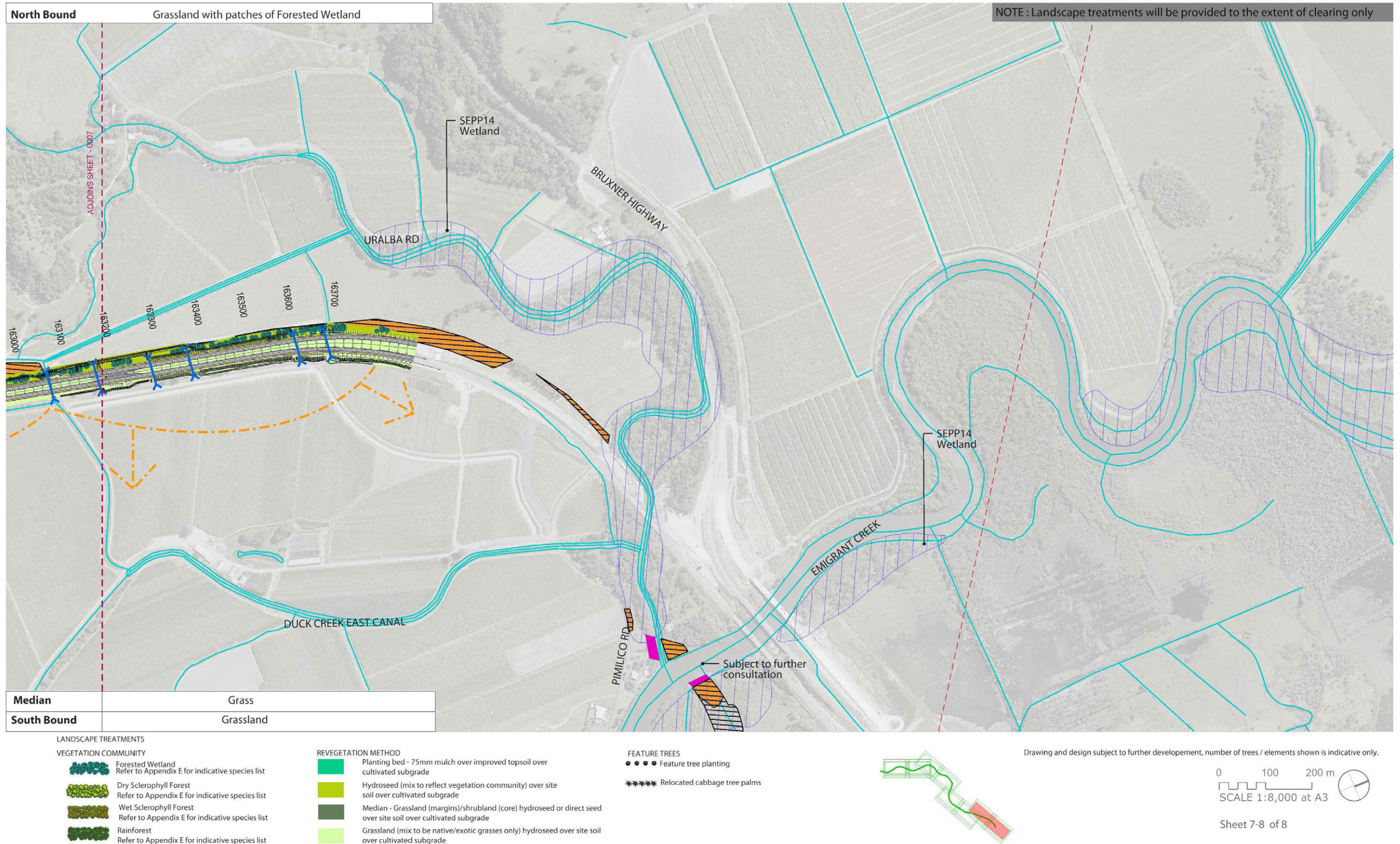


Figure 41: Urban and landscape design plan - Sheets 7 and 8 (Scale 1:8000)



7.1.7 LANDSCAPE SECTIONS



Figure 42: Cross section A-A in Bagotville (Scale 1:400)

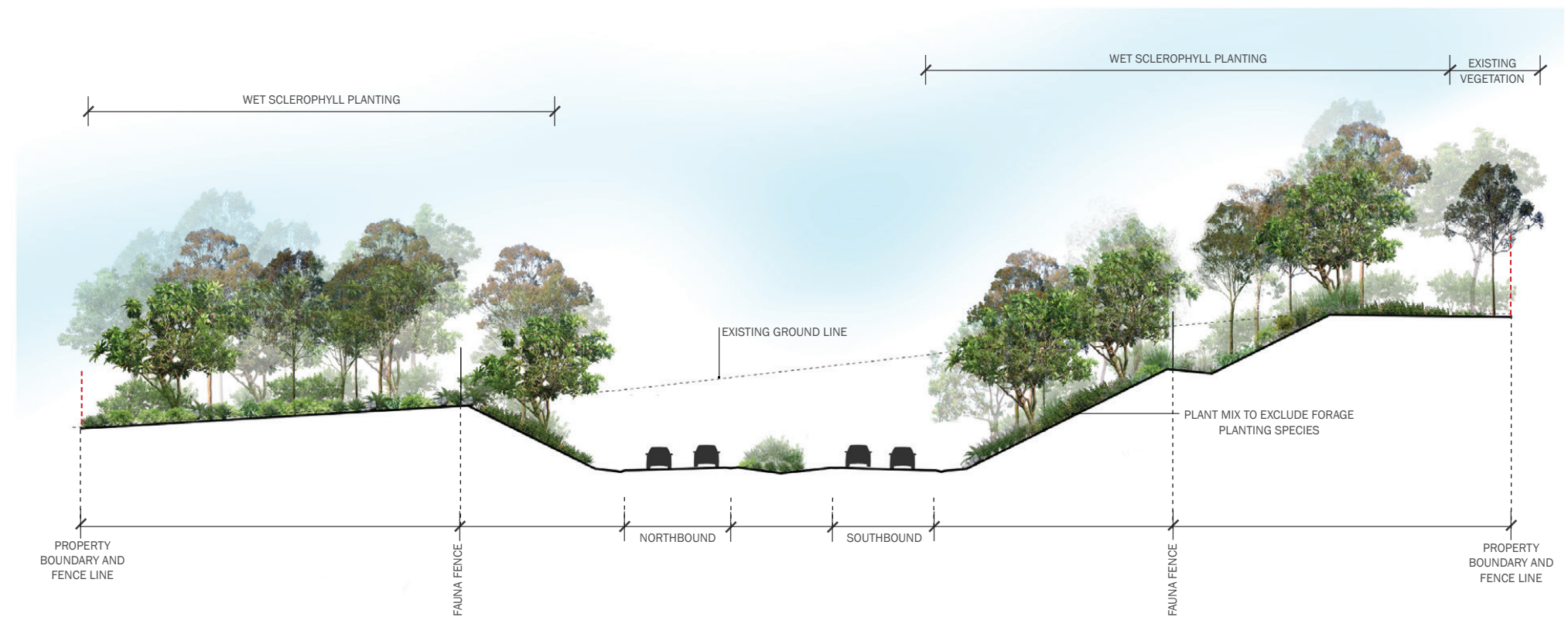


Figure 43: Cross section B-B in Bagotville (Scale 1:400)

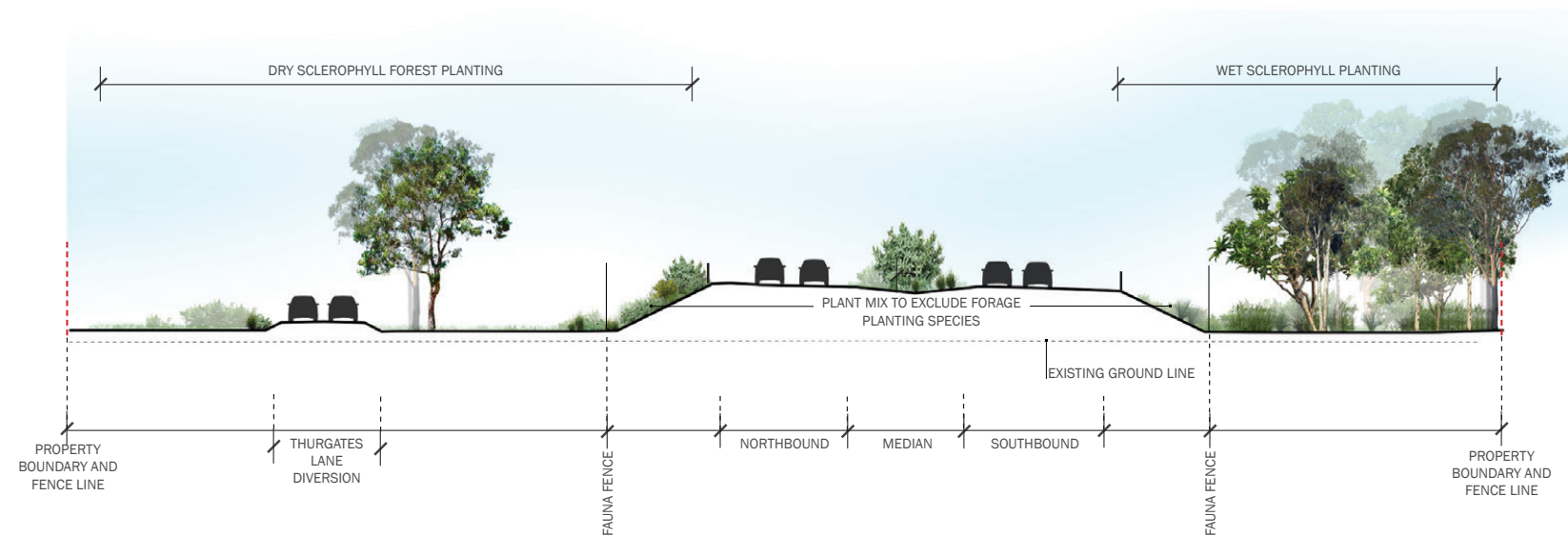


Figure 44: Cross section C-C in Wardell (Scale 1:400)

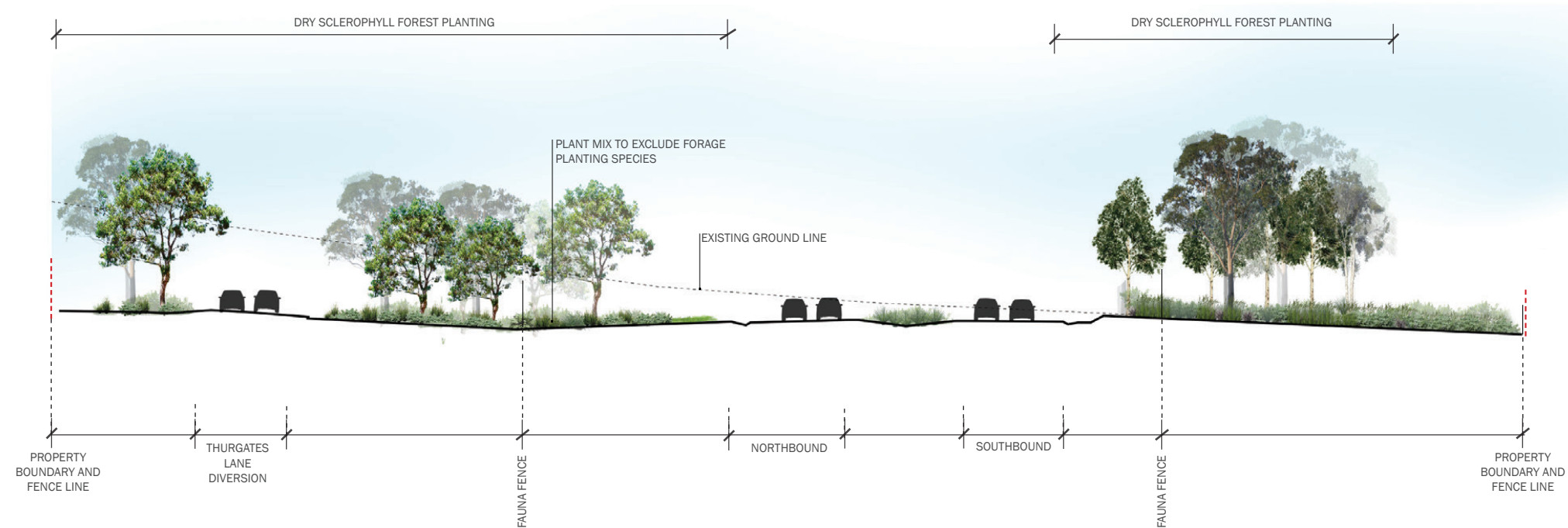


Figure 45: Cross Section D-D in Wardell (Scale 1:400)

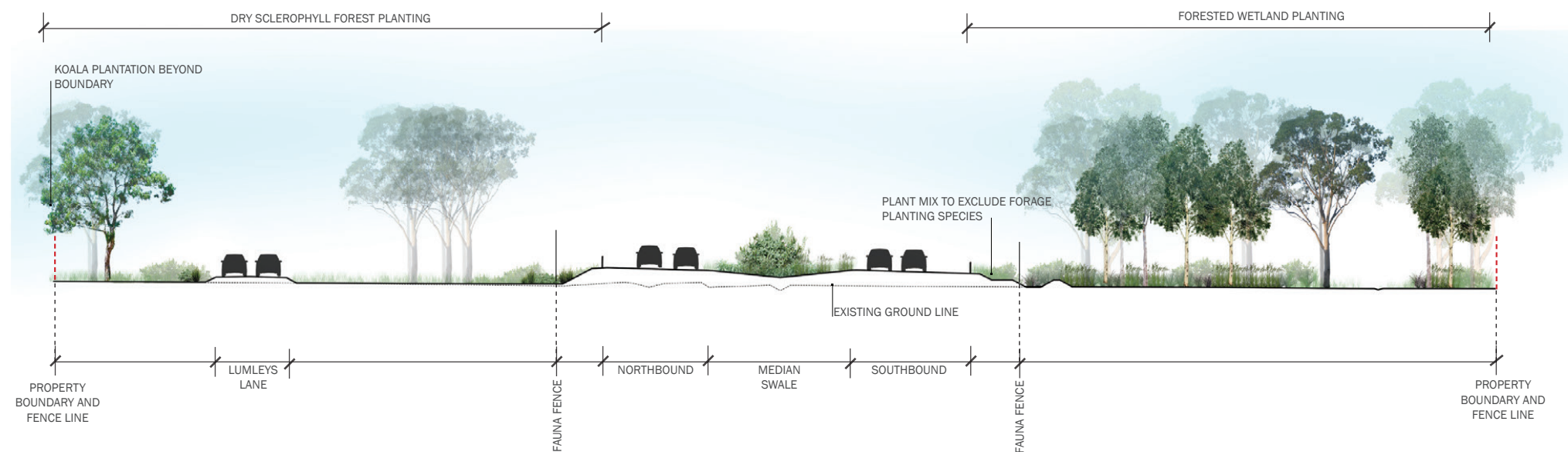


Figure 46: Cross section E-E in Wardell (Scale 1:400)

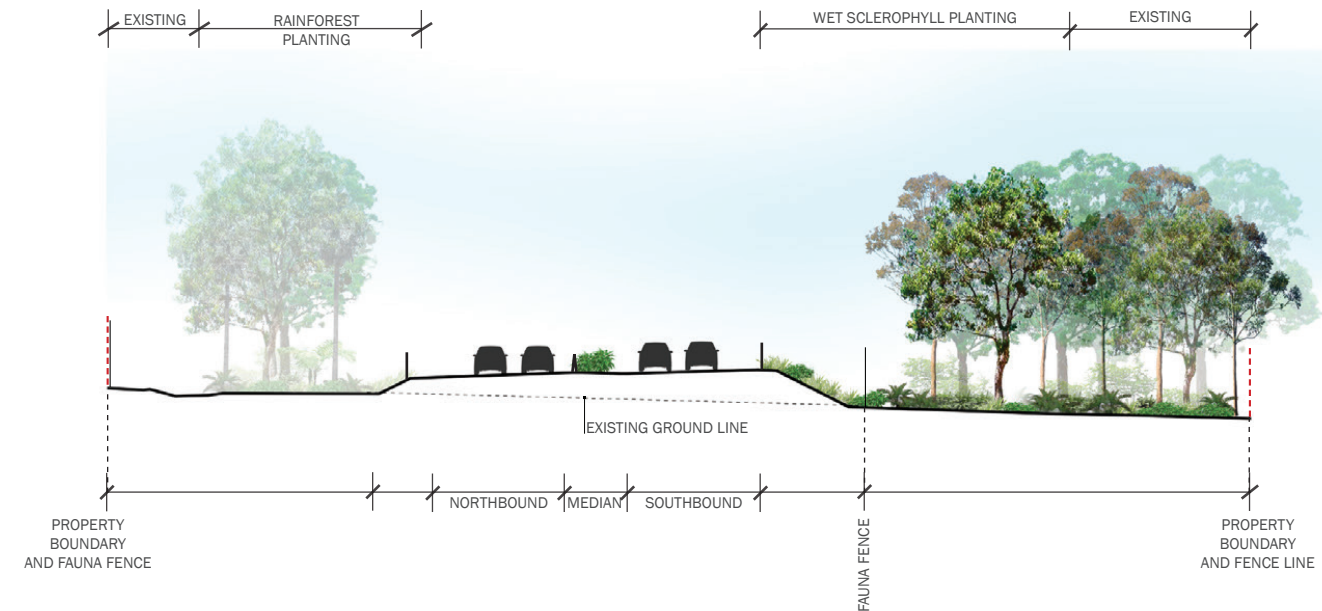


Figure 47: Cross section F-F in Wardell (Scale 1:400)

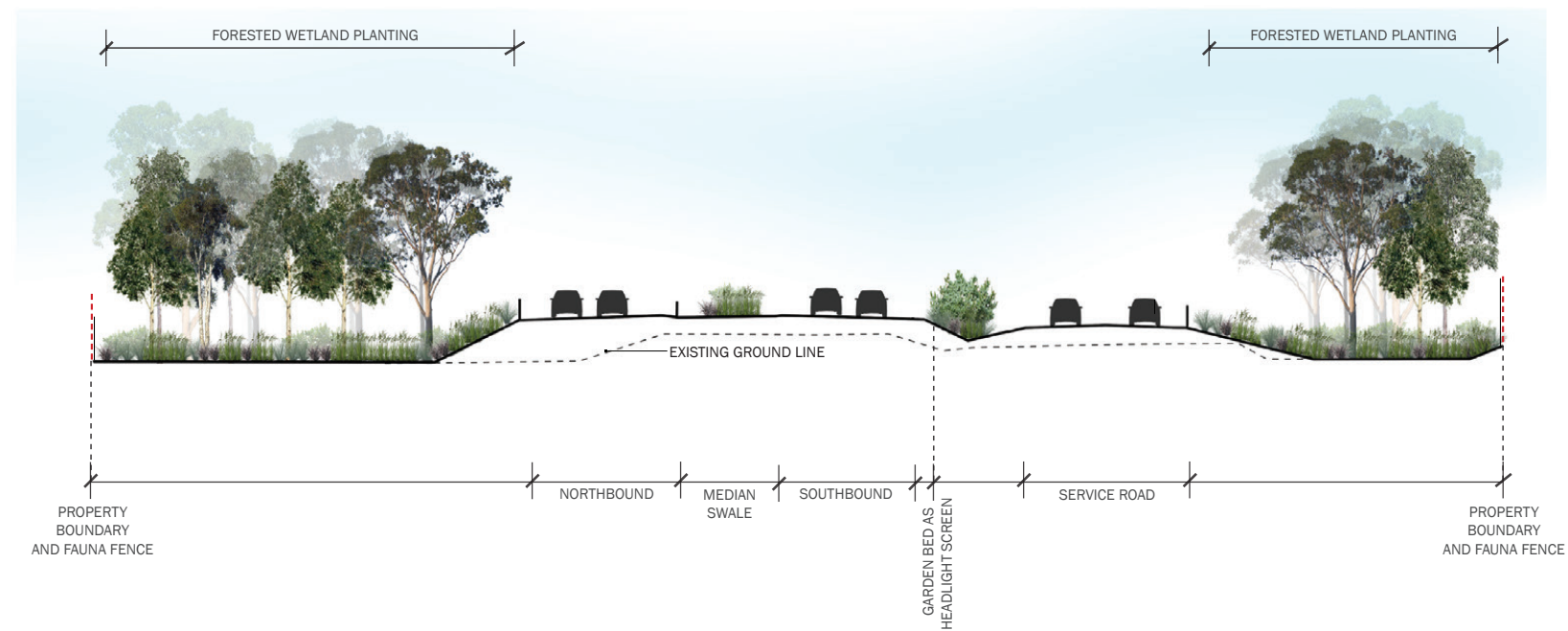


Figure 48: Cross section G-G in Pimlico (Scale 1:400)

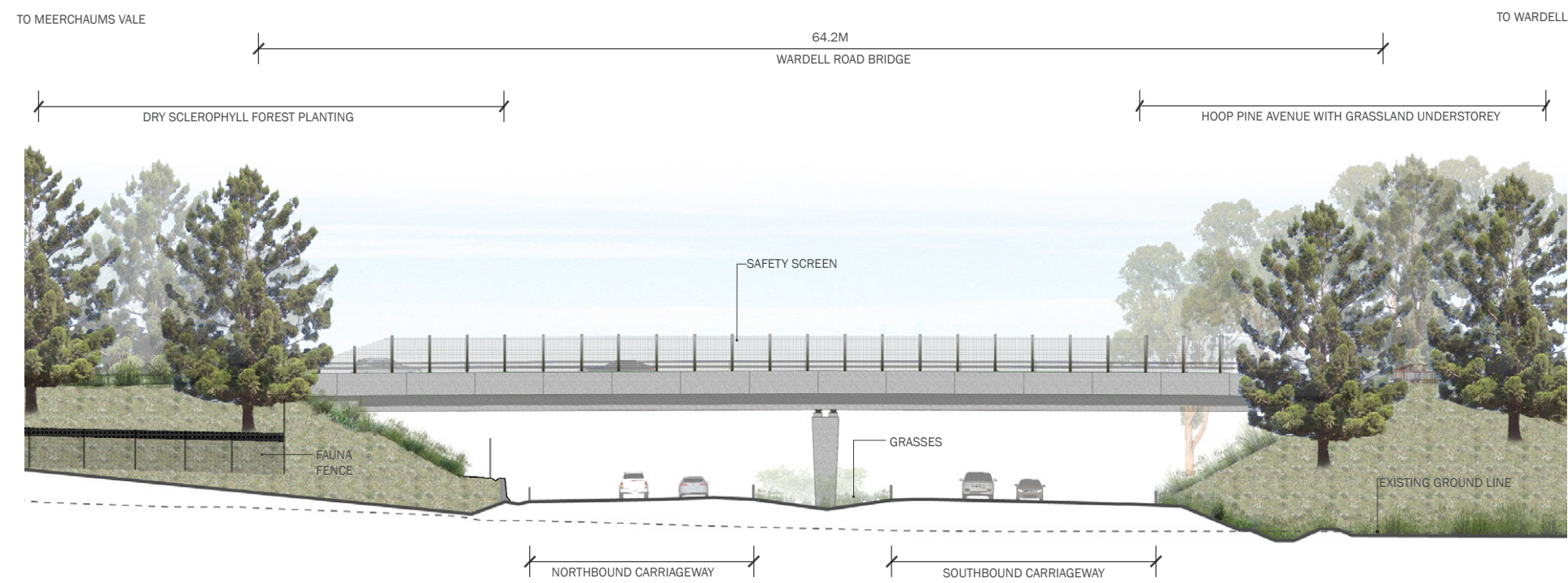


Figure 49: Wardell Road overbridge elevation (Scale 1:400)

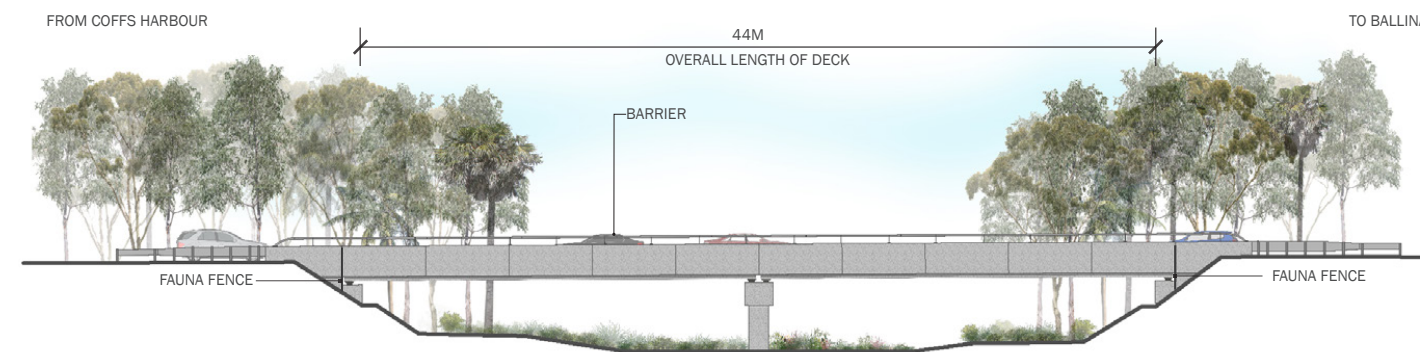


Figure 50: Floodway bridge (Wardell Bridge) - elevation (Scale 1:400)



Figure 51: Typical floodway bridge (Wardell Bridge) - cross section (Scale 1:200)

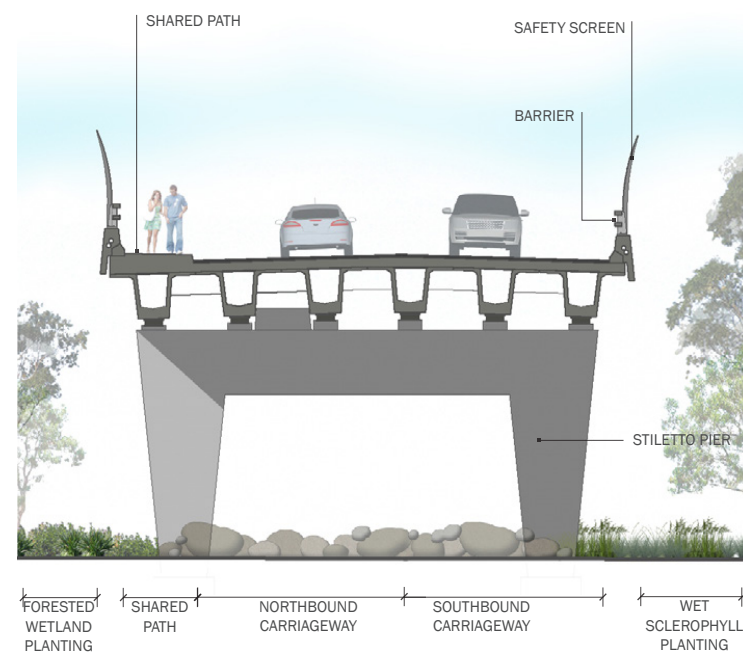


Figure 52: Typical cross section of overpass bridges (Scale 1:200)

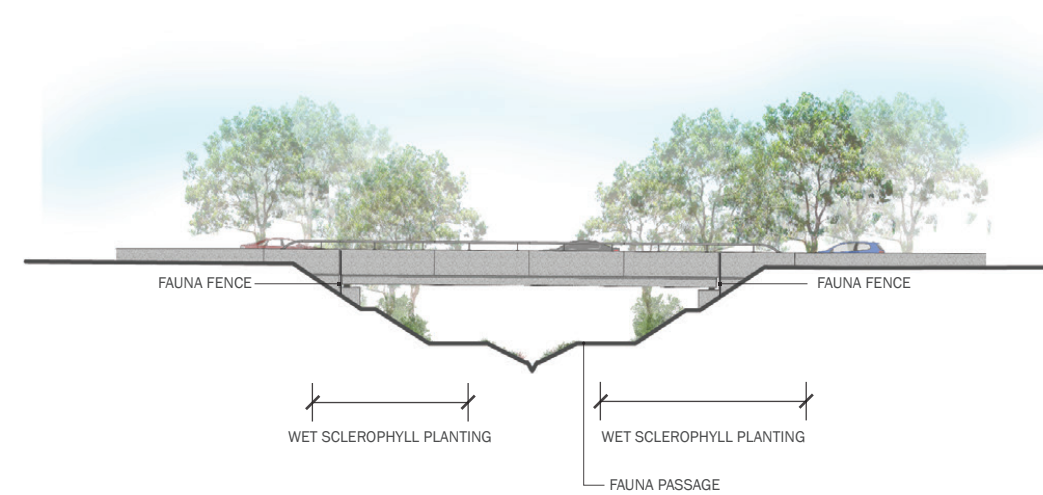


Figure 53: Elevation of typical fauna passage (Scale 1:400)

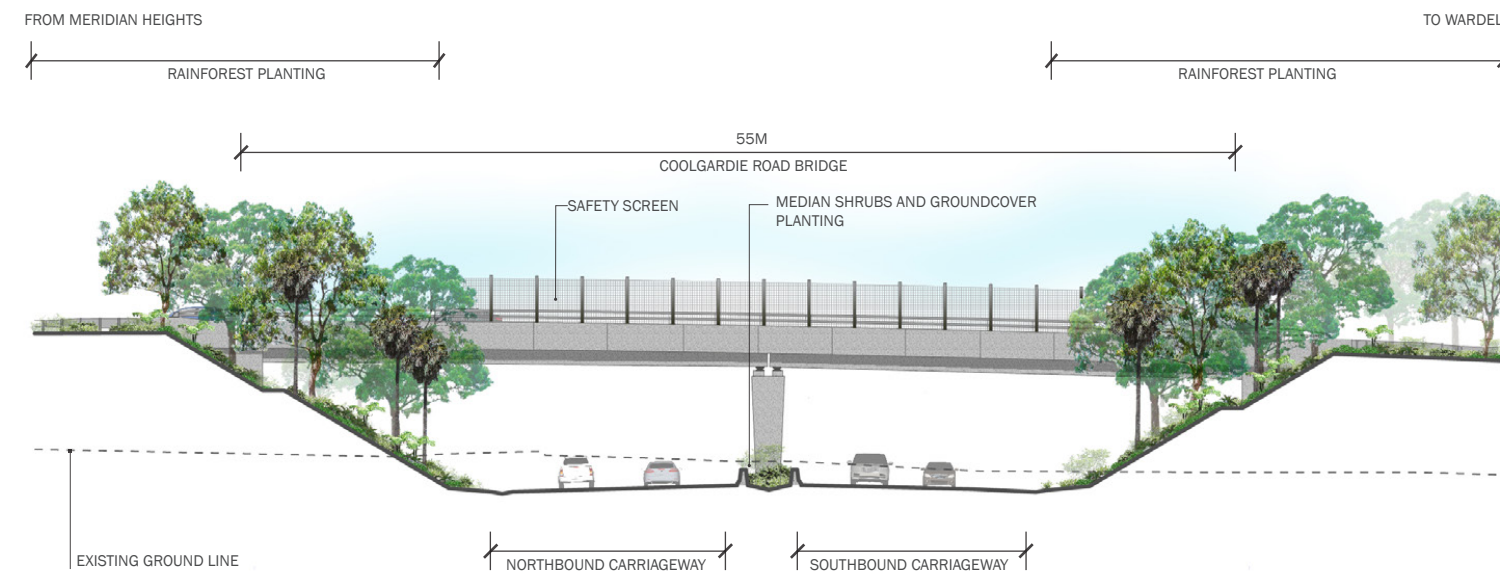


Figure 54: Coolgardie overpass - elevation (Scale 1:400)

7.1.8 DETAILED LANDSCAPE PLANS

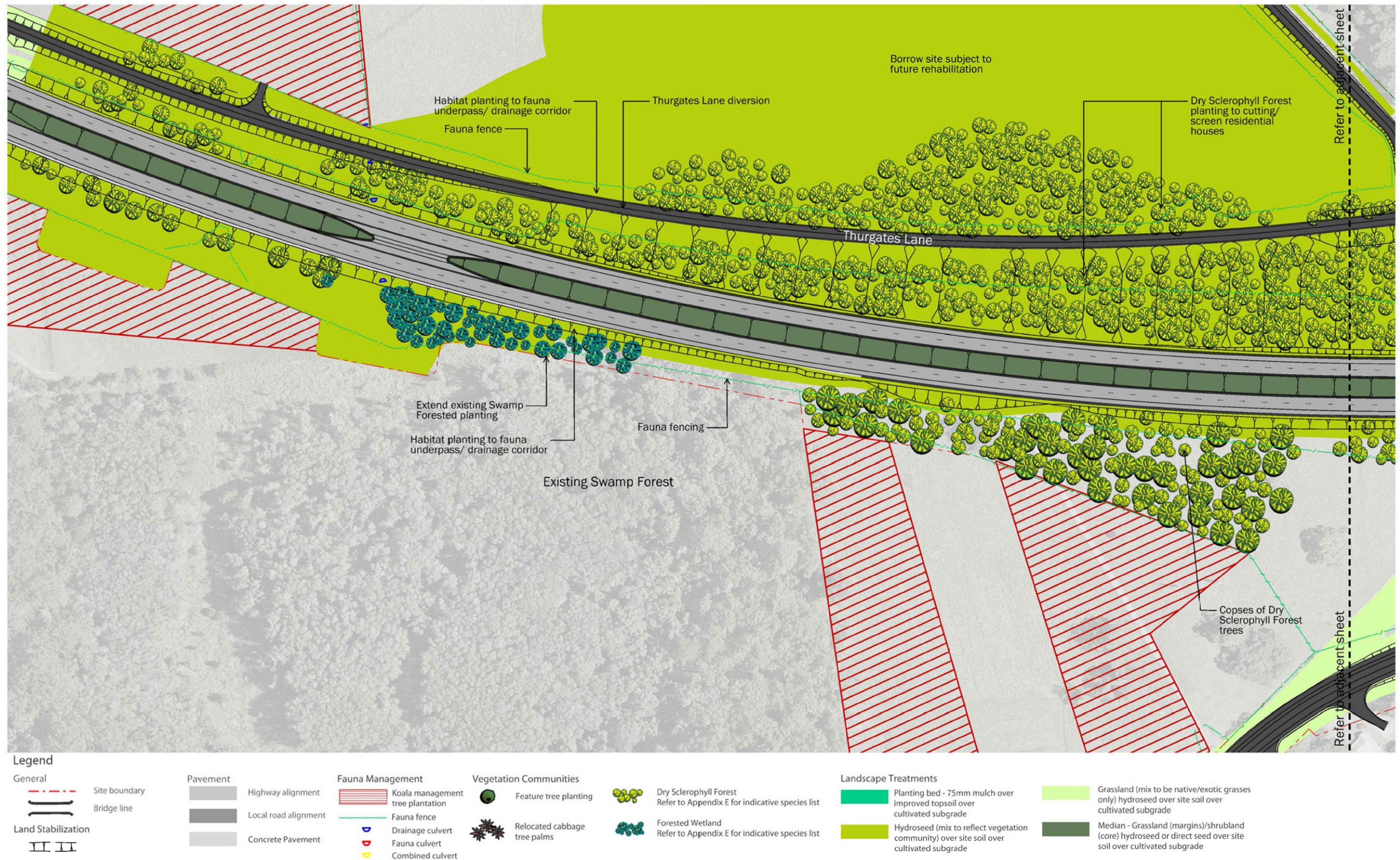
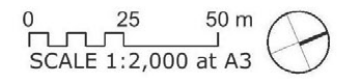


Figure 55: Urban and landscape detail plan - Wardell Road overbridge (Scale 1:2000)



Legend

<p>General</p> <ul style="list-style-type: none"> Site boundary Bridge line Land Stabilization 	<p>Pavement</p> <ul style="list-style-type: none"> Highway alignment Local road alignment Concrete Pavement 	<p>Fauna Management</p> <ul style="list-style-type: none"> Koala management tree plantation Fauna fence Drainage culvert Fauna culvert Combined culvert 	<p>Vegetation Communities</p> <ul style="list-style-type: none"> Feature tree planting Relocated cabbage tree palms 	<p>Landscape Treatments</p> <ul style="list-style-type: none"> Dry Sclerophyll Forest Refer to Appendix E for indicative species list Forested Wetland Refer to Appendix E for indicative species list Planting bed - 75mm mulch over improved topsoil over cultivated subgrade Hydroseed (mix to reflect vegetation community) over site soil over cultivated subgrade 	<ul style="list-style-type: none"> Grassland (mix to be native/exotic grasses only) hydroseed over site soil over cultivated subgrade Median - Grassland (margins)/shrubland (core) hydroseed or direct seed over site soil over cultivated subgrade
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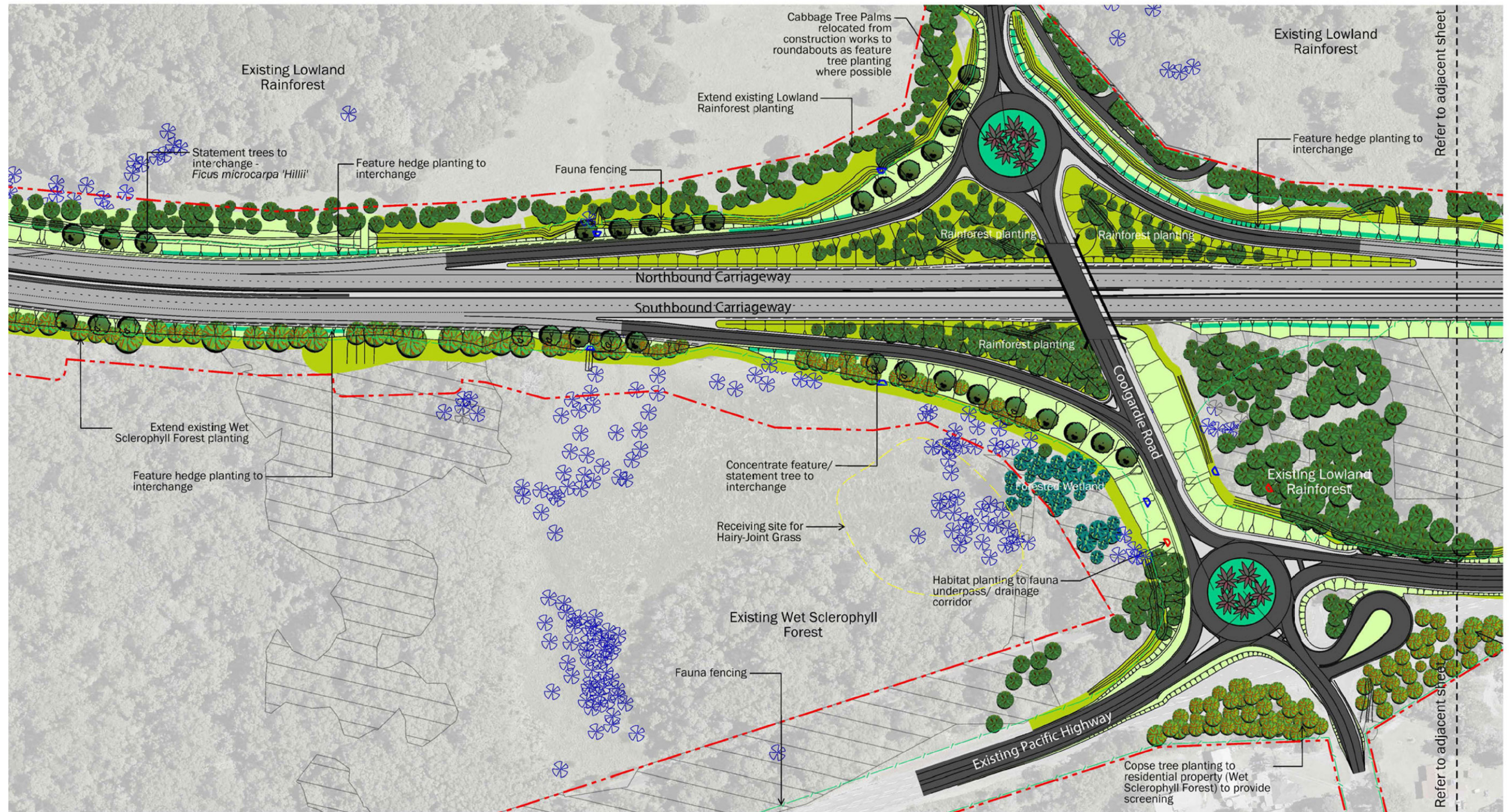
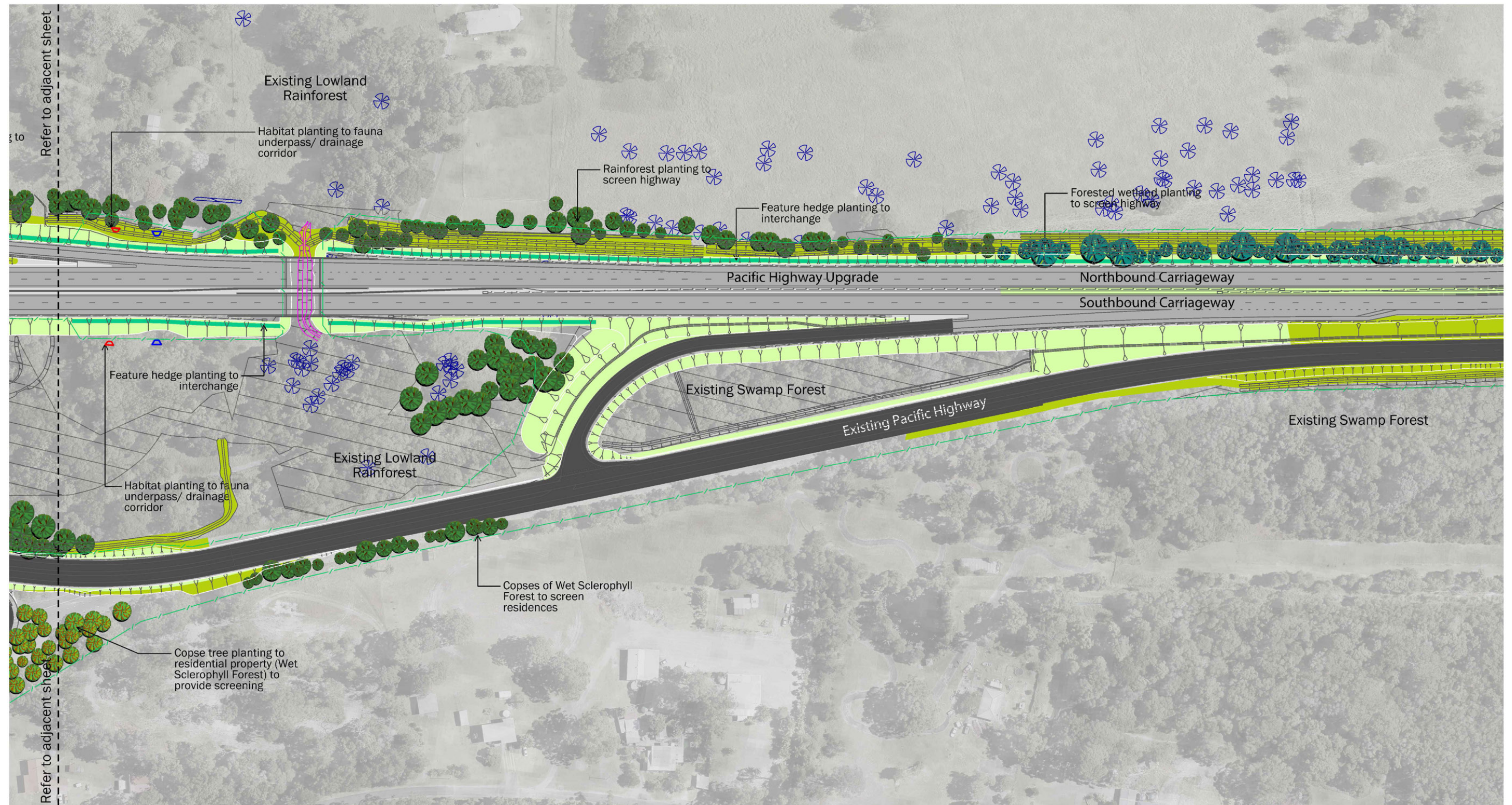






















Figure 56: Urban and landscape detail plan - Coolgardie interchange (Scale 1:2000)



Legend

- | General | | Pavement | | Fauna Management | | Flora Management | | Landscape Treatments | | | |
|---|---------------------------------|---|----------------------|---|----------------------------------|---|-------------------------------|---|---|---|--|
|  | Site boundary |  | Highway alignment |  | Koala management tree plantation |  | Endangered / threatened flora |  | Planting bed - 75mm mulch over improved topsoil over cultivated subgrade |  | Grassland (mix to be native/exotic grasses only) hydroseeded over site soil over cultivated subgrade |
|  | Bridge line |  | Local road alignment |  | Tree fence |  | Existing endangered community |  | Wet Sclerophyll Forest
Refer to Appendix E for indicative species list |  | Median - Grassland (margins)/shrubland (core) hydroseeded or direct seed over site soil over cultivated subgrade |
| Land Stabilization | |  | Concrete Pavement |  | Drainage culvert | Vegetation Communities | |  | Rainforest
Refer to Appendix E for indicative species list | | |
|  | Fill embankment/ cut embankment | | |  | Fauna culvert |  | Feature tree planting |  | Forested Wetland | | |
|  | | | | | Combined culvert | | | | | | |

0 25 50 m
SCALE 1:2,000 at A3

7.1.9 ARTIST'S IMPRESSION OF COOLGARDIE INTERCHANGE



Figure 57: Artist's impression - Coolgardie interchange from the north bound carriageway (Note: Landscape shown at maturity)



Figure 58: Artist's impression - the design on the approach to Coolgardie interchange signals the entry into Wardell township
(Note: Landscape shown at maturity.)

7.2 SUMMARY OF LANDSCAPE MONITORING AND MANAGEMENT

As part of the delivery of the landscape design and its intent, there is a requirement for ongoing landscape monitoring and management. This ensures the landscape achieves its final intent in relation to:

- Screening of views from impacted properties
- Establishment/reinforcement of the character of the adjoining vegetation community
- Enhanced connectivity of fauna corridors
- Provides a safe environment for those using, as well as those maintaining, the work
- Manages and controls the spread of noxious weeds.

As part of this process a structure is established for the implementation and establishment period which is reflected in the Landscape Documentation.

The objectives of the monitoring are to provide:

- Progressive review of environmental conditions including:
 - Rate of vegetation establishment
 - Issues in diversity development
 - Presence of weeds, including noxious , environmental and general weeds
 - Compliance with sightline requirements
 - Compliance with clearance requirements to fences and carriageways with a view to establishment of maintenance requirements and additional work.

The objectives of management work is to ensure the observations made as part of the monitoring process are taken forward into field operations to ensure that the landscape achieves its environmental objectives and design intent. The works will be responsive to changing seasonal demands and the degree of establishment achieved. Critical periods for weed management will be the hot/wet periods in which growth can be rapid and infestations can become established and set seed.



Figure 59: View of the project area from Lumleys Lane within Richmond River to Coolgardie Road - Section 10

7.3 VISUAL IMPACT ASSESSMENT AND MITIGATION

This chapter provides a reassessment of the impact of the highway on landscape character and views, using the Environmental Impact Assessment Practice Note: *Guidelines for Landscape Character and Visual Impact Assessment* (“EIA No. 4 Guidelines”, Roads and Maritime, March 2013), compared to the EIS design.

7.3.1 LANDSCAPE CHARACTER AND IMPACT ASSESSMENT

To assess landscape character the local context of the site is broken up into a number of units to help understand the local context and the implications of the proposal. These include defining the landscape character precincts (precincts of similar spatial or character properties), and the analysis of changes to these precincts as a result of the proposed project.

Landscape character is defined as:

“The combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place.” (EIA No.4 Guidelines, 2013).

The proposal is assessed in terms of its impact on these character zones and the impact ranked in terms of sensitivity to change. This assessment differs from a visual assessment in that it assesses the overall impact of a proposal on an area’s character and sense of place.

7.3.2 VISUAL IMPACT ASSESSMENT

7.3.2.1 VISIBILITY

The view fields of a road corridor or object are composed of static receptors i.e. those that adjoin the corridor and mobile receptors include those that travel along the corridor. The impact of the two groups are unique in that the time and frequency of the exposure differ. The extent to which views can be obtained is referred to as the view catchment.

STATIC RECEPTORS

Static receptors occur within the visual catchment of the project alignment i.e. they are points, which have a view of or can be viewed from the alignment. The visual envelope of the proposal is visually defined by both the topography and vegetation, which adjoins the proposal.

MOBILE RECEPTORS

Mobile receptors are the users of the project alignment and the adjoining streets. Their experience of the space is short term.

7.3.3 LANDSCAPE CHARACTER AND VISUAL ASSESSMENT MATRIX

Landscape character and visual assessment are equally important. Landscape character assessment helps determine the overall impact of a proposal on an area’s character and sense of place including all built, natural

and cultural aspects, covering towns, countryside and all shades between. Visual impact assessment helps define the day to day visual effects of a proposal on people’s views.

To quantify these impacts it is important to assess two qualities in relation to landscape character or view point. These are: Sensitivity and Magnitude

“Sensitivity refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed change. For example a pristine natural environment will be more sensitive to change than a built up industrial area.

Magnitude refers to the nature of the project. For example a large interchange will have a very different impact on landscape character than a localised road widening in the same area” (Roads and Maritime, 2013).

As part of the assessment, Roads and Maritime, has adopted a matrix which combines sensitivity rankings with magnitude to determine the proposal’s overall impact. This is used to inform the Landscape Character and Visual Impact Assessment. Refer Table 11.

Note: The EIS referenced an earlier edition of the Impact Assessment Grading Matrix produced in the Guideline for *Landscape Character and Visual Impact Assessment* (Roads and Maritime, 2013).

Table 11: Impact assessment grading matrix

		MAGNITUDE			
SENSITIVITY		HIGH	MODERATE	LOW	NEGLIGIBLE
	HIGH	High Impact	High - Moderate	Moderate	Negligible
	MODERATE	High - Moderate	Moderate	Moderate - low	Negligible
	LOW	Moderate	Moderate - low	Low	Negligible
	NEGLIGIBLE	Negligible	Negligible	Negligible	Negligible

7.3.4 LANDSCAPE CHARACTER IMPACT

Chapter 5 reviewed the eight precincts impacted by the project and described their character. The EIS findings the changes in design and consequent impact on assessment are below. These findings are summarised in Table 12.

7.3.4.1 PRECINCT P-47: TUCKEAN BROADWATER

EIS ASSESSMENT

The precinct was assessed as of moderate sensitivity due to the proximity of the Blackwall Range and its unique scenic quality. The scale of impact was assessed as negligible as the area is outside the road corridor. The overall impact was consequently assessed as **negligible**.

CHANGES IN DESIGN

No changes in design impact this character precinct.

LANDSCAPE CHARACTER ASSESSMENT

The are no changes in design which impact the sensitivity of the character of the precinct and consequently no change in assessment. Overall change in landscape character is assessed as **negligible**.

7.3.4.2 PRECINCT P-48: CABBAGE TREE ISLAND AND FLOODPLAIN

EIS ASSESSMENT

The precinct is visually removed from the alignment by a ridge and vegetation cover. Its sensitivity was assessed as low and its magnitude of change as negligible. The overall impact was consequently assessed as **negligible**.

CHANGES IN DESIGN

No changes in design impact this character precinct.

LANDSCAPE CHARACTER ASSESSMENT

There are no changes impacting the character precinct and so assessment is unchanged with **negligible** impact.

7.3.4.3 PRECINCT P-49: BAGOTVILLE FLOODPLAIN & LUMLEYS HILL

EIS ASSESSMENT

The precinct was assessed as of moderate sensitivity as the alignment is set to the edge of open agricultural lands with views to the Blackwall Range at the interface with Character Precinct 50 providing an enclosed landscape character. The magnitude of change was assessed as moderate reflecting the introduction of the new road infrastructure and the relatively low scale of embankments. Its overall impact was assessed as **moderate**.

CHANGES IN DESIGN

Refinements to the design since the EIS include:

- Rest area is to be provided as a future provision and not constructed as part of the initial work
- *Koala Revegetation Strategy* (2015) is developed proposing revegetation of 130 hectares of cleared land within the valley
- Changes in provisions for fauna crossing including number and type of structures
- Refinement in alignment with minor changes in embankment scale and geometry
- Wardell Road realigned at the eastern side of the main carriageway
- Wardell Road bridge raised western side to achieve safe sight distances.

LANDSCAPE CHARACTER ASSESSMENT

The proposed changes do not change the sensitivity rating and this will remain moderate. The changes in form are not sufficient to change the magnitude rating and this will remain as moderate. The overall landscape character impact remains as **moderate**.

7.3.4.4 PRECINCT P-50: BINGAL CREEK

EIS ASSESSMENT

The precinct adjoins the eastern edge of the alignment and consists of woodland forest lands with some agricultural use. The area is assessed as of moderate sensitivity with its character assessed to have the ability to absorb impact and the alignment set to the edge of the character precinct minimising physical change. The magnitude of change involves the construction of the new highway corridor predominantly on embankment but including some minor cuttings. It was assessed as moderate to high. Its overall impact was assessed as **moderate - high**.

CHANGES IN DESIGN

Refinements to the design since the EIS include:

- Rest area is to be provided as a future provision and not constructed as part of the initial work
- Changes in provisions for fauna crossing including increase in number and type of structures
- Refinement in alignment with minor changes in embankment scale and geometry.

LANDSCAPE CHARACTER ASSESSMENT

The proposed changes do not change the sensitivity rating and this will remain moderate. The changes in form are not sufficient to change the magnitude rating and this will remain as moderate - high. The overall landscape character impact remains as **moderate - high**.

7.3.4.5 PRECINCT P-51: WARDELL TOWNSHIP

EIS ASSESSMENT

This precinct is removed from the alignment and characterised by the built form of the township of Wardell. The realignment of the highway will remove the through traffic from cutting the town in two. The sensitivity of the precinct was assessed as moderate reflecting its urban nature and the magnitude of physical change assessed as negligible due to its removal from the project alignment. The overall impact was consequently assessed as **negligible**.

CHANGES IN DESIGN

- Refinements to the extent of fauna fencing extending this facility along both Wardell Road and the existing Pacific Highway alignment.

LANDSCAPE CHARACTER ASSESSMENT

The magnitude of change remains negligible. The proposed changes do not change the sensitivity rating and this will remain moderate. The overall landscape character impact remains **negligible**.

7.3.4.6 PRECINCT P-52: BLACKWALL RANGE

EIS ASSESSMENT

The precinct is removed from the impact of the project alignment being located to its west. Associated with the Great Dividing Range, it consists of steeper, heavily vegetated topography and is of unique scenic quality. Its sensitivity is assessed as high. The magnitude of impact is assessed as negligible as the work is outside the precinct. The overall impact is consequently **negligible**.

CHANGES IN DESIGN

There are no changes impacting this precinct

LANDSCAPE CHARACTER ASSESSMENT

The magnitude of change remains negligible. The proposed changes do not change the sensitivity rating and this will remain high. The overall landscape character impact remains **negligible**.

7.3.4.7 PRECINCT P-53: PIMLICO

EIS ASSESSMENT

Pimlico is a precinct that primarily includes the agrarian floodplains east to the Richmond River. The proposal sees the introduction of new and expanded highway infrastructure. The sensitivity of the alignment was assessed as moderate reflecting the existing road corridor and the limited number of houses within a highly altered agricultural landscape. The magnitude of change was assessed as moderate. The overall impact is consequently **moderate**.

CHANGES IN DESIGN

Refinements to the design since the EIS include:

- Revisions to geometry of the Coolgardie interchange including;
 - Relocation of eastern roundabout to the west
 - Revisions to the skew of the bridge.

LANDSCAPE CHARACTER ASSESSMENT

The proposed changes do not change the sensitivity rating and this will remain moderate. The changes in form are not sufficient to change the magnitude rating and this will remain as moderate. The overall landscape character impact remains as **moderate**.

7.3.4.8 PRECINCT P-54: EMIGRANT CREEK

EIS ASSESSMENT

Located to the east of the alignment, Emigrant Creek is characterised by the winding path of the creek, which feeds into the Richmond River. This landscape forms a transition between the productive floodplain and the creek edges which are heavily vegetated.

CHANGES IN DESIGN

There are no work proposed in this precinct.

LANDSCAPE CHARACTER ASSESSMENT

As no work is occurring within the precinct, the sensitivity and magnitude are both considered **negligible**.

Table 12: Landscape sensitivity summary

LANDSCAPE CHARACTER PRECINCT	EIS SENSITIVITY	DESIGN SENSITIVITY	EIS MAGNITUDE	DESIGN MAGNITUDE	EIS IMPACT RATING	DESIGN IMPACT RATING
PRECINCT 47	Moderate	No change	Negligible	No change	Negligible	No change
PRECINCT 48	Low	No change	Negligible	No change	Negligible	No change
PRECINCT 49	Moderate	No change	Moderate	No change	Moderate	No change
PRECINCT 50	Moderate	No change	Moderate - High	No change	Moderate -High	No change
PRECINCT 51	Moderate	No change	Negligible	No change	Negligible	No change
PRECINCT 52	High	No change	Negligible	No change	Negligible	No change
PRECINCT 53	Moderate	No change	Moderate	No change	Moderate	No change
PRECINCT 54	Negligible	No change	Negligible	No change	Negligible	No change

7.3.5 IMPACT ON KEY VIEWS

The EIS determined the visual impact of 75 key viewpoints along the corridor. Of these 15 views are located within Richmond River to Ballina - (Sections 10 and 11) (Figure 60). These views are as follows:

Section 10- Richmond River to Coolgardie Road

- 48B - Backchannel Road
- 50 - Old Bagotville Road
- 51 - Thurgates lane
- 52 - Wardell Road
- 53 - Lumleys Lane, Wardell
- 54 - Lumleys Lane, Wardell
- 55 - Lumleys Lane, Wardell
- 56 - Coolgardie Road, Coolgardie
- 57 - Pimlico Road, Pimlico
- 58 - Pimlico Road, Pimlico.

Coolgardie Road to Ballina - Section 11

- 59 - Whytes lane (East), Pimlico
- 60 - Whytes Lane, Pimlico
- 61 - Pimlico Road, Pimlico
- 62A - Whytes Lane (West) Pimlico
- 62B - 110 Sartories Lane, Pimlico.

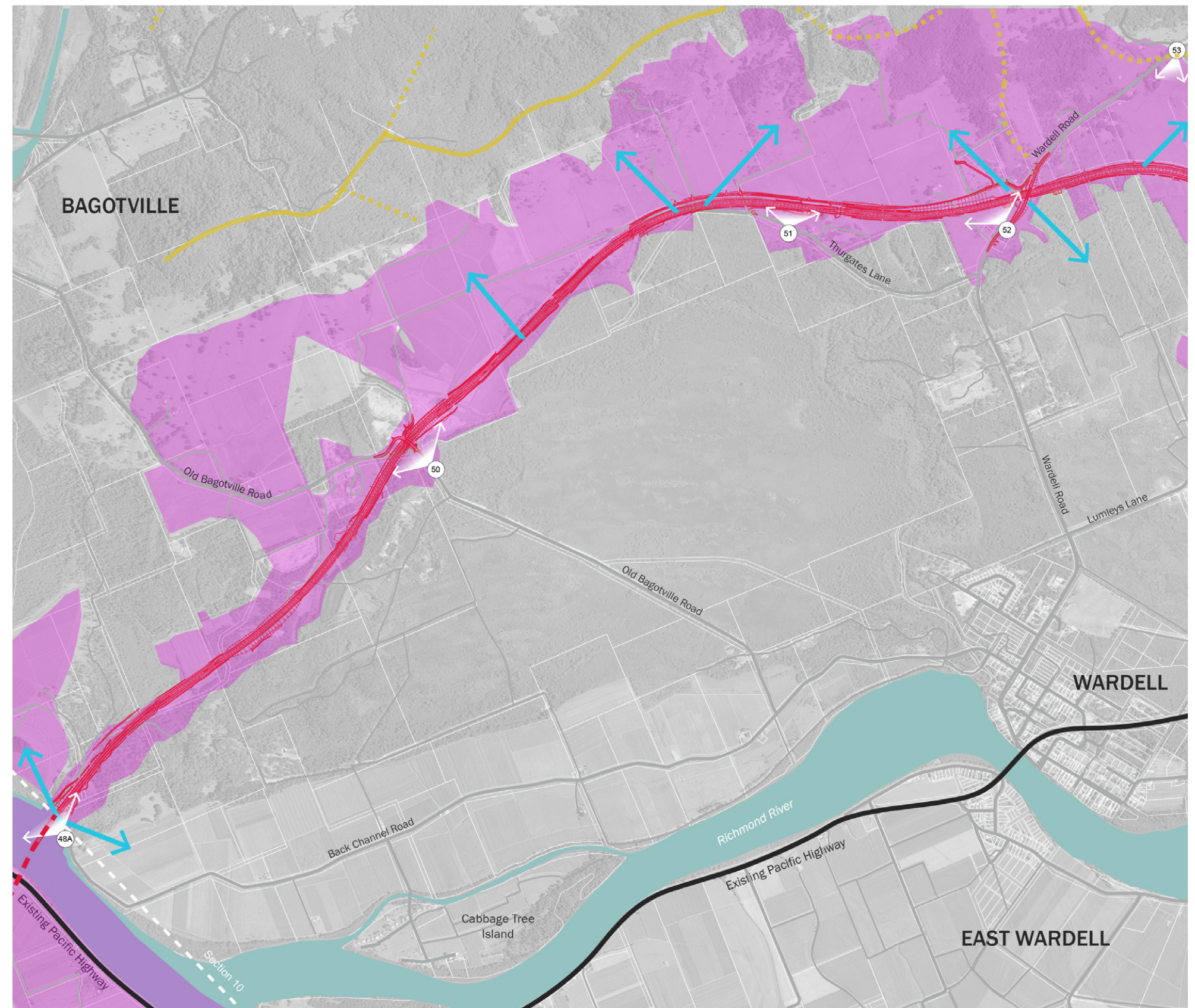
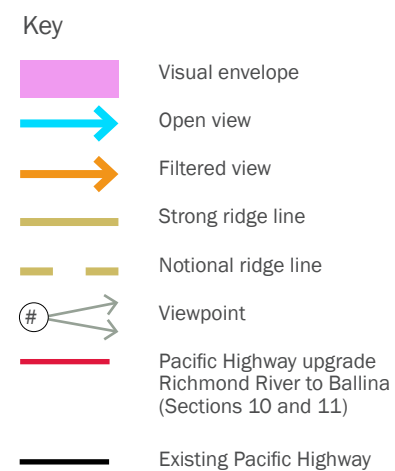
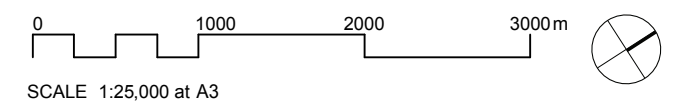
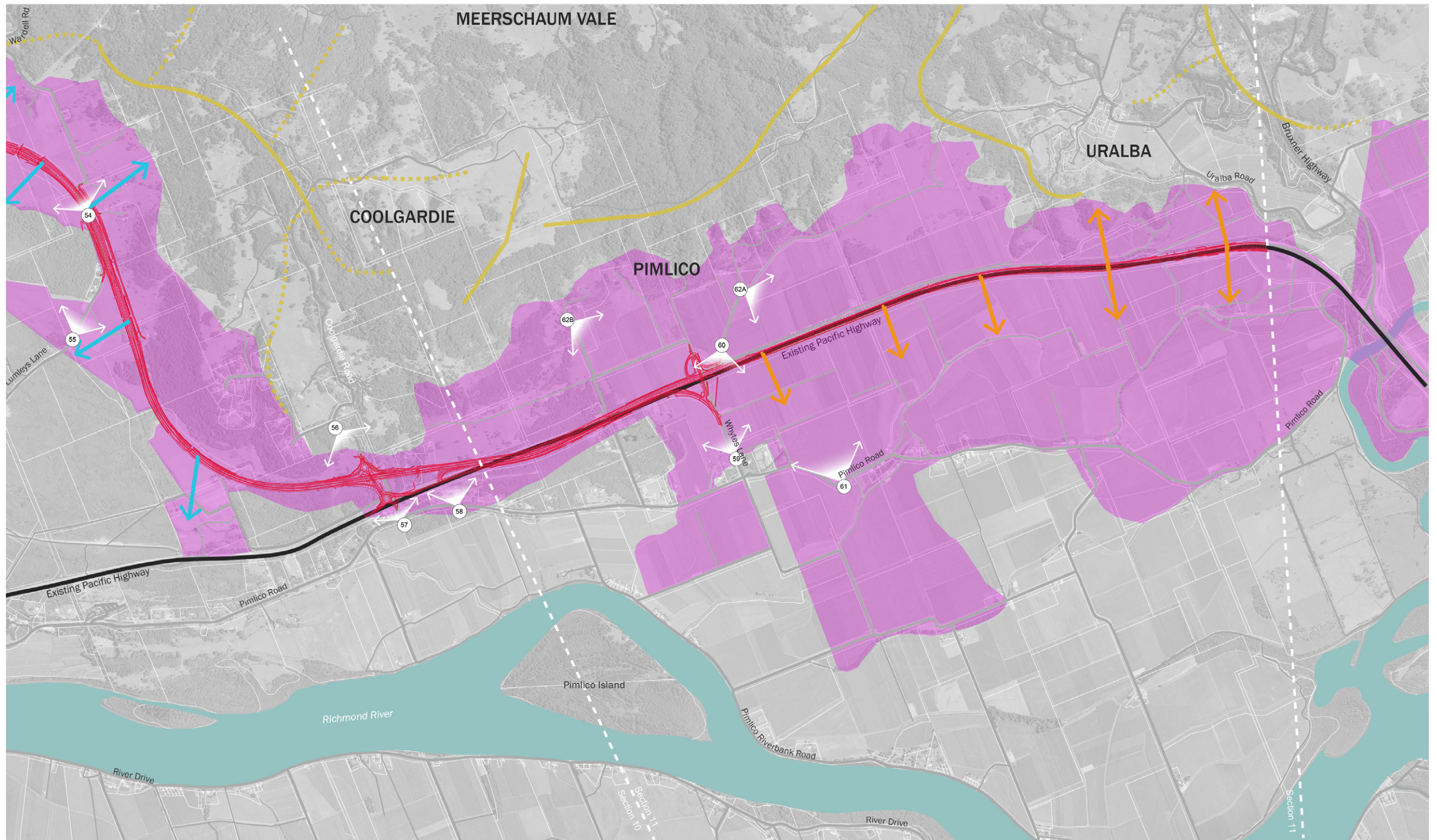


Figure 60: Visual Impact Assessment key plan showing viewpoints





7.3.5.1 VIEW POINT 48B: BACKCHANNEL ROAD (NOTED IN EIS PLAN AS 48A)

DESCRIPTION:

Foreground view looking west from the end of Backchannel Road, next to the Richmond River. View point is located just east of the project alignment.

EIS ASSESSMENT

The viewpoint was assessed to have low sensitivity due to the low number of viewers and its magnitude assessed as high. The magnitude reflected the construction of a major new bridge built over a natural setting. The overall visual impact was assessed as **moderate**.

VISUAL IMPACT ASSESSMENT

The sensitivity of rating of the EIS will not change as a result of the development of the design. The bridge design is not part of the Richmond River to Coolgardie Road - Section 10 design package but will form part of the overall project work and will be subject to its own assessment in another document. The scale of the new bridge will remain similar to the EIS concept and so the magnitude rating is considered to remain high. The visual assessment impact will remain **moderate**.



7.3.5.2 VIEW POINT 50: OLD BAGOTVILLE ROAD

DESCRIPTION

Foreground view looking west from Old Bagotville Road (in the location of the proposed Old Bagotville Road Underpass) overlooking the existing quarries.

EIS ASSESSMENT

The viewpoint was assessed to have moderate - low sensitivity due to the low number of viewers and its magnitude was assessed as high to moderate. The magnitude reflected the construction of a major new overbridge within a disturbed quarry area. The overall visual impact was assessed as **moderate**.

VISUAL IMPACT ASSESSMENT.

The change in design from an overpass bridge to an underpass structure for Old Bagotville Road will see changes in impact as a result of an increase in scale of the main alignment formation and changes to the alignment of Old Bagotville Road. The sensitivity of rating of the EIS will not change as a result of the development of the design. The scale of the formation is similar to the existing but has seen the removal of the overbridge and its associated formation. The magnitude is consequently considered to be reduced to moderate. The visual assessment impact will be reduced to **moderate to low**.



7.3.5.3 VIEW POINT 51: THURGATES LANE

DESCRIPTION

Foreground view looking west from Thurgates Lane to the Blackwall Range.

EIS ASSESSMENT

The viewpoint was assessed to have moderate sensitivity, with a small number of houses identified as having direct views of the project. The magnitude was assessed as high due to the scale of infrastructure introduced to the peaceful agricultural setting. The overall visual impact was assessed as **moderate to high**.

VISUAL IMPACT ASSESSMENT

Four residential properties are identified as overlooking this view. Two of these properties fall within the proposed *Koala Revegetation Strategy* (2015) and will incorporate plantation work within the lots between the highway and Thurgates Lane. The overall sensitivity has therefore been considered to be moderate reflecting distance of views and screening of the closest properties as part of the Koala Strategy. The magnitude is assessed as moderate reflecting the establishment of a plantation between the highway and the lane reducing the visual impact.

Overall the visual impact rating is assessed as reduced to **moderate**.



7.3.5.4 VIEW POINT 52: WARDELL ROAD

DESCRIPTION

Foreground to mid-ground view looking west from Wardell Road to the Blackwall Range.

EIS ASSESSMENT

The view point was assessed to have moderate sensitivity due to the low number of people viewing the change. The magnitude of the change was assessed as high, reflecting the introduction of a major highway within the agricultural setting. The overall rating was assessed as **moderate to high**.

VISUAL IMPACT ASSESSMENT

The detailed design development will not change the sensitivity rating of the EIS with the site remaining moderate. The developed design has an area of plantation revegetation proposed as part of the proposed *Koala Revegetation Strategy* (2015) which will reduce the level of exposure of the proposal along with the proposed revegetation work within the proposed landscape design. The magnitude of change is consequently considered to be reduced to moderate. This sees an overall reduction of impact to **moderate**.



7.3.5.5 VIEW POINT 53: LUMLEYS LANE, WARDELL

DESCRIPTION

View from the intersection of Lumleys Lane and Wardell Road looking south east. This presents a mid-ground view of the alignment within the valley.

EIS ASSESSMENT

The sensitivity of the proposal is assessed as moderate reflecting the visibility of the highway from the local road network. The magnitude of change is assessed as high to moderate in response to the introduction of a major highway within the agricultural setting. The overall rating is **moderate to high**.

VISUAL IMPACT ASSESSMENT

The detailed design development will not change the sensitivity rating of the EIS with the sensitivity remaining moderate. The magnitude of the impact has however been altered by the plantation revegetation work proposed as part of the proposed *Koala Revegetation Strategy* (2015). This strategy will reduce the level of exposure of the proposal with plantation proposed both behind and in front of the alignment. The impact has consequently been reassessed as **moderate**.



7.3.5.6 VIEW POINT 54: LUMLEYS LANE, WARDELL

DESCRIPTION

Foreground view looking west along the alignment from where Lumleys Lane intersects with it. The view is similar to that of the proposed service road.

EIS ASSESSMENT

The sensitivity of the proposal is assessed as moderate reflecting the visibility of the highway from the local road network. The magnitude of change is assessed as high in response to the introduction of a major highway within the agricultural setting and the proximity of viewer. Overall impact was assessed as **moderate to high**.

VISUAL IMPACT ASSESSMENT

The detailed design development will not change the sensitivity rating of moderate in the EIS. The magnitude of the impact also will not change and has been assessed as high. Overall impact is unchanged and is assessed as **moderate to high**.



7.3.5.7 VIEW POINT 55: LUMLEYS LANE, WARDELL

DESCRIPTION

Mid-ground view looking, north along the Lumleys Lane, towards the proposed alignment.

EIS ASSESSMENT

The sensitivity of the proposal is assessed as moderate reflecting the visibility of the highway from the local road network and low number of adjoining houses. The magnitude of change is assessed as moderate to high in response to the introduction of a major highway within the agricultural setting and the proximity of viewer. Overall impact was assessed as **moderate to high**.

VISUAL IMPACT ASSESSMENT

The detailed design development sees the view largely located within an area of plantation revegetation as part of the proposed *Koala Revegetation Strategy* (2015). This will result in a reduction in both the sensitivity and magnitude of the proposal as the views will ultimately be concealed. Sensitivity has consequently been assessed as moderate to low. The magnitude of the impact will also change and is assessed as moderate to low. Overall impact is assessed as **moderate to low**.



7.3.5.8 VIEW POINT 56: COOLGARDIE ROAD, COOLGARDIE

DESCRIPTION

Foreground view from Coolgardie Road looking east across the proposed interchange.

EIS ASSESSMENT

The viewpoints sensitivity was assessed as moderate as part of the EIS reflecting the relatively low number of adjoining houses and the otherwise well-screened nature of the site. The magnitude of the impact was assessed as high, reflecting the scale of the infrastructure proposed and the extent of clearing. Overall impact was assessed as **moderate to high**.

VISUAL IMPACT

As part of the design development the visual sensitivity of the view has not changed and is considered moderate. The design however has seen the realignment of the bridge resulting in a reduced level of exposure of the infrastructure when travelling along Coolgardie Road. The nearest dwelling is 350 metres from the interchange and will be screened by the existing vegetation cover. The magnitude of impact has been revised to moderate. The overall impact is considered to have a reduced visual impact which has been assessed as **moderate**.



7.3.5.9 VIEW POINT 57: PIMLICO ROAD, PIMLICO

DESCRIPTION

View looking west from Pimlico Road towards the existing highway and proposed Coolgardie interchange beyond.

EIS ASSESSMENT

The view point is assessed to have a moderate to low sensitivity with a number of residents noted as having changed foreground views but views generally being screened by existing vegetation. Its magnitude is assessed as high to moderate reflecting the scale of the new infrastructure. Overall impact was assessed as **moderate**.

VISUAL IMPACT ASSESSMENT

The view from Pimlico Road is substantially screened from the existing highway and the proposed highway beyond. The realignment of the bridge since EIS has moved the roundabout further west, further limiting clearance of vegetation east of the highway. The sensitivity of the view is considered to remain unchanged however the magnitude is considered to be reduced to moderate to low. Overall assessment is considered to be **moderate to low**.



7.3.5.10 VIEW POINT 58: PIMLICO ROAD, PIMLICO

DESCRIPTION

Middle ground view looking west from Pimlico Road to the existing highway and the proposed highway alignment beyond.

EIS ASSESSMENT

The view point was assessed to have a moderate sensitivity reflecting the presence of a number of houses overlooking the general alignment and acknowledging its well screened nature. The magnitude of the change was assessed as low due to screening provided by existing vegetation between the existing highway and the proposed. The overall rating was **moderate to low**.

VISUAL IMPACT ASSESSMENT

The view from Pimlico Road is substantially screened from the existing highway and the proposed highway beyond. The sensitivity and magnitude of changes to the view are considered to remain unchanged. The overall assessment is considered to remain as **moderate to low**.



7.3.5.11 VIEW POINT 59: WHYTES LANE (EAST), PIMLICO

DESCRIPTION

Middle ground view looking west from Whytes Lane East across the sugarcane fields towards the scenic hills of the Blackwall Range.

EIS ASSESSMENT

The EIS assessment has assessed the sensitivity as moderate to low due to the relatively low number of viewers. The EIS concept assessed the magnitude of impact as moderate, reflecting the elevated highway and introduction of the Whytes Lane Bridge structure. The overall rating was assessed as **moderate**.

VISUAL ASSESSMENT IMPACT

Whytes lane is substantially exposed within the sugarcane landscape of the Richmond floodplain. Sensitivity is considered moderate due to the number and distance of viewers. The magnitude of the impact of construction of the bridge is considered to be moderate. The overall rating has not changed and remains as **moderate**. The landscape response has sought to provide screening of the structure from all angles. This screening in time will lower the overall impact of the works.



7.3.5.12 VIEW POINT 60: WHYTES LANE, PIMLICO

DESCRIPTION

View looking south-east from Whytes Lane, Pimlico with the Blackwall Range visible to the west. The area is cleared as part of the early works package resulting in vegetation loss between Whytes Lane and the Pacific Highway.

EIS ASSESSMENT

The viewpoint was assessed as having moderate sensitivity reflecting the relatively limited usage of the local road. The EIS concept was assessed to have a high impact due to the possible removal of vegetation between Whytes Lane and the Highway. The overall rating was assessed as **moderate to high**.

VISUAL IMPACT ASSESSMENT

The detailed design has not changed the sensitivity rating from the EIS with its assessment remaining as moderate. The detailed design has remained relatively unchanged compared to the EIS concept with the exception of the site clearance that has occurred as part of the early works package. This confirms the magnitude assessment as being high. This confirms the magnitude assessment as being high. The overall assessment remains unchanged and is rated **moderate to high**. Screen planting proposed will assist in moderating the overall visual impact over time.



7.3.5.13 VIEW POINT 61: PIMLICO ROAD, PIMLICO

DESCRIPTION

Middle ground view looking west from Pimlico Road towards the existing Pacific Highway and the scenic Blackwall Range beyond.

EIS ASSESSMENT

The view point was assessed as having moderate to low sensitivity reflecting the limited number of viewers and distance from the proposal. The EIS concepts magnitude of change was assessed as moderate to low reflecting the existence of similar infrastructure already in this general location. The overall impact was assessed as **moderate to low**.

VISUAL IMPACT ASSESSMENT

The detailed design has not changed the sensitivity rating assessed in the EIS and remains as moderate to low. The developed design is relatively unchanged compared to the EIS from this view with the foreground dominated by the changing landscape of sugarcane crops. The magnitude therefore remains as moderate to low with an overall impact rating remaining the same as **moderate to low**.



7.3.5.14 VIEW POINT 62A: WHYTES LANE (WEST) PIMLICO

DESCRIPTION

Middle ground view looking east from Whytes Lane West, Pimlico, providing views across sugarcane paddocks to both the existing and proposed alignment.

EIS ASSESSMENT

The view point was assessed to have a moderate to low sensitivity reflecting the distance and limited number of viewers within the landscape. The magnitude of the EIS concept was assessed to be of moderate to low magnitude reflecting the shallow height of the proposal and its augmentation of the existing Pacific Highway infrastructure. Its overall impact was assessed as **moderate to low**.

VISUAL IMPACT ASSESSMENT

The detailed design is relatively unchanged and has not changed either the sensitivity (moderate to low) or magnitude (moderate to low). The overall assessment therefore remains **unchanged**. The landscape design has responded to these impacts to provide screening over time from properties in the Blackwall Ranges to the west of the alignment.



7.3.5.15 VIEW POINT 62B: 110 SARTORIES LANE, PIMLICO

DESCRIPTION

Middle ground view looking east from Sartories Lane, Pimlico, providing views across agricultural lands from adjoining a cluster of housing.

EIS ASSESSMENT

The view point was assessed to have moderate sensitivity as any change impacts a small number of houses. The magnitude of the EIS concept was assessed as moderate, reflecting the intensification of infrastructure traversing the agricultural floodplain. This gave an overall visual impact rating as **moderate**.

VISUAL IMPACT ASSESSMENT

The detailed design has seen the clearance of the screening vegetation removed, along the existing Pacific Highway, intensifying the impact from the EIS. The sensitivity rating assessed will remain unchanged. The magnitude of change has increased as a result of clearing and so is assessed as high. The overall visual impact rating has risen to **moderate-high**. Screen planting as part of the design response seeks to mitigate this impact further by limiting views to the alignment over time.

7.3.5.16 VIEWPOINT SUMMARY

Table 13 summaries and compares the viewpoint assessment of the EIS and the changes that have occurred as part of design development.

7.3.6 MITIGATION STRATEGY

The *Landscape Character and Visual Impact Assessment* (Hassell, 2012) undertaken during the EIS outlined specific mitigation measures to be provided at every vantage point to ensure that impacts were minimised and addressed as part of the design process. As part of the design development the design intent has been modified as a result of the Biodiversity Strategy, and consequently amendments to the mitigation strategy have been made. Table 14 summarises the measures defined in the EIS and the additional or new actions proposed as part of the revised concept. We have addressed the requirements in the MCoA D20 (Clause G) as outlined in Sub-chapter 1.3.

Table 13: Viewpoint sensitivity summary

VIEWPOINT	EIS SENSITIVITY	DESIGN SENSITIVITY	EIS MAGNITUDE	DESIGN MAGNITUDE	EIS IMPACT RATING	DESIGN IMPACT RATING
VIEW POINT 48B	Low	No change	High	No change	Moderate	No change
VIEW POINT 50	Moderate - Low	No change	High - Moderate	Moderate	Moderate	Moderate-Low
VIEW POINT 51	Moderate	No change	High	Moderate	Moderate - High	Moderate
VIEW POINT 52	Moderate	No change	High	Moderate	Moderate - High	Moderate
VIEW POINT 53	Moderate	No change	High - Moderate	Moderate	Moderate - High	Moderate
VIEW POINT 54	Moderate	No change	High	No change	Moderate - High	No change
VIEW POINT 55	Moderate	Moderate - low	Moderate - High	Moderate - Low	Moderate - High	Moderate - Low
VIEW POINT 56	Moderate	No change	High	Moderate	Moderate - High	Moderate
VIEW POINT 57	Moderate - Low	No change	High - Moderate	Moderate -Low	Moderate	Moderate - Low
VIEW POINT 58	Moderate	No change	Low	No change	Moderate - Low	No change
VIEW POINT 59	Moderate - Low	Moderate	Moderate	No change	Moderate	No change
VIEW POINT 60	Moderate	No change	High	No change	Moderate - High	No change
VIEW POINT 61	Moderate - Low	No change	Moderate -Low	No change	Moderate - Low	No change
VIEW POINT 62A	Moderate - Low	No change	Moderate -Low	No change	Moderate - Low	No change
VIEW POINT 62B	Moderate	No change	Moderate	High	Moderate	Moderate - High

Table 14: EIS mitigation measures summary

MITIGATION MEASURE	VP 48B	VP 50	VP 51	VP 52	VP 53	VP 54	VP 55	VP 56	VP 57	VP 58	VP 59	VP 60	VP 61	VP 62A	VP 62B
Minimise the loss of existing riparian vegetation	x														
Minimise loss of existing trees		x	x	x	x	x	x	x	x	x		x			
Plant local forest trees on cut/fill batters		x		x				x	x	x		x			
Reinstate local forest vegetation where applicable		x	x												
Plant dense low grasses/ground covers on fill batters			x		x	x	x				x		x	x	
Reinstate agricultural land where possible			x		x	x	x				x		x	x	
Reinstate local forest vegetation where applicable					x	x		x	x	x		x			
Provide new screen planting buffer to existing homes and landscape treatment generally in accordance with the concept design				x				x							
Provide intermittent screen planting on batters to screen the project from individual homes in accordance with the concept design									x	x	x	x	x	x	
Replace existing roadside screen vegetation where it provides a screen between the highway and local homes along Sartories Road and other local streets											x	x		x	x
Provide vegetation planting consistent with <i>Koala Revegetation Strategy</i> (2015)			x	x	x	x									
Provide landscape character which relates to the township of Wardell to signify connection								x							
Lay back and feather top cut of large batters to blend with natural landform				x											
Minimise the depth of the bridge deck	x	x													
Provide a high quality bridge design	x	x													

Notes:

X – mitigation recommended as part of EIS and adopted in design response

X – mitigation recommended as part of EIS and no longer applicable

X – mitigation measures adopted as part of design development to reflect changes to biodiversity strategy and community consultation



Figure 61: Aerial view of project area near Bagotville within Richmond River to Coolgardie Road - Section 10, looking north-east

CHAPTER 8

DETAILED RESPONSES FOR THE URBAN AND LANDSCAPE DESIGN

8.1 STRUCTURES

8.1.1 INTERCHANGES

The interchange design reflects the local context and provides identity, which relates to the urban centre it serves. There is only one interchange in this portion of the work - Coolgardie Road interchange. This interchange provides access from the Pacific Highway to the township of Wardell, which is bypassed by the new alignment.

The configuration of the interchange consists of:

- A diamond shaped arrangement with entry and exit ramps located either side of the bridge. An early south bound exit lane breaks this form
- The bridge has roundabouts at either end to facilitate full turning movements and is typical of this form of interchange arrangement along the Pacific Highway.

The landscape design -

- Consists of Fig trees, *Ficus hillii*, as its signature tree and hedge planting. These flank the entry and exit ramps to the south of the interchange
- Copses of *Ficus hillii* trees to south of the interchange serve as markers of an impending exit and part of the visual language of the road corridor working in association with signage to reinforce awareness of this connection
- Hedge planting to the north of the interchange reinforces the sweeping entry from Coolgardie Road entry ramp onto the road corridor
- The Rainforest Community is used to line the corridor providing a backdrop to the more structured planting of fig trees and hedging
- Salvaged palm trees supported by a garden bed of feature plants are used within the roundabouts marking this decision point.

8.1.2 BRIDGES AND THEIR ELEMENTS

The design of bridges on the project follows the guidelines described in the *Bridge Aesthetics* (Roads and Maritime, 2013) document and the requirements as set out in the *Upgrading the Pacific Highway Design Guidelines* (Roads and Maritime, 2015).

The key principles adopted in the design of the bridges are:

- Uniformity across the entire upgrade is achieved through the agreement of key design features across the project
- The main bridge elements have a simple design with a smooth finish and clean lines producing an elegant outcome in keeping with the overall language for the Pacific Highway. All bridge elements including piers, parapets, headstocks, abutments, transition panels, road traffic barriers and leading edges are fully integrated in the design.

From Richmond River to Ballina (Sections 10 and 11) there are a total of 14 bridge structures comprised of overpasses, fauna passages, and creek and floodplain bridges. Table 15 provides a brief description of each.

8.1.2.1 BRIDGE ELEMENTS

BRIDGE PARAPETS AND BARRIERS

- Twin steel rail and post system traffic barriers are used on all overpasses to allow through views to the surrounding landscape and to reduce the height of the concrete portion of the structure in elevation
- Regular performance barriers are used on all floodplain bridges
- Bridge parapets are precast concrete units
- Parapets incorporate a skirt to provide a drip edge and conceal drainage/service pipes where required.

ABUTMENT FINISH AND MAINTENANCE ACCESS

- All spill-through bridge abutments are finished as rock pitched/or rock armoured depending on the location. The rock will be sourced from site or local quarries
- Maintenance access steps are completed in concrete.

THROW SCREENS

- The design of the safety screen is integral with the bridge parapet design and barrier transition panel
- The safety screen tapers down over two panels at either end of the bridge.

LIGHTING ON BRIDGES

- Road lighting is provided at interchanges only. There is no lighting on bridge structures.

LANDSCAPE ADJOINING BRIDGES









The landscape design at bridges is responsive to the nature and context of the bridge, and has adopted these key strategies:

- A 10 metre offset for trees is adopted. The offset of trees is an important consideration, which needs to be considered in order to minimise ongoing maintenance inputs and not compromise safety during maintenance activities and future damage to structures
- Interchange and overpass bridges have the potential to add to the story of progress along the corridor. They are to be developed with a unique and distinctive character which provides some insight into the setting
- Fauna bridges are developed with a particular function being the movement of fauna under and across the alignment. The landscape design needs to facilitate this movement through appropriate revegetation works which enables and encourages the movement of the prescribed fauna for which the bridge is developed
- Creek bridges provide the opportunity to express the purpose of the crossing through the revegetation utilising the community which adjoins them. The crossing of creeks is associated with the wetter swampland communities and this is reflected in the revegetation utilising this community in the design. In addition to the reinforcement of the vegetation communities there is also a focus on fauna connectivity. This is achieved through the creation of clear zones for fauna passage which is designed around the specific fauna movements anticipated.

BRIDGES

D50. Fauna Passage 1 (Main line bridge)
D51. Fauna Passage 2 (Main line bridge)
D03. Old Bagotville Road Underbridge
D04. Bingal Creek
D52. Fauna Passage 3 (Main line bridge)
D53. Fauna Passage 4 (Main line bridge)
D05. Wardell Floodway 6
D06. Wardell Road Overbridge
D55. Fauna Passage 5 (Main line bridge)
D56. Fauna Passage 6 (Main line bridge)
D57 Fauna Passage 7 (Main line bridge)
D09. Coolgardie Overbridge
D10. Randles Creek
D11. Whytes Lane Overbridge

Key

	Interchange
	Overbridge
	Creek and Floodplain Bridge
	Fauna Passage (Main line bridge)
	Fauna Passage (Dedicated and combined culverts)
	Bridge I.D.
	Pacific Highway upgrade Richmond River to Ballina (Sections 10 and 11)
	Existing Pacific Highway

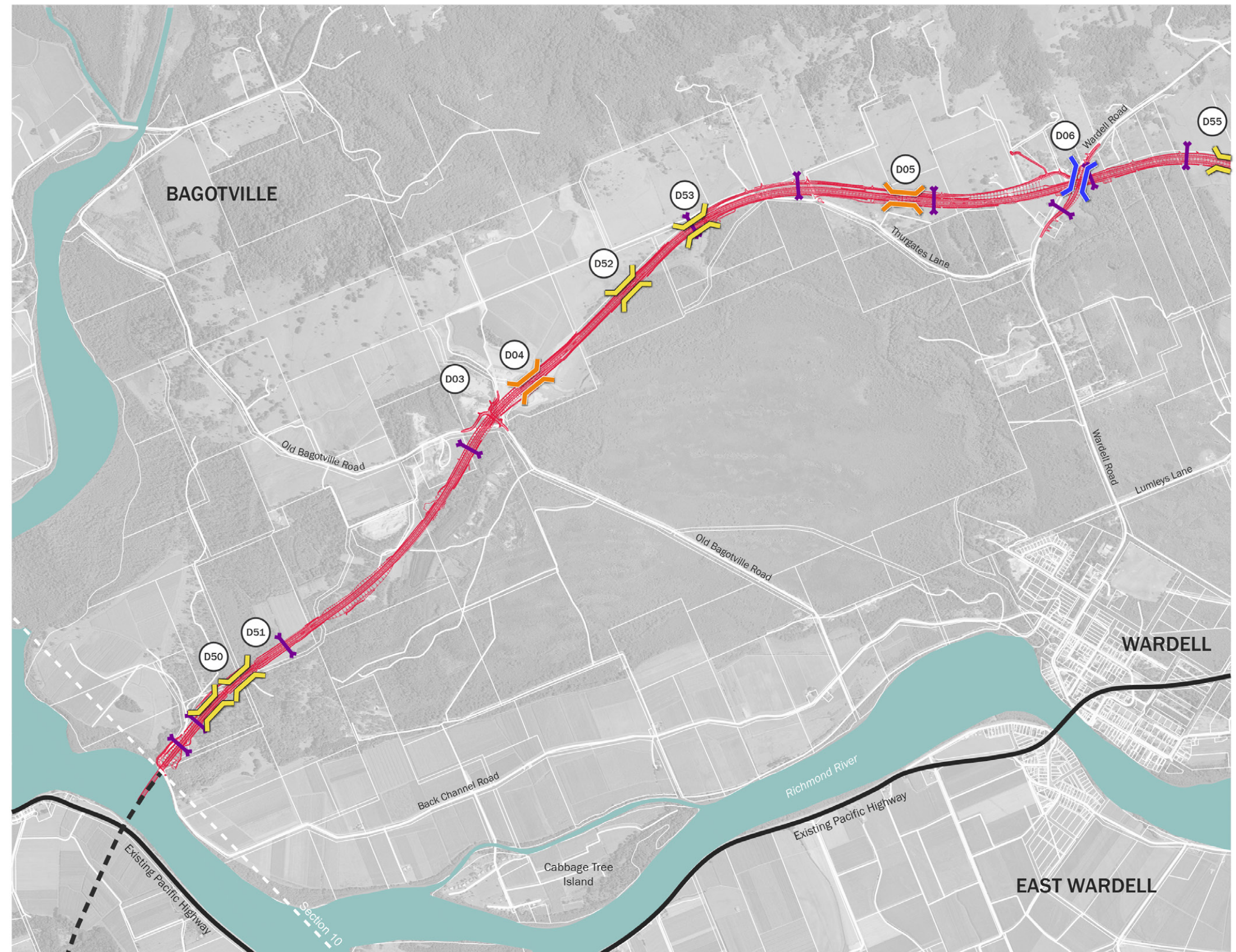


Figure 62: Location of structures

Note: Bridge definitions reflect the primary role of the bridges. It is noted that these bridges may also serve secondary functions i.e. a creek and floodplain bridge may also enable fauna passage.

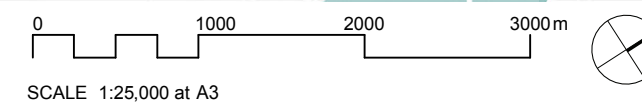
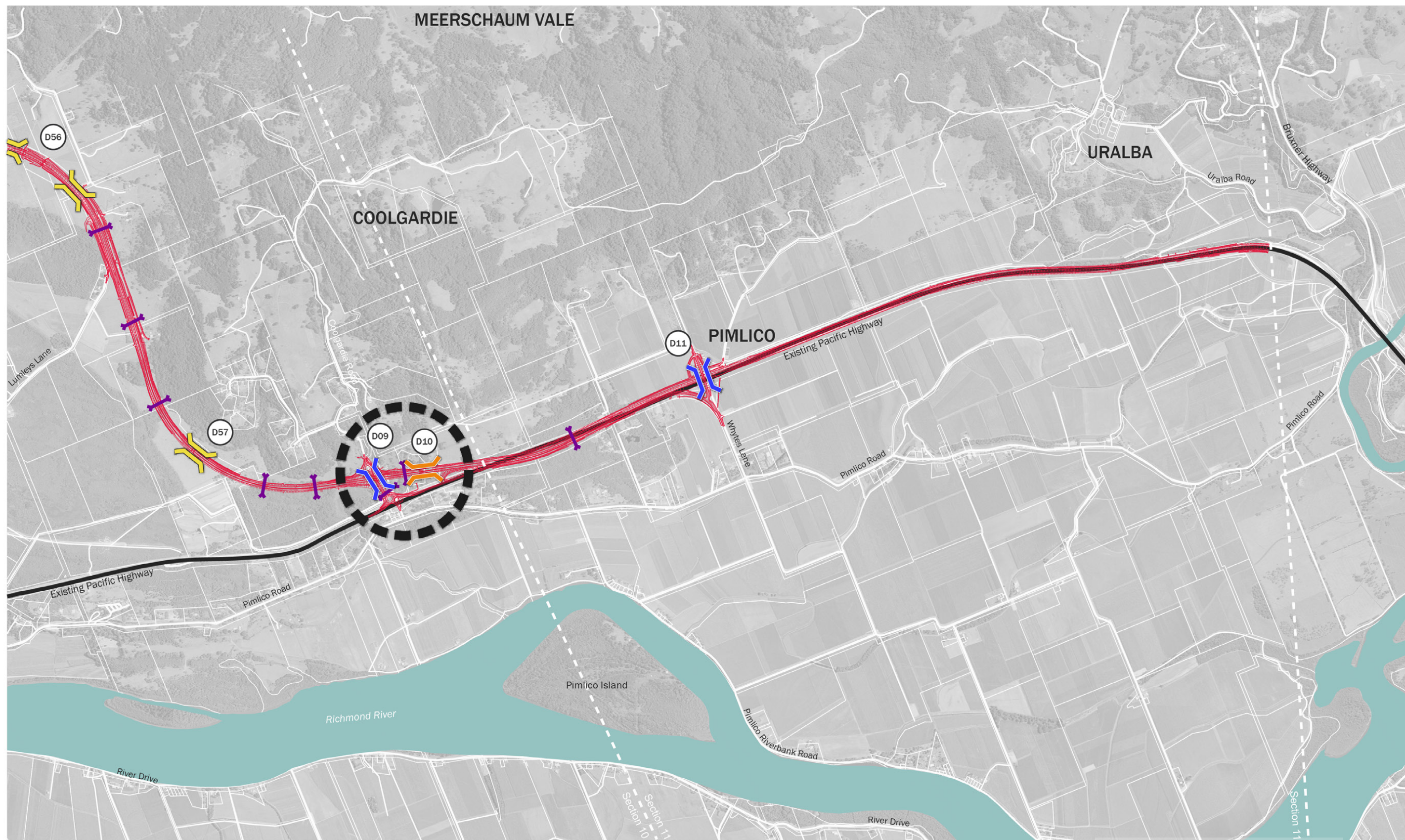


Table 15: Richmond River to Ballina (Sections 10 and 11) bridge urban design summary

ID	BRIDGE REFERENCE	EIS PRECINCT	BRIDGE LOCATION (CHAINAGE)	PIER TYPE	GIRDER TYPE	MEDIUM PERFORMANCE BARRIER WITH TWIN RAILS	REGULAR PERFORMANCE BARRIER WITH CYCLIST GRAB RAIL (NEAR SIDE)	FAUNA PASSAGE	VISIBILITY OF THE BRIDGE (1-3)
D03	Twin bridges over Old Bagotville Road	P-50	148900	Stiletto Pier	Winged PSC Plank		•		1
D04	Twin bridges over Bingal Creek	P-50	149216	N/A	Super-T		•		3
D05	Twin bridges over Wardell Viaduct 6 – Northbound	P-49	151795	Rectangular	Winged PSC Plank		•		2
D06	Wardell Road Overbridge	P-49	152878	Stiletto Pier	Super-T	•			1
D09	Coolgardie Road interchange Overbridge	P-53	157556	Stiletto Pier	Super-T	•			1
D10	Twin bridges over Randals Creek Northbound	P-53	157833	N/A	Winged PSC Plank		•		3
D11	Whytes Lane Overbridge	P-53	159874.4	Stiletto Pier	Super-T	•			1
D50	Twin Bridges over fauna passage 1	P-49	146603	N/A	Winged PSC Plank		•	•	3
D51	Twin Bridges over fauna passage 2	P-49	146838	N/A	Winged PSC Plank		•	•	3
D52	Twin Bridges over fauna passage 3	P-49	150034	N/A	Winged PSC Plank		•	•	2
D53	Twin Bridges over fauna passage 4	P-49	150603	N/A	Winged PSC Plank		•	•	2
D55	Twin Bridges over fauna passage 5	P-49	153872	N/A	Winged PSC Plank		•	•	3
D56	Twin Bridges over fauna passage 6	P-49	154020	N/A	Winged PSC Plank		•	•	3
D57	Bridge over fauna passage 7	P-53	156263	N/A	Winged PSC Plank		•	•	3

Note: Visibility assessment methodology

The assessment of visibility was based on a review of the location of each structure in relation to the highway, local roads, public places, urban areas and houses. Factors affecting visibility such as topography, landscape, and the distance of the structure in relation to these receiving points (and therefore the magnitude of impact) are considered. A rating of one to three is assigned to each bridge, with a rating of one indicating structures that are highly visible to the public and three indicating structures that are not visible to the public.

8.1.3 GANTRY AND OVERHEAD STRUCTURES

Point to point speed cameras are provided on the northbound and southbound carriageways, north of Whytes Lane.

8.1.4 RETAINING WALLS

Not applicable to Richmond River to Ballina (Sections 10 and 11).

8.1.5 CUTTINGS, EMBANKMENTS AND STABILISATION STRATEGY

The landscape and topography of the alignment have a strong influence on its character. The response to the design of cuttings and embankments forms an integral part of the stabilisation of the road corridor and its management of erosion control in response to the conditions of consent and the statement of commitments as part of the submissions report.

The scale and nature of the work from Richmond River to Ballina (Sections 10 and 11) are relatively minor with cut and fill embankments typically less than five metres in height. This relatively small scale reflects the nature of the landscape through which the alignment passes, i.e. low lying slightly undulating topography. While the typical scale of works is relatively small. Two significant cuttings are experienced south of Old Bagotville Road, and a further cutting on the southern approach to Wardell Road. The later of these is also identified as a borrow site for the project.

Ch 146050 to 146200 – This is the first and largest of the cuttings which shaves the side of the ridge. The scale of this cut is 19 m with one bench.

Ch 147400 - 147850 – The road cuts through the middle of a small ridge in the formation of this cuts with batter slopes to either side of the corridor. Its height is 11 m plus a bench.

Ch 152200 – 152800 – this is broad shallow cut, which forms part of the Lumley's cut borrow site. The depth of this is typically 6 m.

8.1.5.1 CUTS

A cutting is an excavation into the natural ground profile, its form and treatment is influenced by the differing layers of soil and geology through which it passes. Harder materials enable the adoption of steeper batter profiles and reduced footprint but limits the potential for revegetation, whereas softer, less stable material requires a broader footprint due to a shallower profile but is more readily revegetated.

Cuttings are shaped to integrate with the local landform. This involves the use of a number of strategies including:

- The feathering of the edges of the cuts so they transition and move gradually into the steeper form of the cutting. The length and nature of the extent of feathering is responsive to the adjoining natural slopes
- The laying back of the cut as it reaches the leading edges of the existing ground/cut face interfaces provided by the use of a transitional slope, which smoothly rounds the batter into the adjoining surface
- The revegetating of batter slopes and benches must occur unless within hard stable rock. Revegetation involves the resspreading of topsoil on to the batter slope and seeding/planting. Topsoil will only be resspread on slopes equal to or flatter than 2H:1V
- The maintenance of cutting benches at a consistent profile and in parallel with the vertical geometry of the highway
- The provision of a smooth, rounded edges at the top of the cutting and re-establishment of the natural vegetation community
- Provide visual integration with the nearby landscape and to satisfy environmental requirements for fauna connectivity.

8.1.5.2 EMBANKMENTS

Embankments play a significant role within the landscape, particularly in the valley floors where the road needs to be nestled in the landscape with slopes transitioned and manipulated so the views of it flow over the formation rather than being stopped by it. Key to addressing the integration of embankments is the:

- Revegetation of embankment batter slopes so they present a consistent vegetation cover to the landscape to which they adjoin
- Addressing of the existing ground/batter interface to avoid obvious junctions between the embankment and the existing ground
- Development of slopes is responsive to the adjoining natural terrain
- The use of surplus material is part of an overall surplus material management plan.

8.2 ROAD CORRIDOR

8.2.1 MEDIAN AND VERGE TREATMENTS

Medians widths are designed to enable the future expansion of the corridor from the current four lane proposal to six lanes. The landscape design of the median is responsive to the context and seeks to provide separation between the carriageways. No tree planting is within the typical median cross section due to their standardised widths and the inability to achieve clear zone requirements. Trees however have been used in association with bridges where protected by barriers.

As part of this process a number of differing strategies are adopted to reflect the context.

- All medians maintain a grassland margin of minimum 2 metres width in order to ensure clear zones, sightlines and maintainability of the median. Grass mix is to be Pasture/Exotic Grass Mix FM 6.1
- Forested areas – the design has sought to establish a frangible shrub lined median, which provides distinct separation between the two carriageways
- Agricultural landscapes - the design has sought to retain an open character with shrubs used only on bends where headlight control is considered important.

8.2.2 PROVISION FOR FUTURE REST AREA

The concept design of the rest area has been undertaken to facilitate the preliminary bulk earthwork and material optimisation for the project including the winning of material from these disturbed areas within the corridor. The construction of the final rest area does not form part of the initial project delivery for Richmond River to Ballina (Sections 10 and 11). The time of delivery of the final rest area will be determined based on the need for such a facility.

The development of the concept design of the rest area is in line with Roads and Maritime Rest Area Guidelines and the scope defined for the project.

As the final concept design is not to be delivered as part of this project an interim landscape design scenario is developed on this land which is:

- Responsive to the natural vegetation context
- Provides a landscape backdrop to the highway corridor.

The site has also been identified as a potential landscape mound site in which surplus materials would be incorporated. The shape of mounding has been developed so as to enable the future development as a rest area while achieving an integrated earth form as part of the overall alignment.

8.2.3 PEDESTRIAN AND CYCLIST NETWORK

Cyclists are allowed to use the highway shoulders, including highway bridges, providing cyclist connectivity along the entire Pacific Highway. The following pedestrian and cyclist facilities are provided for the project:

- Signposting and crossing points for cyclists at the entry and exit ramps at Coolgardie interchange as per Pacific Highway Guidelines
- Wayfinding to indicate the proximity of the Coastal Cycleway
- Bridges will contain railings for cyclists on shared paths and Highway bridges will provide 1300 millimetre high regular performance barriers to provide for cyclist safety
- Shared path connections on local road bridge overpasses.

8.2.4 BUS STOPS

There is one bus stop in Richmond River to Coolgardie Road - Section 10 near Coolgardie interchange that will be relocated. Any existing provision at Whytes Lane will be maintained.

8.2.5 HEAVY VEHICLE STOPPING BAYS

General heavy vehicle stopping bays are provided at several cross over locations along the main alignment.

8.3 FURNITURE

8.3.1 FENCES

8.3.1.1 BOUNDARY FENCING

Fencing is required to the road corridor as a means of defining the boundary, and restricting stock and pedestrian movements. Boundary fencing will adopt Roads and Maritime standards for fencing. This is responsive to the adjoining land use. Key features of the design are:

- The typical fence for the corridor is a five strand stock fence consistent with the agricultural context of the alignment
- Posts are to be concrete with a design life as required
- No corridor fencing is provided within the areas immediately next to cane farms consistent with the farming practices of this land use
- Fencing is to be sited to minimise the area of vegetation between the alignment and the fence which will act as an attraction to fauna. Where not possible/desirable to do this the use of fauna fencing will be adopted.

8.3.1.2 FAUNA FENCE

Fauna fences are used in identified fauna movement corridors to encourage the use of fauna connectivity structures and to reduce the potential for conflicts with motorists. To maintain consistency throughout the Project standard fence drawings have been prepared by Pacific Complete. Sections 10 and 11 have adopted the Koala Exclusion fence as the base fence type, which underlines all fauna fence types used. Key features of the Koala Exclusion fence design are:

- Galvanised chain link fence with 2100x50x1.6mm diameter steel core netting
- Galvanised steel sheeting min 600 from top of fence
- Post spaced at 3m centres.

Installation principles are as follows:

- Fauna fences are set back from the road edge to minimise impact on the visual environment of the road corridor
- Trees and shrubs to be setback min 3m from outside face of fence to minimise fauna gaining access beyond fencing and to the highway alignment
- As identified in the Ballina Koala Plan fauna fencing will be provided for the entire alignment from Ch.145,800 to 160,700 and on parts of the adjoining road network including parts of Wardell Road and the existing Pacific Highway alignment.

8.3.2 HEADLIGHT SCREENS

All headlight screens from Richmond River to Ballina (Sections 10 and 11) are to be planted rather than a built element. The planted headlight screen achieves a minimum garden bed of five metres width. Planting within the bed is to incorporate a portion of shrubs species of an initial height of 1.5 metres at time of road opening with a final height greater than 2.5 metres in order to control headlight glare. Species selection considers the density of canopy and longevity to ensure a robust and effective screen.



Figure 63: Colourbond fauna fence



Figure 64: Headlight screening planting

8.3.3 LIGHTING

The project is typically an unlit highway. Lighting is provided at Coolgardie interchange at the roundabouts and intersection of the new southbound exit ramp and the existing Pacific Highway.

The design of lighting ensures that light spillage into residential properties and sensitive fauna habitats are minimised or avoided as per AS4282-1997. The management of light on entry into the Wardell township from the Coolgardie interchange is critical in both establishing legibility of the town from the highway, and at the same time minimising impact on the adjoining residences and potential breeding habitat for Southern Pink Underwing Moth and Atlas Rainforest Ground Beetle.

The lighting design makes a number of provisions consistent with the Threatened Invertebrates Management Plan in order to address these factors, eliminating any potential impacts including:

- Reduced wattage from typical 250 watt to 150 watt
- Reduced height of lighting poles
- Selection of luminaires to incorporate sodium vapour lamps reducing the attraction to insects.

Based on these design initiatives there is no overlap between light contours and the habitat areas refer Figure 65. A key point to note is that the outermost light contour is broadly equivalent to moonlight. In addition to the lighting design the landscape response has sought to contain the interchange within a landscape setting enhancing habitat outcomes, refer Sub-chapter 8.4.2. No provision is made for street lighting on footpaths or shared pathways.

All lighting for the project complies AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting. Detailed lighting reports have been prepared for the project.

8.3.4 SAFETY BARRIERS

Safety barriers have been provided where required along the main alignment, service roads, and local roads to give protection from hazards including steep slopes, narrow medians and physical hazards including non-frangible signs, street lighting columns, powerpoles, headwalls, fauna connectivity structures, and non-traversable table and catch drains.

In general, the design has been carried out with a preference for the adoption of 4H:1V or flatter batters where possible and thereby reducing the need for safety barriers. The proximity of the project boundaries, as well as environmental and clearing constraints however, have limited the use of flatter slopes in a number of areas.

In general Wire Rope Safety Barriers have been used on the main alignment and the Thrie Beam (single rail) have been used on connection to bridge parapets on local roads. Other safety barriers used on the project are W-Beam and Single and Double Sided Type F barriers (820 mm high).

8.3.5 SIGNAGE

Future community and stakeholder consultation is planned for signage along the alignment. There are signage standards, which apply to the project; these will be communicated to the community and agencies at an appropriate time in the development of the project.

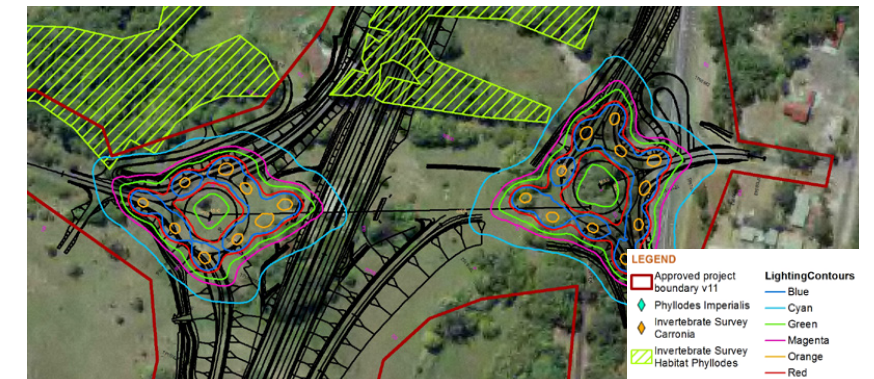


Figure 65: Lighting contours

8.4 REVEGETATION

8.4.1 EXISTING VEGETATION AND LANDSCAPE DESIGN

8.4.1.1 PROPOSED LANDSCAPE DESIGN

With respect to the bioregion's ecological communities, habitats, existing vegetation and flora and fauna, the landscaping strategies below are put forward to minimise the impact of the highway upgrades on the environment.

The landscape design will provide a strong emphasis on creating a well-vegetated corridor with lush and distinctive intersections, interchanges and rest areas. Where planting is used the mix must contain tube stock for indigenous ground cover, shrub and tree species and larger stock for feature trees.

REVEGETATION STRATEGY

The revegetation strategy provides:

- An attractive approach and departure from developed areas
- A planting/seeding palette based on key local vegetation patterns to ensure the visual and ecological integrity of the journey. It reinforces enclosure when passing through forest and woodland areas, provide long distance views for road users when they are available, and retains existing district views for residents
- Screening to minimise the visibility of the project from townships, farms and homesteads
- A varied sequence of views along the journey to reduce the linear effect of the highway, providing visual interest and enjoyment and reducing the potential from driver fatigue
- Semi-mature tree plantings, of locally significant/characteristic trees and hedge planting are used to emphasise junctions to local towns and rest areas, or to provide character along the route and to rest areas
- Mitigation measures to address the visual impact of fauna fencing and overhead power lines where they occur
- Revegetation to cuttings and embankments to maintain the character of undulating green hills against the horizon line
- A range of frangible low shrubs, grasses, or ground covers in medians
- Non- frangible planted and seeded areas conforming to clear zone requirements and roadside furniture requirements
- Safe sight distances and signage which is not obscured by planting and revegetation areas
- Setbacks for structures, roadside furniture and pathways enable clear access for maintenance and visual inspections when the landscape matures

Table 16: Design communities in relation to structure and floristics

DESIGN COMMUNITIES	EQUIVALENT CMA BIOMETRIC VEGETATION TYPE	EQUIVALENT VEGETATION ASSOCIATION MAPPED IN THE PREFERRED ROUTE CORRIDOR STUDIES	THREATENED ECOLOGICAL COMMUNITY TYPE
Wet Sclerophyll Forest	Blackbutt grassy open forest of the lower Clarence Valley of the North Coast	Sections 1, 9-10 Equivalent associations of Blackbutt/Tallowwood Lower Slopes and Gully Forest (Ecotone 2007) and Mahogany - Blackbutt Forests (Geolyse 2005)	
Dry Sclerophyll Forest	Coast Cypress Pine shrubby open forest of the North Coast Bioregion	Sections 9-11 Equivalent associations of Banksia - Callitris Dry Heathy Woodlands & Heaths (Geolyse 2005)	Coastal Cypress Pine Forest in NSW North Coast Bioregion (E)
Wet Sclerophyll Forest	Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast	All Sections Equivalent association of Riparian Forest (SKM 2010), Moist Floodplain Eucalypt Forest and Riparian Forest (Ecotone 2007), Forest Red Gum Forest and Mixed Floodplain Forest (SKM 2009), Red Gum - Tuckeroo Forests and Paperbark - Blackbutt Closed Forest (Geolyse 2005), and Red Mahogany (floodplain), Forest Red Gum, Wet Heath - Sedgeland and Stringybark-Ironbark-White Mahogany (Floodplain) (Ecos Environmental 2005)	Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion (E)
Dry Sclerophyll Forest	Grey Gum - Grey Ironbark open forest of the Clarence lowlands of the North Coast	Section 3, 6-8 and 10 Equivalent association of Grey Ironbark - Bloodwood Forest and Grey Gum - Tallowwood Forest (Early works sites SKM 2010), Tallowwood - Ironbark Open Forest (SKM 2009), Stringybark- Ironbark-White Mahogany (Ecos Environmental 2006)	
Rainforest	Hoop Pine - Yellow Tulipwood dry rainforest of the North Coast	Section 10 Equivalent association of Closed Forests (Geolyse 2005)	Lowland Rainforest on Coastal Floodplains (E) Lowland Rainforest of Subtropical Australia (CE)
Estuarine Wetland	Mangrove - Grey Mangrove* low closed forest of the NSW Coastal Bioregion	Sections 5, and 10-11 Equivalent associations of Mangrove Forest (SKM 2009, 2010) and Mangrove Closed Forest (Geolyse 2005)	
Forested Wetland	Swamp Mahogany swamp forest of the coastal lowlands of the North Coast	Sections 1-6, and 8-10 Equivalent associations of Swamp Forest - Swamp Mahogany/Forest Red Gum (Ecotone 2007), Swamp Mahogany - Paperbark Forest (SKM 2009), Wet Heath - Sedgeland (Ecos Environmental 2006), and Paperbark - Mahogany Wet Heathy Woodlands and Paperbark - Swamp Mahogany Forest (Geolyse 2005)	Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (E)
Forested Wetland	Swamp Oak swamp forest of the coastal lowlands of the North Coast	Sections 1, 3, 4, 5, and 8-11 Equivalent associations of Swamp Oak Forest and Paperbark - Swamp Oak Forest (SKM 2009, 2010), Swamp Oak Forest (Ecotone 2007), Swamp Oak (Ecos Environmental 2006), and Paperbark - Swamp Oak Emergent Closed Forest and Paperbark - Swamp Oak Swampy Forests (Geolyse 2005)	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (E)
Rainforest	White Booyong - Fig subtropical rainforest of the North Coast	Sections 8, 10 and 11 Equivalent association of Closed Forests (Geolyse 2005)	Lowland Rainforest on Coastal Floodplains (E) Lowland Rainforest of Subtropical Australia (CE)

(Source: Roads and Maritime, 2012)

Note: *Listed as protected marine vegetation under the Fisheries Management Act.

Note: Design communities refers to a standardised community simplified for constructability/availability reasons and are an abstraction of the natural community

- In disturbed areas within the project work zone revegetation treatment will augment the existing indigenous vegetation communities
- The use of the local seed bank and soils is adopted
- Retention of existing vegetation (including root and above ground plant mass) is maximised.

In areas where the possibility of weed invasion is high, revegetation of disturbed areas includes planting, seeding, and the establishment of a clean weed free layer of topsoil as the foundation for revegetation work. Weed free topsoil or other growing medium is used in all landscape works.

LOCAL ACCESS ROADS

- Where local access roads are located within close proximity to the upgrade, screen planting and seeding on batters is provided.

CREEK CROSSINGS AND RIPARIAN ZONES

- Where bridges and road structures cross creeks and interrupt riparian zones, revegetation strategies will endeavor to reconnect the riparian patterns. indigenous species are utilised to revegetate the affected areas and reconnect local habitat
- Topsoil or other growing medium used in landscape work must be free of weeds as defined in Roads and Maritime W2B project specific specification R178 or other unintended or undesirable species
- Maximise riparian vegetation under creek crossings to encourage fauna connectivity along creek lines.

8.4.2 VEGETATION COMMUNITIES

Sub-chapter 5.7 identifies the key vegetation communities of the corridor. In order to address the slightly varying structure of the vegetation communities along the alignment a simplified response is developed based on the dominant structural forms. Table 16 identifies the design communities and their relationship to the floristics of each vegetation type identified from Richmond River to Ballina (Sections 10 and 11). As part of the analysis and design process four dominant natural communities are identified. These are:

- The Rainforest – dominates the foot slopes of the transition between Sections 10 and 11 around Coolgardie interchange
- Forested Wetland – occurs on the floodplain where drainage is impeded or in association with creeklines
- Dry Sclerophyll Forest - Located within Character Zone B on dry raised grounds and sandy soils
- Wet sclerophyll– located on the raised area of Character Zone B or at the interface between lowland rainforest.

A fifth community is an open grassland community, which will comprise a robust mix of native and exotic grasses common within the corridor.

The make-up of these communities is reflected in Appendix F.

Median treatments are responsive to the adjoining vegetation defined by a margin of grassland mix (Pasture/ Exotic Grass Mix - FM6.1) a minimum 2 metres wide. They consist typically of a shrub treatment related to the adjoining vegetation will be established to reinforce the sense of enclosure and to help in the control of headlight glare. In more open zones the grassland community will be continued to provide a connection with the broader landscape.

Interchange landscape design is responsive to the cultural setting of these environments and introduces a level of structure to the landscape. A dominant species is selected which relates to this setting and is discussed in Chapter 7.

The Coolgardie Interchange in addition to having a specific cultural character is used as part of the way finding of the road and is impacted by an environmental overlay. The southern Pink Underwing Moth has been identified in the area adjoining Coolgardie Interchange. The revegetation response in this area has sought to re-establish the lowland rainforest community with which this moth is associated. This provides connection between isolated pockets of this forest as well as providing a buffer of landscape between highway and these remnant pockets reducing the potential impacts of edge effects. Maintenance, as for the entire road corridor, will form an important role in the establishment of this landscape and its potential benefits for the habitat of the moth.

8.4.3 IMPACTED LANDSCAPE

As identified in Chapter 3 - Part 2 of the *Biodiversity Assessment* prepared by Roads and Maritime, Aurecon and SKM, the list below summarises the vegetation communities and threatened ecological communities that are impacted from Richmond River to Ballina (Sections 10 and 11) of the highway upgrade.

Richmond River to Coolgardie Road - Section 10 vegetation communities include:

- Blackbutt grassy open forest
- Swamp Box, Swamp Mahogany. Grey Gum, Paperbark swamp forest
- White Booyong
- Swamp Oak.

The Section also has a number of endangered ecological communities including:

- Swamp Sclerophyll Forest
- Coastal Cypress Pine
- Lowland Rainforest
- Subtropical Coastal Floodplain Forest.

Coolgardie Road to Ballina - Section 11 comprises similar vegetation communities including:

- Hoop Pine
- Blackbutt and grassy open forest and
- Mangrove forests.

Endangered ecological communities including

- Lowland Rainforest on Coastal Floodplains , and
- Swamp Oak Floodplain Forest.

Details of native species including key representative plants and weed species present within the corridor are summarised in Appendices F and G.

8.4.4 LANDSCAPE AND VISUAL SCREENING

A number of key areas of visual screening are identified as part of the environmental assessment process. The focus of visual screening identified is associated with views of local residents and those using local roads and is recommended in order to minimise the degree of visual change.

As part of this process the strategies below are adopted.

- Minimise loss of existing trees
- Planting and seeding of local native trees to blend with the existing landscape and screen views
- Planting and seeding of dense low grasses, ground covers on fill batters within agricultural landscapes
- Reinstatement of agricultural land where possible.

In addition to these requirements planting and/or seeding will be of:

- Small to moderate height shrubs to screen local roads from the alignment and minimise risk of headlight glare issues
- Small to moderate height shrubs within the median to reduce the visual scale of the alignment to road users and to mitigate headlight glare.

8.4.5 HERITAGE ZONES

The landscape response to heritage is still being developed. Many of the sites relate to Aboriginal heritage and occur within the more forested sites. It is not intended that these will be interpreted as part of the broadscale landscape strategy as the scale of any interpretation will impact the biodiversity objectives. Any interpretation will consequently happen off site in consultation with the Local Aboriginal Land Council.

Heritage, however, also has the potential to limit revegetation work through the restrictions on excavation which may be imposed in relation to certain sites. In such instance planting of trees would be excluded.

8.4.6 DISTURBED LANDSCAPE

The alignment of the corridor passes through a variety of modified and disturbed landscapes. In all instances these disturbed landscapes are productive and includes pasture, crop, and quarry lands. The alignment of the corridor to some degree has kept to these areas where possible to minimise its impact on the natural systems. Pasture and crop lands are the dominant of these modified communities and are managed vegetated landscapes, for the purpose of this section as they are excluded from the discussion as they are perceived as part of the everyday landscape of the region.

For the purposes of this section disturbed land is interpreted as the quarry sites which have impacted both landform and vegetation cover and resulted in a landscape which is considered to be degraded in visual and physical form.

The alignment also passes through a number of degraded sites, which are concentrated around the area of Old Bagotville Road. These quarried areas fall largely within the corridor and are to be revegetated as part of the project work. Where these areas are used as borrow sites they will be revegetated in accordance with requirements of ancillary sites as discussed in Sub-chapter 6.8. The purpose of this revegetation is to both rehabilitate and stabilise the damaged areas within the corridor enabling the reinforcement of the closed dry forest character on the higher grounds and swamp forest in the lower region of this portion of the alignment, as well as providing improved fauna connectivity.

8.4.7 BATTER STABILISATION

Vegetation is used to stabilise the disturbed soil profile of the corridor after completion of engineering work. Stabilisation encompasses both a combination of seeding and planting. Seeding is discussed in Sub-chapter 8.8.

Trees are only to be planted to ensure appropriate distribution and cover as required in response to vegetation communities and compliance with sightlines and clear zones. The use of trees within seed mixes is typically not used in order to avoid conflicts. Tree seeding may be incorporated on upper or lower batters or where barriers are required as part of the alignment design.

All plants species with the exception of interchanges are selected from plants known to grow naturally within the project area. Plant selection of these species has sought to use these species due to the suitability, climatic and site conditions but also their contribution to biodiversity.

8.4.8 SEED APPLICATION AND ESTABLISHMENT

Seeding Mixes are consistent with Roads and Maritime landscape design guidelines for the region and consist of a cover crop – short lived non-native pasture grasses to provide quick establishment and minimise erosion, and/or native seed - comprised of a mix of native grasses, shrubs and potentially trees.

A number of different mixes are to be developed to reflect the various vegetation communities/associations along the route, refer Appendix F Proposed Seed Mixes. These mixes are to be based around the core mix parameters defined above.

Seeding techniques to be used are:

- Hydroseeding – Hydraulically application of seed, seed carrier and soil ameliorants
- Direct Drill Seeding - a form of mechanical seeding to be used on slopes flatter than 4H:1V
- Compost blanket - High quality compost incorporating organic tackifiers, biological stimulants, wetting agents, soil ameliorants and incorporates seed mix applied pneumatically to slope - may be used on steeper cuttings.



Figure 66: Batter stabilisation

Generally hydromulch is to be used as a surface application to prevent erosion, its make up is as follows:

- Hydromulching – Hydraulically application of mulch matrix, sprayed onto the soil as a slurry which sets to form a layer of protection from erosion.

In some locations hydroseeding may be used in association with hydromulch due to erosion risk.

8.4.9 SEED COLLECTION

Seed procurement will be the responsibility of the civil contractor who will have overall responsibility for implementation of the landscape works. The collection of native seed is to be undertaken in accordance with Roads and Maritime Specification R178.

The native seed must be of local provenance (seed collected from plants growing in the locality of the project site which may include the road corridor and adjoining areas within the NSW North Coast Bioregion) where possible. The provenance of all seed must be provided by the seed supplier. Where provenance seed is not available, seed must be collected from areas where the habitat of the source area mostly closely matches that of the proposed location. In all other respects, the specified activities outlined in R178 will be followed.

Seed collection, processing and storage are to generally follow the NSW protocols contained in the Florabank Guidelines (Florabank Online). No seed collection will be carried out for species protected under the NPW Act Schedule 13 available from the following link:

http://www.austlii.edu.au/au/legis/nsw/consol_act/npawa1974247/sch13.html



Figure 67: Revegetation

8.4.10 ECOLOGICAL ESTABLISHMENT AND MONITORING

In order to ensure complete coverage of the corridor is achieved in a timely and effective manner and provides ongoing protection and biodiversity benefits, it is important to have a focused maintenance program.

To ensure this, a Landscape Management Plan (LMP) (refer Appendix G) has been prepared. This document details landscape management actions for the upgrade and covers requirements following construction completion from Richmond River to Ballina (Sections 10 and 11). Key elements covered in this plan include:

- Weed control
- Review of clearances to fencing - in particular fauna fencing to ensure this is not breached in any way
- Landscape management – including appropriate establishment procedures, fertiliser, pest and disease management.

WEED CONTROL

Weed control adopts a systematic approach in order to reduce potential weed impacts in the future. Key to this is ensuring weed control is:

- An integral part of the build process, with weed assessment and management actions undertaken before site clearance and an ongoing throughout the work period in line with the *Weed Management Plan* (WMP) part of the *Construction Environmental Management Plan* (CEMP)
- Carried out by the contractor in all areas of the corridor including revegetated and planted areas for a period of 36 months beyond practical completion of the work
- The adoption of a strategy which addresses structural weed issues as a focus as opposed to general weed issues. Critical to this process is the acceptance of revegetation as a gradual process which has numerous interactions which influence the landscape response in varying ways. Weed strategies will need to evolve to the various issues that arise from season to season and year to year as the landscape develops.

CLEARANCE TO FENCING

Fencing will be maintained in order to exclude cattle and other stock from entering the road corridor. Critically it is important to ensure offsets and integrity is maintained for fauna fences to ensure they are not breached in any way. Breaching of fauna fence may occur when seeded material establishes next to fence lines providing the opportunity for fauna to cross the fence. It may also be facilitated by falling trees or limbs, establishment of taller vegetation and or twinning climbers growing on fence, providing the opportunity for fauna to scramble over the fence structure.

LANDSCAPE MANAGEMENT

Establishment of seeded landscapes

The establishment of seeded landscapes may take some years to establish but that monitoring and appropriate action will be taken to ensure that the desired species mix is established or that soils with seed bank reliance are responding as envisaged. Responses will be gauged against locally successful installations and corrective actions determined to encourage and ensure response achieves the planned intent.

Supplementary Watering and Mulching

The plan requires that revegetated areas are watered and maintained until plants have become established. If extended periods without rain are experienced during the establishment period then watering will be required to supplement natural rainfall.

Fertiliser

Fertilising post landscape installation may be required where specific nutrient deficiencies are identified. The need for additional fertiliser is minimised by the use of slow release fertiliser. Fertiliser may be required to address specific soil/vegetation responses of the build process. This may include nitrogen draw down as a result of mulch in soil media etc. These issues are addressed as part of the soil amelioration process defined as a result of site soil testing in both the design and construction phases.

Pruning and Thinning

Pruning and thinning is likely to form a minor component of maintenance. Pruning may be required to ensure retention of sightlines where seeded shrubs have grown obscuring signage or views around bends or to maintain clearances to fauna fencing.

Pests and Diseases

The management of pests and disease within the vegetation communities will be monitored as part of the regular inspections. Actions will be determined based on these assessments and implemented and monitored.

Plant Replacements

As part of the monitoring requirements, diseased or dying plants are to be replaced to ensure 90 per cent of planting has established after 12 months.

8.5 TOPSOIL MANAGEMENT

8.5.1 TOPSOIL MANAGEMENT

The Woolgoolga to Ballina project traverses a number of different landscape situations that include forested areas, cleared land used for grazing and flood plains that are extensively used for sugarcane and other crops. Consequently the topsoils within these landscape situations vary significantly in terms of their physical and chemical composition as well as the species of seed they contain. Topsoil is a highly valuable resource that requires management by careful planning, implementation and monitoring to ensure the best use is made of it. Good topsoil management results in cost effective landscape outcomes that require minimal on-going maintenance.

Topsoil stripped from the highway construction formation in the forested areas will contain a valuable seed bank of diverse native species that is generally not practical to replicate by seed application alone. The most effective revegetation in forest areas is therefore achieved by re-spreading site topsoil containing intact soil-borne seed bank soon after it has been stripped. The forest topsoil needs to be re-spread within a time frame that will allow most of the soil-borne seed to remain viable.

Natural regeneration from the soil-borne seed ensures that species diversity is also maximised and the risk of introducing foreign genotypes to the existing vegetation communities is minimised. Use of fertiliser is also minimised or avoided to prevent excess fertiliser in surface run-off, which can cause algal blooms in waterway resulting in death of fish and other aquatic fauna. Topsoil reuse also introduces indigenous species which are impractical to establish by other means, either because their seed is difficult to collect in quantity or to apply (Terrestrial Orchids, ferns and native lilies) or because they are opportunistic colonisers that will persist or colonise rapidly where conditions are favourable (Bracken Ferns, Blady Grass and Geebung species). These types of plants can be expected to rapidly re-colonise disturbed areas of the corridor with the application of correct topsoil management procedures.

There are five key aspects to the management of existing topsoil:

- 1) Stripping of the topsoil from the existing vegetation communities to maintain the integrity of species composition and micro-organisms
- 2) Direct return of topsoil (where feasible)
- 3) Topsoil management zones and stockpile management procedures
- 4) Testing topsoil
- 5) Amelioration of topsoil with composted mulch.

These aspects are outlined further below.

TOPSOIL STRIPPING

For the purposes of stockpile management on this project two types of topsoil have been classified, which are described below.

Bushland topsoil

This includes topsoil stripped within mapped forest vegetation communities that have been cleared as part of the project. The areas of Bushland topsoil will be stockpiled and managed to provide the best opportunity to retain their environmental integrity and preserve the soil seed bank, microflora and microorganisms. Topsoils from different vegetation communities are to be stockpiled separately.

Bushland topsoil will be reused where native vegetation community is to be re-established as indicated on the landscape drawings. Where appropriate, supplementary seeding and planting will be carried out as indicated on the landscape drawings.

Landscape topsoil

This includes topsoil stripped from existing pasture grass or cultivated areas as well as areas mapped in the Weed Management Plan as having a High Weed Density Abundance. Landscape topsoil will generally contain weed seeds and therefore must be quarantined from Bushland Topsoil.

Landscape topsoil is to be used where pasture grasses are shown on the landscape drawings or where there is insufficient bushland topsoil and the area being revegetated has been former pasture lands. Areas identified as High Weed Density Abundance will be managed in accordance with the procedures outlined in the Weed Management Plan. This includes appropriate management actions to limit the potential for existing weeds to impact or spread through the landscaping and rehabilitation activities.

DIRECT RETURN OF TOPSOIL

Direct return is the procedure in which site topsoil is returned to the cut/fill batters in the location from which it was stripped, either immediately or soon after formation works are completed. This effectiveness of this process is dependent on the construction staging and availability of space within constrained construction corridors. Direct return will be implemented where construction staging allows.

TOPSOIL MANAGEMENT

Topsoil stockpile management procedures are designed to ensure survival of the soil seed bank, microflora and microorganisms in the stockpile for the duration of the storage period and until it is returned to re-vegetation areas.

The size of stockpiles will be designed to maintain the viability of native seed. They will be managed to ensure that the information on the vegetation community type, soil horizon, collection area (e.g. by station) and date of stockpiling is captured to assist the revegetation process.

TOPSOIL TESTING

Topsoils will be tested in situ prior to stripping in accordance with Roads and Maritime specification R44 to provide information for vegetation species selection. Topsoil testing in the stockpiles will also be carried out in accordance with Roads and Maritime W2B project specific Specification R178. This testing includes analysis of standard landscape and soil health parameters to guide rehabilitation activities. Where applicable, amelioration is to be carried out prior to reuse of topsoil in accordance with the recommendations of the soil test report.

Topsoil management zones are derived from the vegetation community boundaries shown on the landscape plans to ensure that the topsoil containing seed from each vegetation community is returned to a location with a similar vegetation community. In some instances the exact extent of a topsoil management zone will need to be rationalised in order to assist the stripping and direct return. For instance a zone may be extended to the end of a batter if the distance to the end of a batter does not warrant a change in soil type. This adaptive management process will focus on ensuring that the landscape outcome proposed is achieved by the revegetation techniques proposed at a particular location.

AMELIORATION OF TOPSOILS

Amelioration of topsoils will be undertaken where the topsoil testing report identifies a potential deficiency or opportunity for improvements in the nutrient capabilities of the soils. This can include the provision of additional nutrients e.g. gypsum, lime or dolomite and fertiliser, or the application and mixing of composted natural materials.

8.5.2 TOPSOIL TREATMENTS

Topsoil treatments proposed to be implemented on the project include:

- Striping and stockpiling or immediate resspreading
- Ripping the subsoil or sub base
- Placement of the site topsoil
- Application of seed mixes by direct seeding or hydro-seeding together with a hyrdo-mulch layer applied to provide surface protection on slopes
- Planting in designated locations with the application of site-won hardwood woodchip mulch (or rice or sugarcane straw mulch in riparian areas) to planted areas.

Note: Where sugar cane is to be used the material should be locally sourced and heat treated/sterilised to avoid potential importation of diseases/pests.

There are three main topsoil treatments that are generally used to revegetate top soil on cut and fill slopes as well as other areas disturbed by the road construction works. The three treatments used include:

Topsoil Treatment 1: Bushland topsoil containing a seed bank that is placed over cut/fill slopes

- Prepare batter slopes by ripping or roughening the surface to a depth indicated on the landscape works drawings and specifications to form a loosened or roughened surface suitable for the application of topsoil
- During ripping, mix in any amelioration materials required by the soil testing report into the upper layer to the rates specified within the soil testing recommendations or geotechnical advisor. This may include the mixing of gypsum or any other suitable agent to prevent erosion of subsoil where dispersive soils are identified as an issue on the cut batter faces to be vegetated. Provide ‘cleatmarks’, ‘dimples’ or horizontal scores to cut and fill batters prior to topsoil application
- Apply A1 horizon site-won topsoil mixed with composted site mulch (as directed by the soil test results), to depths shown on the landscape drawings. Topsoil and mulch must be ameliorated at the stockpile in accordance with recommendations of the soil testing report
- Alternatively, apply A1 horizon topsoil to depths shown on the landscape drawings and mix with windrowed composted site mulch by pushing up and down the prepared slope in order to achieve a reasonable mixing of the soil and mulch
- Spread the topsoil/composted mulch mix to achieve an even surface but do not otherwise smooth or compact the surface
- Apply appropriate seed mix by hydro-seeding if the topsoil has been stockpiled beyond the recommended period and soil seed is therefore not expected to germinate
- For slopes steeper than 2H:1V and up to 1.5H:1V (e.g. transitions from bridge abutments to 2H:1V slopes) and for basins, vegetated swales and channels install organic fibre mesh over topsoil preparation prior to seeding as per the landscape drawings and specifications.

Topsoil Treatment 2: Planting and seeding areas

- Rip the subsoil to depth shown on landscape drawings and specifications. Leave the subsoil surface in a roughened and uncompacted state, prior to the application of topsoil
- Apply A1 horizon topsoil to the depth show on landscape drawings. Spread the topsoil but do not otherwise smooth or compact the surface except where pasture/native grass is to be applied
- Level and trim the surface flush with adjacent surfaces and roll to lightly compact
- Apply appropriate seed mix by direct seeding or hydro-seeding or plant in accordance with landscape drawings
- Apply fertiliser at the rates as shown on the landscape drawings
- Install advanced trees/tubestock and backfill with topsoil to finish flush with ground level

- Apply surface wood chip mulch over planted areas to depths shown on landscape drawings.

Topsoil Treatment 3: Pasture grasses and native grass seeding on medians, verges and cut/fill slopes

- Cultivate all areas to depth shown on landscape drawings. Leave the subsoil surface in a roughened and uncompacted state, prior to the application of topsoil
- Apply site-won topsoil to depth shown on landscape drawings. Do not mix composted site mulch in to the topsoil
- Spread the topsoil, level and trim the surface flush with adjacent surfaces to provide an even finish and roll to lightly compact
- Apply appropriate grass seed mix via direct seeding or hydro-seeding with fertiliser as indicated on the landscape works drawings and Specification.

Other topsoil treatments are to be applied in specific situations that include:

Topsoil Treatment 4: for vegetated swales, channels and water quality basins

- As for Topsoil Treatment 1 but with organic fibre mesh laid over the slope and berms following topsoil spreading and preceding hydro-seeding to the extent of the topsoiling and/or to the top and bottom of the embankments; as shown in details on landscape drawings.

Topsoil Treatment 5: for wastewater treatment irrigation areas

- As for Topsoil Treatment 2 in accordance with topsoil depths shown in details on landscape drawings.

Topsoil Treatment 6: where existing pavement is to be removed

- Remove the pavement to the depth of the road formation
- Apply bushland topsoil to depths shown in details on landscape drawings
- Apply appropriate seed mix by hydro-seeding or planting in accordance with the landscape plans.

8.5.3 MULCHES

Vegetation material generated by clearing operations is to be used as mulch in the landscape works. Wood chip mulch is to be used as a surface cover on planted areas to suppress weeds and retain soil moisture. Composted mulch is to be incorporated in top soil spread on cut and fill slopes to improve the resistance to surface erosion and assist revegetation.

Surface mulch

All planted areas are to have a layer of hardwood chip mulch sourced from site applied to the soil surface to a depth shown landscape drawings and in accordance with the R178 Specification and landscape drawings.

Composted mulch

Vegetation generated from site clearing is to be windrowed for a minimum of six months in a manner that will accelerate the composting process. The composted mulch may be mixed with site topsoil in accordance with landscape specifications and the landscape works drawings. The proportion of composted mulch mixed with topsoil is specified within the documentation and will be subject to final review as part of the soil testing recommendations undertaken during construction.

Composted site mulch will be ameliorated to raise the pH, improve the composting processing to reduce the nitrogen drawdown effect of the mulch, and to counter any major nutrient deficiencies that would inhibit germination and growth of seedlings. The soil test reports will provide advice as to soil and compost additives to render the mix suitable for growth of the proposed plant species.

Within riparian zones a straw mulch (rice or sugarcane) will be used in lieu of site won mulch in order to avoid tannins from leaching into waterways.

8.6 DRAINAGE & WATER QUALITY

Drainage work can potentially have a significant influence on the character and appearance of the road corridor and its landscape treatments, as well as influence the movement and usage by fauna – both aquatic and terrestrial. Care has been taken to ensure the drainage design has been considered and integrated with both the formation and structures associated with the road. As part of the drainage response the use of concrete lined drainage channels and rock mattresses has been minimised in favour of vegetated drains or rock armoured channels. Drains with grades flatter than 5 per cent use jute webbing installed as erosion matting. Design solutions for drains with grades steeper than 5 per cent have adopted rock or a coloured concrete treatment. The use of this erosion matting systems, in association with revegetation treatments is considered to provide an appropriate solution to the management of the stormwater and its quality. The alignment of channels will be informal and not rigid, responding to the topography and interfacing with the road formation.

8.6.1 WATER QUALITY CONTROL SYSTEMS

Water quality control systems consist of two phases:

Construction Phase – consisting of temporary erosion and sediment controls for construction

Operational Phase - consisting of permanent water quality treatments which address the ongoing operation of the highway.

As part of this process a range of water quality systems are adopted as part of the drainage design. This includes:

- Vegetated swales and channels
- Concrete lined channels and gutters.

8.6.1.1 VEGETATED SWALES AND CHANNELS

Vegetated swales and channels are used wherever water velocities permit. The design has maximised the use of vegetated channels, helping to clean the water but also integrate the drainage with its landscape context. The vegetated nature of these drains ensures velocities are reduced and the potential for sediment to be removed from the water column is maximised.

8.6.1.2 CONCRETE LINED CHANNELS AND GUTTERS

Concrete lined channels are to be used where other drainage forms are unsuitable due to:

- Steepness of slope
- Velocity and concentration of flows.

Channels located in highly visible areas are coloured, using dark unobtrusive colours consistent with the natural rock colour and recede into the landscape. Embankment scupper drains are likely to fall into this category. Landscape will be used to help reduce the visual prominence of drains where possible by providing screening or visual foil to the drain.

8.6.1.3 BASINS

Basins form a significant component of the water treatment chain as part of the construction and operational phases of many highway projects. The final form of a basin has the potential to impact visually the character of the alignment as a result of its context and grading and the degree to which it can be integrated.

As part of the design development for the project basins have been identified as being required only for the construction phase. Construction phase basins will be filled at completion of the works and revegetated to match the adjoining landscape.

The absence of permanent basins results in limited long term visual integration issues as a result of removing the need for fencing and integration of the landform associated with basins. The role of basins has been addressed by the use of vegetated channels which aid the cleansing and infiltration of the water from the alignment.

8.6.2 CULVERTS

Structural culverts on the project include fauna connectivity culverts and flood relief/drainage culverts. Fauna connectivity culverts are designed to allow for the passage of fauna under and across the highway. Flood relief and drainage culverts convey floodwaters and surface flows under the highway.

With fauna culverts the primary design input has been the location and the size of the culvert depending on the type of fauna. Siting reflects key movement corridors and connections to other appropriate environments to minimise fragmentation caused by the highway alignment. Culverts have been sited as part of the development of management plans for all fauna.

Floodwater and drainage culverts have been sited reflecting present surface flows and the need to maintain and, or augment these flow paths in response to flood modelling in order to alleviate adverse impacts.

The form of the culverts has been standardised to enhance constructability and are consistent along the project length. Culverts consist of wing walls and concrete apron with the use of soft engineering methods where possible at their inlet and outlet points of drainage culverts. Fauna furniture is only incorporated in associated with fauna culverts.

8.6.3 CREEK REHABILITATION

8.6.3.1 CREEK REALIGNMENT

The realignment of a number of creeks requires an approach which maintains the creek character while providing a channel alignment compatible with the alignment constraints in both the short to long term.

To this end a combination of rock armoured and vegetated treatments is used so the overall feel of the creekline remains a vegetated creek corridor.

This will ensure visual continuity, the maintenance of the creekline as a wildlife corridor, and stability of the channel in relation to bridge or culvert structures.

Creekline are to be revegetated with riparian vegetation indigenous to the corridor. Species selection reflects the ephemeral or permanent nature of the creekline.

8.7 FAUNA CROSSINGS

8.7.1 FAUNA CONNECTIVITY

Fauna connectivity is an important part of the assessment and subsequent mitigation strategy for the corridor. As a result of broad-scale native vegetation clearing and development, there is currently a high degree of habitat fragmentation from Richmond River to Ballina (Sections 10 and 11). The project has the potential to isolate native fauna on both a local and regional population level. To inform the design development of the project, key movement corridors have been identified and specific measures for each section of the alignment identified (Figure 68).

From Richmond River to Coolgardie Road - Section 10 and to a lesser degree Coolgardie Road to Ballina - Section 11 a critical component of the design and its mitigation measures is the consideration of the Ballina Koala population. The design of fauna underpasses and fencing for koalas is a critical aspect of the mitigation measures adopted. Several long-term studies undertaken by Roads and Maritime to track koalas pre, during, and post major work to investigate effectiveness of various underpasses, overpasses and exclusion fencing is incorporated within the proposed strategies for this Pacific Highway Upgrade. A critical component of the response for koala movement and habitat impacts is identified in the *Koala Revegetation Strategy* (2015). This requires the provision of 130 hectares of tree planting adjoining the highway is focussed on existing movement corridors.

Also considered are the impacts on the habitat of the long nose potaroo which has been found at a number of sites throughout Section 10, associated with Wardell Heath. This species is known to inhabit coastal heath and sclerophyll forests and requires a dense understorey with occasional openings. A key element of its management is the implementation of fauna exclusion fencing to avoid or limit impacts of road kill on the population and to assist in the connectivity of the Wardell Heath population with populations to the west.

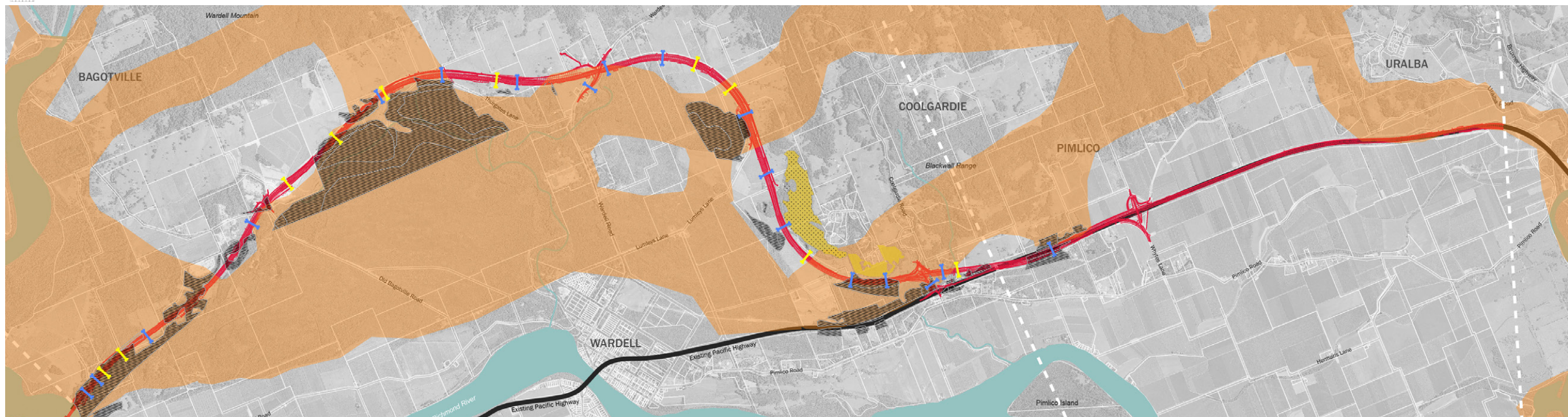
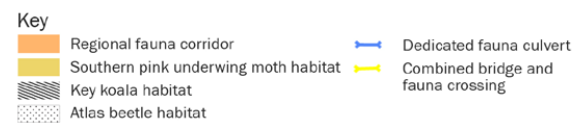
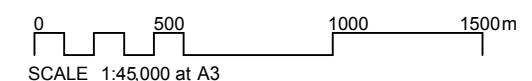


Figure 68: Proposed fauna connectivity



8.7.1.1 REVEGETATION FOR FAUNA CONNECTIVITY

Upgrading the Pacific Highway Design Guidelines (2015) sets out the requirements for revegetation for fauna connectivity. This includes:

REVEGETATION NEAR FAUNA CONNECTIVITY STRUCTURES

Vegetation planted or seeded within an approach to a fauna crossing is provided in such a way as to:

- Be complete as soon as practicable after clearing of existing vegetation, and within three months of completion of construction of the fauna crossing
- The density of vegetation planting or seeding will match the surrounding natural habitat
- Not obstruct access to the underpass or bridge
- Be indigenous species and representative of the surrounding natural habitat
- Be designed to attract native fauna species to the structure, except where fauna exclusion fences are not present
- Not obstruct the views through, or disguise, the entrance to the underpass or bridge.

REVEGETATION NEAR FAUNA/FROG FENCING

Native tree and shrub seeding and planting stock must not be used within three metres of fauna fences or one metre of frog fences during the revegetation process. The growth of vines and heavy vegetation / grass growth in and next to fauna fences must be reduced.

KOALA SPECIFIC REVEGETATION

As identified above the provision of 130 hectares of tree planting will be provided to enhance connectivity beyond the project boundary. Within the project boundary the revegetation work will include primary and secondary koala food trees in areas that will not cause a road safety traffic hazard and will encourage the use of fauna underpasses. This includes revegetation of lands disturbed by the work and land within the corridor cleared as part of the previous land use where outside the limits of fauna fencing. If planting occurs within fauna fencing species selection will avoid those attractive to koalas. All work will be consistent with proposed *Koala Revegetation Strategy* (2015).

8.7.2 FAUNA CROSSING STRUCTURES

Fauna structures have been standardised across the Woolgoolga to Ballina project in order to provide efficiencies in the provision and delivery of these structures. A number of bridges as well as culverts with fauna furniture beneath, are provided from Richmond River to Ballina (Sections 10 and 11).

Crossing structures are designed in line with the Conditions of Approval. These include preparing a connectivity strategy, detailing crossings for terrestrial and aquatic fauna including bridge and culvert crossings. Crossing for arboreal fauna has been considered in the development of the strategy.

A summary of the key fauna structures is in Appendix I.

The landscape design has been developed with the help of ecologists and is composed of plant species which encourages the movement of fauna through these elements by the utilisation of plants attractive to the relevant fauna species, but which do not obstruct or disguise the entrance. The ground surface has also been considered with the adoption of soft scour protection treatments on the approaches to the fauna passage structures.

8.7.3 FISH PASSAGE

Fish passages are required to any class 3 or above water way, which occur within this portion. The allowance for fish passage is incorporated in the design of the drainage culverts and is in line with:

- Why do fish need to cross the road – *Fish Passage Requirements for waterway crossings*, Department of Primary Industries, 2003
- *Policy and Habitat Guidelines for Fish Habitat*, Department of Primary Industries, 2013.

Randles Creek Is identified as a Class 2 waterway and the bridge design at this location (D10) has provided for the passage for fish. This principle has been adopted for all waterways beneath bridges.

8.7.4 FROG MANAGEMENT

From Richmond River to Coolgardie Road - Section 10 the presence of the Wallum Sedge Frog is identified one kilometre north of the Richmond River and between 200 to 500 metres south of Old Bagotville Road. Management of its environment and the frog itself is addressed as part of the Project Threatened Frog Management Plan. As part of this plan the use of Frog Fencing to limit access to the alignment is required. The landscape response adopted utilises the relevant vegetation community related to the sites natural characteristics. As part of this there is a requirement to maintain minimal vegetation cover within 1 metre of the fauna fence in order to discourage movement adjacent or over fencing. To achieve this the grassland mix is adopted adjoining fences.



Figure 69: Example of fauna furniture at culvert



Figure 70: Koala furniture



Figure 71: Example of glider poles

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CHAPTER 9

CONCLUSION

The document has been prepared to address the Minister's Condition of Approval (D20) for Richmond River to Ballina (Sections 10 and 11) of the Pacific Highway Upgrade – Woolgoolga to Ballina. As part of this process the key conditions and approval requirements have been identified and the design developed to respond and address these.

The detailed design is a development of the original EIS design. In order to ensure that the project is consistent with the approval and to assist in the refinement of mitigations measures a revised assessment was undertaken of both the landscape character and key viewpoints to confirm/validate or revise the assessment to reflect any changes which have occurred since the granting of approval.

As part of the Conditions of Approval for the project, the Ballina Koala Plan (2016) and Koala Management Plan (2016) have been adopted in the area known as Section 10, which starts at Broadwater and finishes at Coolgardie, south of Ballina.

The character assessment revealed no change in the overall findings for the eight precincts identified. The visual assessment on the other hand revealed some improvement in the overall impact. Of the 15 sites assessed six were identified as having been improved by the proposed design. This improvement reflected the impact of the commitment to revegetate 130 hectares of the valley adjoining the road alignment in order to strengthen the connectivity as part of the proposed *Koala Revegetation Strategy* (2015) and Ballina Koala Plan (2016). The impact of this has seen a reduction of either the overall sensitivity, or magnitude, of the proposal on a number of viewpoints. This has removed five of the seven 'moderate to high' impact rankings within this portion of works. All other impacts are either 'moderate' or 'moderate to low'.

The report presents a plan, cross sections, illustrative perspectives and supporting text to illustrate the compliance and addressing of the key environmental conditions of the project. In doing so it:

- Clearly identifies the principles and standards adopted for the projects' urban and landscape design response
- Defines the vegetation communities which occur within the corridor and the revegetation strategies to be adopted in response to these
- Details the approach to the management and revegetation of ancillary facilities
- Addresses planting in relation to heritage constraints
- Integrates the revegetation of disturbed sites within the overall revegetation strategy
- Addresses the issue of local access including lighting and signage and path connectivity
- Address the visual impacts of the project through the adoption of a range of mitigation measures consistent with the EIS
- Defines the ongoing maintenance of the works to ensure it establishes and achieves the design intent
- Illustrates the involvement of community and Councils in the development of the plan.

The UDLP is submitted in fulfilment of MCoA D20 by the applicant Road and Maritime for approval for construction to proceed.

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CHAPTER 10

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CHAPTER 11

APPENDICES

- A EIS & SPIR ENVIRONMENTAL MITIGATION MEASURES COMPLIANCE
- B BIODIVERSITY WORKING PAPER COMPLIANCE
- C THREATENED SPECIES MANAGEMENT PLAN COMPLIANCE
- D COMMUNITY CONSULTATION REPORT
- E STAKEHOLDER COMMENTS
- F PLANTING AND SEEDING SCHEDULES
- G LANDSCAPE MANAGEMENT PLAN
- H WEED SPECIES LIST
- I FAUNA CONNECTIVITY SCHEDULE

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APPENDIX A EIS & SPIR ENVIRONMENTAL MITIGATION MEASURES COMPLIANCE

SPIR REQUIREMENT	DOCUMENT REFERENCE
HYDROLOGY AND FLOODING	
Operational impacts on cane drains - HF3 Cane drain diversions will be designed and constructed in consultation with the relevant cane industry stakeholders and impacted landowners and in consideration of the potential diversions detailed in the Working Paper – Hydrology and flooding, and the additional assessment provided in Chapter 3 of the Submissions / Preferred Infrastructure Report	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Permanent road fencing - HF4 Any permanent fencing at culvert and bridge crossings will consider the potential for blockage and be designed and operated to maintain the existing flood regime.	Detail Fencing design documentation and Chapter 8, Sub-chapter 8.3.1
Scour protection - HF6 Scour and erosion protection measures at temporary and permanent waterway crossings will be provided upstream and downstream of the highway, particularly within 50 metres of Class 1 waterways or within the range of the Oxleyan Pygmy Perch as identified in section 3.9.6 of the Working paper – Biodiversity and the supplementary biodiversity report in Appendix J of the SPIR. This will be undertaken in consultation with the Department of Primary Industries (Fisheries)	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Water way diversions - HF7 Waterway diversions will be designed in consultation with Office of Environment and Heritage, NSW Office of Water and Department of Primary Industries (Fisheries so that the final diversion, where feasible and reasonable, the characteristics of the waterway that is being diverted. Characteristics include flow regime, flow velocity, base material, vegetation and habitat for aquatic fauna.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Water way diversions - HF8 Revegetation of waterway diversions and surrounding areas will be undertaken in accordance with the following principles: <ul style="list-style-type: none"> Diversions will be stabilised prior to the diversion receiving flows, in conjunction with the establishment of other scour and erosion control measures Diversions will establish of appropriate vegetation communities along the channel bed and banks, using endemic native species. 	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Management of flows for aquatic habitat and movement - HF19 All work within 40 metres of a permanent watercourse, crossed by the project, will be undertaken in accordance with the NSW Office of Water 'Guidelines for Controlled Actions' and industry best practice including maintaining where feasible and reasonable the geomorphic integrity and natural hydrological flow regime	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
SOIL , SEDIMENT AND WATER	
Design of cut and fill batters - SSW1 Batter slope gradients will be designed to minimise erosion of select topsoil.	Detailed Alignment design and Chapter 8, Sub-chapter 8.1.5
Design of cut and fill batters - SSW2 Where feasible, bench cuttings will be diverted onto contours and surface flow drainage paths designed to spread flow at the source in preference to concentrating the flow and treating it further downstream.	To be reviewed as part of detailed design with the alignment team and drainage team
Management of soils, sediment and water issues - SSW7 Exposed areas will be progressively rehabilitated. Methods will include permanent revegetation, or temporary protection with spray mulching or cover crops.	Chapter 8, Sub-chapter 8.4

SPIR REQUIREMENT	DOCUMENT REFERENCE
Stockpile management - SSW10 Topsoil, earthworks and other excess spoil material will be stockpiled and managed in accordance with Roads and Maritime Stockpile Management Guidelines (Roads and Maritime, 2011a) and the “Management of Surplus Material” in Section 3.9 of the SPIR.	Chapter 8, Sub- chapter 8.5
Stockpile management - SSW13 Topsoil will be stockpiled separately and inspected for noxious weed seedlings at six monthly intervals and controlled with herbicide as required.	Chapter 8, Sub-chapter 8.5
Soil erosion and sediment control - SSW27 Works within waterways will consider the need to maintain fish passage, in consultation with the Department of Primary Industries (Fisheries).	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Soil erosion and sediment control - SSW28 Flow discharge points will be designed with erosion controls to manage the flow velocities.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Protection of groundwater impacts at type A and Type B cuttings and embankments - SSW49 Major embankments will be designed to enable distributed flow of surface waters.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Protection of Water Quality - SSW59 All permanent water quality basins will incorporate measures to contain accidental fuel and chemical spills resulting from vehicle accidents on the highway. Basins will be designed to accommodate a spill volume of up to 40,000 litres.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Protection of Water Quality - SSW60 For water quality treatment in floodplains and other locations with minimal changes in gradient, grassed swales will be considered during detailed design.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Protection of Water Quality - SSW61 Appropriate scour protection for drainage measures will be determined during detailed design.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
BIODIVERSITY	
Interchange at Wardell - B56 Street lighting on the roundabouts at the interchange at Wardell will be designed to reduce light spill during detailed design. This could include using deflection shields around the lights or using a UV light, with reduced UV light emissions.	Street Lighting documentation Chapter 8, Sub-chapter 8.3.4
Monitoring strategy - B1 The Ecological Monitoring Program (Appendix K of the PIR) and will be finalised in consultation with relevant State and Commonwealth agencies and incorporate any specific conditions of consent approval and feedback from the expert review.	Ecological monitoring would occur principally via the individual targeted flora/ fauna management plans already prepared by Roads and Maritime.
Fauna connectivity - B2 The Connectivity Strategy will be further developed during detailed design, in consultation with relevant State and Commonwealth agencies, building upon the Connectivity Strategy in Appendix A of the Working paper – Biodiversity and the Supplementary Biodiversity Report in Appendix J of the SPIR.	Development of the Connectivity Strategy for Section 10 and 11 is at Draft Report. Further development will occur during FDD. Items related to landscape and urban design are discussed Chapter 8, Sub-chapter 8.7.1

SPIR REQUIREMENT	DOCUMENT REFERENCE
Fauna connectivity - B3 All fauna connectivity structures will be developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity, Biodiversity and the Supplementary Biodiversity Report in Appendix J of the Submissions / Preferred Infrastructure Report.	This has occurred and is documented in the Connectivity Strategy for Section 10 and 11. Items related to landscape and urban design are discussed Chapter 8, Sub-chapter 8.7.1
Fauna connectivity - B4 Opportunities for improved connectivity for koala and long-nosed potoroo will be further investigated at between station 144.2 and station 146.6.	Chapter 8, Sub-chapter 8.7
Fauna exclusion fencing - B5 Fauna exclusion fencing locations and design will be further developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity,	Detailed Fencing documentation and Chapter 8, Sub-chapters 8.3.1 and 8.7
Minimise loss of vegetation and habitat - B13 Disturbance and clearing of vegetation will be minimised, particularly: <ul style="list-style-type: none">▪ Avoiding and minimising vegetation removal wherever possible through the detailed design process.▪ Placing water quality basins in the optimal location for treating surface runoff. During detailed design, the location of water quality treatment measures will consider minimising vegetation removal, particularly where there is the potential for threatened plant species, threatened fauna habitat or in identified regional wildlife corridors.	Detailed Clearing and stripping documentation and Chapter 8, Sub-chapters 8.6
Reuse of woody debris and bushrock - B26 Woody debris and bushrock will be re-used on site for habitat improvement where possible and will be detailed in the landscape management plan in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a).	To be detailed in CEMP and co-ordinated with landscape documentation
Weed management - B27 A weed management plan will be developed as part of the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and the Introductory Weed Management Manual (Richards, 2004).	Detailed CEMP and Chapter 8, Sub-chapter 8.5 and Appendix G Landscape Management Plan
Riparian and aquatic habitat management - B35 The bed and banks are to be reinstated to a condition similar to or better than the original condition ensuring that there are no adverse impacts on the aquatic values (different measures may be required for each crossing) and where feasible and reasonable, avoid impacts on geomorphic processes.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Riparian and aquatic habitat management - B40 Appropriate plant species will be incorporated into the rehabilitation of disturbed aquatic habitats and drains as a result of construction.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Stockpile and ancillary facility management - B52x Ancillary facility - Section 10 site 3b: <ul style="list-style-type: none">▪ Map and avoid stripping of trees along northern boundary	Detailed in Chapter 6, Sub-chapter 6.7
Stockpile and ancillary facility management - B52y Ancillary facility - Section 10 site 4: <ul style="list-style-type: none">▪ Revegetate site post-construction, focus on approaches to land bridge and avoid Arthraxon hispidus.	Deletion of land bridge has altered this response. Response will seek to achieve objectives of <i>Ballina Koala Plan</i> 2016

SPIR REQUIREMENT	DOCUMENT REFERENCE
URBAN AND LANDSCAPE DESIGN	
Noise wall visual impacts - UD1 <p>If further noise modelling identifies that noise walls are required, further visual assessment address the visual implications of the change. Their location and design will be in accordance with the Noise Wall Design Guideline (RTA, 2007) and the principles identified in Working Paper – Urban design, Landscape Character and Visual Impact (Section 4.6.3).</p>	Noted in case of change to noise attenuation strategy.
Clarence River and Richmond River bridge impacts - UD2 <p>Changes to the design of the Clarence and Richmond rivers bridges from this EIS, will require further visual assessment. Any changes will consider the principles identified in Working Paper – Urban design, Landscape Character and Visual Impact (Section 4.6.2), the performance criteria outlined in Chapter 5 of the EIS and funding arrangements.</p>	Not part of package
Landscaping and planting strategy - UD3 <p>The project will be carried out in accordance with the urban design and landscaping strategy, as identified in Section 11.4.1 of this EIS. Detailed landscape design for all project batters, and median planting areas will be developed in accordance with the Landscape Guidelines (RTA, 2008), the requirements of the Working Paper – Biodiversity (Section 5.2.2) and the landscape strategy to provide a robust, successful and effective planting design.</p>	Chapter 7 and Chapter 8, Sub-chapter 8.4
Design of urban design features and road furniture - UD4 <p>The built form of the project, including consideration of the height, bulk, scale, materials and finishes for:</p> <ul style="list-style-type: none"> ▪ Bridges. ▪ Cuttings and embankments. ▪ Road barriers. ▪ Signage. ▪ Fences. ▪ Clear zones. ▪ Topsoil management. ▪ Water quality control ponds. ▪ Fauna crossing. ▪ Place marking and cultural plantings. <p>The project will be designed in accordance with the design principles identified in Working Paper – Urban Design, Landscape Character and Visual Impact, and relevant Roads and Maritime guidelines.</p>	Chapter 8, Sub-chapter 8.1.2 Sub-chapter 8.1.5 Sub-chapter 8.3.5 Sub-chapter 8.3.6 Sub-chapter 8.3.1 Sub-chapter 8.5 Sub-chapter 8.6 Sub-chapter 8.7 Sub-chapter 8.8
Visual impacts from viewpoints - UD6 <p>Measures to mitigate visual impacts to viewpoints will be implemented, as identified in Table 11-42 and Working Paper – Urban Design, Landscape Character and Visual Impact. If any further viewpoints were identified during detailed design that have a moderate–high or high impact, screen planting also be considered.</p>	Chapter 5, Sub-chapter 5.7
Construction visual impacts - UD7 <p>Disturbed areas will be progressively revegetated throughout the construction period.</p>	Chapter 8, Sub-chapter 8.4

SPIR REQUIREMENT	DOCUMENT REFERENCE
Visual impacts of ancillary facilities - UD8 <p>Where required, typical landscape treatments for ancillary facilities in forest areas will include:</p> <ul style="list-style-type: none"> ▪ Providing screen planting. ▪ Considering reinstatement of disturbed forest in heavily forested. ▪ Considering the importance of the visual landscape at each location and allowing restoration of important forest vegetation to prominent ridge lines or other landscape elements where feasible and reasonable. ▪ Negotiating with private landowners, as applicable, to determine future treatments for other non-forested ancillary facility locations. ▪ Re-grading disturbed areas to achieve a sustainable and functional landform. <p>Stabilising all surfaces in accordance with good engineering and environmental practice.</p>	Chapter 6, Sub-chapter 6.7
Visual impacts of ancillary facilities - UD9 <p>Typical landscape treatments for ancillary facilities in agricultural areas will include:</p> <ul style="list-style-type: none"> ▪ Considering returning remnant agricultural land to agricultural uses. ▪ Providing screen planting. ▪ Reinstating riparian vegetation through ancillary facilities, where practicable, in the open landscape. ▪ Considering the visual landscape at each ancillary facility and considering restoration of important forest vegetation to prominent ridge lines or other landscape elements where feasible and reasonable. ▪ Re-grading disturbed areas to achieve a sustainable and functional landform. <p>Stabilising all surfaces in accordance with good engineering and environmental practice.</p>	Chapter 6, Sub-chapter 6.7
Visual impact of borrow sites - UD10 <p>The extent of excavation and the landscaping strategy at borrow sites will be reviewed considering material requirements on the project and the visual impact on the resultant cuttings.</p>	To be undertaken on a case by case basis. Details of borrow sites to be provided by PC. Refer Chapter 6, Sub-chapter 6.8
Visual impact of borrow sites - UD11 <p>Any backfilling of the Lang Hill and West of Wardell borrow sites will be undertaken with available surplus material from the project. Rehabilitation of the sites will be undertaken in accordance of the landscape strategy (UD3), design principles (UD5) and the intended future land use of the sites.</p>	Noted
Visual impact of borrow sites - UD12 <p>Any backfilling of the Eatons and Gibson borrow sites will be undertaken with available surplus material from the project. Landscaping on the site use indigenous species, including those species suitable for koala. The landscaping will connect to the existing vegetation to the east of the project by a fauna land bridge to be constructed at station 147.6. Rehabilitation of the sites will be undertaken in accordance of the landscape strategy (UD3) and design principles (UD5).</p>	Noted.
Monitoring of landscaping and rehabilitation - UD13 <p>Landscape and rehabilitation works will be monitored and remedial measures implemented where required until vegetation has stabilised.</p>	Chapter 8, Sub-chapter 8.4 and Appendix G Landscape Management Plan
Earth mounds - UD14 <p>The mounding profile of any earth mound will blend suitably into the existing landscape setting. Any mounding to be landscaped will be compacted in 1.5 metre layers with 1:3 maximum batter slopes where reasonable in consideration of constraints within the project corridor. Where feasible and reasonable, permanent mounds will be treated with ameliorants and overlaid with topsoil to minimum 150 millimetres to ensure suitable planting conditions are achieved.</p>	Chapter 6, Sub-chapter 6.9

SPIR REQUIREMENT	DOCUMENT REFERENCE
ABORIGINAL HERITAGE	
Awareness of Aboriginal heritage - AH12 An Aboriginal heritage interpretation strategy will be prepared as part of the Aboriginal heritage management plan. Measures will include opportunities for promoting salvage and investigation, the recovery of information, permanent installations and ways of marking the presence of Aboriginal people in the landscape, including, signage, interpretation products such as written materials, and through place naming.	Opportunities to incorporate recommendations within the Aboriginal Heritage Management Plan will be investigated. (Note: There is no SPIR Management commitment to the preparation of this plan.)
Impacts on the Gumi Site - AH30 For the Gumi site (O4-4-O180): <ul style="list-style-type: none">The tree (registered on AHIMS database) will be removed and the trunk will be relocated to an area agreed to with the registered stakeholder groups and Roads and Maritime – an arborist will be consulted to guide in the removal of the tree.The final tree location will be visually protected with culturally sensitive plantings or by existing vegetation. Access to the tree will be provided for local Aboriginal people to enable them to be able to use the tree as a teaching site.	Access to the site of the relocated tree will be provided.
Direct impact on culturally significant places - AH41 Place D: Welcome to country signage will be installed within the highway corridor between Woodburn and Wardell and information on culture installed at the rest area in Section 10, as agreed with the registered Aboriginal parties.	Welcome to Country Signage will be addressed as part of the Business Signage and Tourism Strategy in consultation with relevant Aboriginal parties. Rest area signage is to be addressed as part of the design of future elements and is not delivered as part of this design.
NON- ABORIGINAL HERITAGE	
Impacts on item 29: ‘Stonehenge’ Property, Wardell Architectural noise treatment to the house will be investigated and provided where reasonable and feasible and in consultation with a qualified heritage consultant. Consideration will be given for the need to revise the SOHI for this item when the specific architectural noise treatment options are identified.	Addressed. Refer to Design Report EN01 Noise and Vibration
TRAFFIC AND TRANSPORT	
N/A	
NOISE AND VIBRATION	
Road traffic noise - ONV1 Architectural treatments will be considered for noise-affected receivers identified in the EIS and Submissions / Preferred Infrastructure Report (Appendix F), subject to confirmation at the detailed design stage.	Addressed. Refer to Design Report EN01 Noise and Vibration
LAND USE AND PROPERTY IMPACTS	
Fencing Strategy - LU4 The Fencing Strategy will be further developed during detailed design, in consultation with relevant stakeholders. This will build upon the principles of the strategy described in Chapter 3 of the Submissions and Preferred Infrastructure Report (Roads and Maritime, 2013).	Refer fencing package and Chapter 8, Sub-chapter 8.3.1

SPIR REQUIREMENT	DOCUMENT REFERENCE
Construction impacts to primary industry, including forestry, and agriculture uses - LU12 Where possible, onsite reuse of any spoil is the preferred solution for managing the impacts, although alternative options for the reuse or disposal of spoil will be identified in the surplus material management plan.	Noted to be incorporated in design development. Chapter 8, Sub-chapter 8.5
Construction impacts to primary industry, including forestry, and agriculture uses - LU13 The management of surplus material will be further developed during detailed design, in consultation with relevant stakeholders. This will build upon the principles of the strategy described in Chapter 3 of the Submissions and Preferred Infrastructure Report (Roads and Maritime, 2013).	Chapter 8, Sub-chapter 8.5
Construction impacts to primary industry, including forestry, and agriculture uses - LU16 Where pesticides are required during construction, implement appropriate environmental management measures to avoid potential impacts on adjoining agricultural properties.	Addressed as part of Construction Environmental Management Plan
Construction impacts to primary industry, including forestry, and agriculture uses - LU27 The Cane Farm Strategy will be further developed during detailed design, in consultation with relevant stakeholders. This will build upon the principles of the strategy described in Chapter 3 of this Submissions and Preferred Infrastructure Report.	Noted
SOCIAL AND ECONOMIC	
By-passed towns - SE4 Signage will be implemented for bypassed towns in accordance with Roads and Maritime signage guidelines and in consultation with relevant councils. Signage on the project will identify bypassed townships (Grafton, Ulmarra, Tyndale, Maclean, New Italy, Woodburn, Broadwater and Wardell) as places for ‘stopovers’ for fuel, supplies and short term accommodation, to support demand for goods and services within these townships.	Advised as not required by Pacific Complete
By-passed towns - SE5 Roads and Maritime will work with Councils affected by the upgrade, where relevant, to support strategies by local councils and/or chamber of commerce and industry to promote townships and villages as stopovers for tourist.	Noted
GREEN HOUSE GAS EMISSIONS AND AIR QUALITY AND WASTE IMPACTS	
Energy consumption: operation - GHG6 Roads and Maritime will investigate the use of LED lighting in place of incandescent lamps as part of the project’s detailed design, and use them where practicable to reduce electrical energy consumption. Any energy-efficient alternatives will have to meet lighting standards for major roads.	Addressed as part of the Lighting design package
Minimising construction Waste - WM6 Sediment removed from sedimentation basins will, where appropriate, be used on-site in landscaping and/or flattening of batters.	To be addressed as part of Construction Environmental Management Plan
Management of operational waste Green waste from highway maintenance activities will be collected and, where possible, recycled for mulch within the road reserve.	To be addressed as part of Construction Environmental Management Plan

APPENDIX B BIODIVERSITY WORKING PAPER COMPLIANCE

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
(Note: Based on EIS Biodiversity Mitigation Measures)	
B2. The Connectivity Strategy would be further developed during detailed design, in consultation with relevant state and Commonwealth agencies, building upon the Connectivity Strategy in Appendix A of the Working paper – Biodiversity.	The final Fauna Design Connectivity Report details the Connectivity Strategy for Section 10 and 11 is at Draft Report. Items related to landscape and urban design are discussed in Chapter 8, Sub-chapter 8.7.1
B3. All fauna connectivity structures would be developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity, building upon the current concept design structures.	This has occurred and is documented in the Connectivity Strategy for Portion D. Items related to landscape and urban design are discussed Chapter 8, Sub-chapter 8.7.1
B4. Fauna exclusion fencing locations and design would be further developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity, building upon the current concept design.	Fencing Detailed documentation and Chapter 8, Sub-chapter 8.7
B8. An overall project Flora and Fauna Management Plan would be prepared to detail consistent guidance on the general management measures required for flora and fauna across all stages of the project. The management plan would cover: <ul style="list-style-type: none">Pre-clearing processExclusion zonesRe-establishment of native vegetationClearing of vegetation and removal of bushrockRe-use of woody debris and bushrockWeed managementPathogen managementNest boxesFauna handlingAquatic habitats and riparian zones.	Threatened Species Management Plans
B.9 A threatened flora management sub plan would be prepared to specifically address project sections where populations of threatened flora are known to have plants immediately adjacent to the project footprint, as identified in this assessment and include: <ul style="list-style-type: none">Identification and physically surveying and mapping the specific location of individuals and patches along the edges of the project boundary to inform the management actions of the flora and fauna management planA clearing protocol, translocation trial, seed collection, storage and propagation to use in revegetation of disturbed habitatsDetails for protection of retained plants, planting and maintenance and monitoring procedure during constructionA revegetation monitoring program and performance criteria, reporting and adaptive management.	Threatened Flora Management Plan

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
B10. A rainforest invertebrates management sub plan focusing on the Pink Underwing Moth and Atlas Rainforest Ground Beetle would be prepared and include: <ul style="list-style-type: none">Details on targeted surveys of both species within and around the project boundary to identify the extent of the population and map the distribution of suitable habitat adjacent to the project. In particular potential breeding habitat containing the caterpillars' food plant, <i>Carronia multisepalea</i> should be identified. This would inform the detailed design, flora and fauna management plan and translocation and habitat rehabilitation program. The surveys will aim to map the species distribution and correlate presence with the habitat characteristics at identified sites to accurately model the distribution of potential habitat in proximity to the projectConsideration to minimise or avoid impacts, where possible. The identified potential habitat would be targeted for translocation of individuals and habitat rehabilitation as compensation for the loss of habitat from the project An outline of capture and relocation actions for Rainforest Ground Beetle and Pink Underwing Moth larvae focusing on identified suitable habitat <ul style="list-style-type: none">Identify procedures for habitat rehabilitation and revegetation of suitable habitat near the project including the planting of the host plant for the Pink Underwing Moth.Details of a monitoring program for translocated individuals and retained habitat adjacent to the project. The monitoring program would include the collection of baseline data and would continue through construction and operation for a period of three years post-construction. The plan would include clear key milestones, performance indicators, corrective actions and timeframes for the completion of all actions outline. The plan would address the success of habitat rehabilitation as well as the translocation success by monitoring populations of the target species.	Threatened Invertebrate Management Plan
B13. A threatened frog management sub plan (with a focus on the Giant Barred Frog, Green-thighed Frog, and Olongburra Frog) would be prepared and include: <ul style="list-style-type: none">A program for survey or potential habitat for these species at least 6 months prior to construction to identify potential waterways and swamp habitat locations to inform the flora and fauna management planA record of riparian / habitat condition baseline data at identified sites near the project to inform construction and post-construction monitoring programIdentification of known sites, protection measures to be implemented during construction, monitoring methods and timing for species and habitat condition and monitoring mitigation measures and reporting in line with the flora and fauna management plan. An outline of methods for monitoring species and habitat condition during post-construction.	Threatened Frog Management Plan
B14. A Koala management sub plan would be prepared and include details on targeted surveys to identify the presence and status of koala populations near the project alignment. The surveys will focus near the project alignment and the data used to inform further development of connectivity structures.	Addressed as part of the <i>Ballina Koala Plan</i> (2016)

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
<p>B17 A landscape management plan would be developed to provide specific details for the re-establishment of native vegetation on batters, cut faces, surrounding sediment basins and other areas disturbed during construction. This would include details for the appropriate removal and restoration of temporary creek crossings. The landscape management plan would be developed in line with Roads and Maritime Biodiversity Guidelines (RTA, 2011a), the design principles identified in the Connectivity Strategy and the design principles in Working paper – Urban design, landscape character and visual impact.</p> <ul style="list-style-type: none">▪ The approach to landscape planting for the purposes of fauna management would be consistent with principles set out in the urban design and landscape strategy for this project (refer to Working paper- Urban design, landscape character and visual impact).	Developed project wide by Pacific Complete
<p>B18. Disturbance and clearing of vegetation would be minimised, particularly:</p> <ul style="list-style-type: none">▪ Avoiding and minimising vegetation removal wherever possible through the detailed design process▪ Sensitive selection of ancillary facilities. The ancillary facilities identified present a selection of available sites; however during detailed design an evaluation should be conducted to select the minimum number of sites required with a priority to avoid native vegetation clearing if possible. A prior site inspection is required to survey and map hollow-bearing trees and check for large nests for species such as raptors, including Osprey and also Black-necked Stork at these sites▪ Construction compounds and stockpile sites are to be sited in cleared or sparsely treed portions of the ancillary facility sites where feasible and reasonable, to avoid unnecessary clearing of vegetation and threatened flora species <p>Water quality basins would be placed in the optimal location for treating surface runoff. During detailed design, the location of water quality treatment measures would consider the competing environmental requirement of minimising vegetation removal, particularly where there is the potential for threatened plant species, threatened fauna habitat or in identified regional wildlife corridors.</p>	Detailed Clearing and stripping documentation, Ancillary Facilities Management Plan prepared by Pacific Complete and Chapter 6, Sub-chapter 6.8
<p>B19. Instream structures such as bridges and culverts are to be designed and managed to minimise any potential impact to flow regimes and fish passage, in accordance with Fairfull and Witheridge (2003).</p> <p>Use of bridges or bebo arch is the preferred structure for Class 1 (major fish habitat) waterways.</p>	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
<p>B22. Each waterway crossing is to be designed to ensure no physical, hydraulic and behavioural barriers to aquatic fauna movements. Impacts would be minimised by ensuring that:</p> <ul style="list-style-type: none">▪ The natural stream flow and velocity are maintained as closely as possible▪ Surface level of any causeway is the same or lower than the natural stream bed to reduce interference with flow▪ Habitat within a culvert is as natural as possible (eg allow rock and bed materials to infill the culvert base)▪ There is the maximum light penetration▪ Fauna and fish passage standards are maintained, as detailed in the Connectivity Strategy, including minimum design widths, including for natural banks, while also providing for scour protection and cut and fill batters▪ Creek crossing structures would be designed to maximise habitat features within the passage. To achieve this, the design of bridge and culverts would encourage the deposition of sediment creating similar bed substrate to adjacent creek and the planning of specific plant species▪ Pools would be constructed or retained upstream and downstream of the waterway crossings to provide resting and refuge habitat near the crossing structures▪ Design culverts (specifically where Oxleyan Pygmy Perch has been confirmed) so that hydraulic habitat conditions would be suitable for fish passage▪ Bridges would be designed and sized to limit peak flood velocities to less than 1m per second in commonly occurring flood events, similarly to the bridge design over Macdonalds Creek where Oxleyan Pygmy Perch have been confirmed	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
<p>B23. Bridge structures would be designed in light of the following principles:</p> <ul style="list-style-type: none">▪ Bridges are to be single span bridges with piers located outside the main channel▪ Bridge structures to be designed to prevent an increase of backup of water during times of flood, that would enable Plague Minnow to access waterbodies where they are currently not found (eg Broadwater National Park)▪ Construction would not alter or reduce flow where there are existing or potential Oxleyan Pygmy Perch populations (primarily within Sections 7, 8 and 9) which would negatively impact on this threatened species by draining the waterbodies.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.1.2
<p>B24. Where temporary access tracks are required over drainage lines with no flow, fords may be installed.</p>	CEMP, Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
<p>B25. Where possible, existing crossings would be used. Where this is not feasible or reasonable, the temporary crossings would be designed to minimise impacts on the existing aquatic ecology and water quality.</p>	CEMP, Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
<p>B26. Temporary crossings would be further investigated during detailed design including, location, type of structure, duration of need and rehabilitation process.</p>	CEMP, Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
<p>B27. General temporary waterway access track mitigation measures have been provided below:</p> <ul style="list-style-type: none"> Installation and subsequent decommissioning of temporary crossings would be undertaken outside of Oxleyan Pygmy Perch spawning seasons (October to March). Temporary crossings would be constructed from clean fill using pipe or box culvert cells to carry flows. All temporary works (eg crossings, flow diversion barriers) would be removed as soon as practicable and in a way that does not promote future channel erosion. The preferred temporary structure for crossing waterways would be consistent with Witheridge (2002) where the use of bridges is the preferred structure for Class 1 (major fish habitat waterways). Scour protection works would be established at temporary crossings as required At the completion of construction, the temporary crossings would be removed and rehabilitated. 	<p>CEMP, Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6</p> <p>Note: <i>Oxleyan Pygmy Perch has not been identified within Richmond River to Ballina (Sections 10 - 11)</i></p>
<p>B30 The location of exclusion zones would be identified, with temporary fencing or flagging tape to indicate the limits of clearing (in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a)). Permanent fauna exclusion fencing for the project (as described in the Connectivity Strategy), where reasonable and feasible, would be installed prior to clearing and can function as exclusion fencing.</p>	<p>Detail Fencing design documentation and Chapter 8, Sub-chapter 8.3.1</p>
<p>B32 Woody debris and bushrock would be re-used on site for habitat improvement where possible and would be detailed in the landscape management plan in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and include:</p> <ul style="list-style-type: none"> Implementing the removal, stockpiling, transportation and relocation of woody debris and/or bushrock in a manner that minimises disturbance to native vegetation or bushrock Engaging an ecologist in the pre-clearing phase of the proposal to provide advice on the re-use of woody debris and bushrock including potential negative impacts and positioning of woody debris and bushrock at the relocation areas When relocating woody debris, placing it evenly across the site while keeping topsoil disturbance to a minimum Avoiding the spread of any weeds or pathogens that may be in the soil when relocating woody debris and bushrock from stockpiles Mulching would include only native vegetation and separate stockpiles need to be established for weedy vegetation and the native vegetation to be mulched. Manage stockpiles in accordance with RTA's Stockpile Site Management Guideline, RTA Environmental Protection (Management System) QA Specification G36 and RTA Vegetation QA Specification R178 Preparing a mulch tannin management plan for the project where tannins are likely to be generated. 	<p>To be detailed in CEMP and co-ordinated with landscape documentation</p>

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
<p>B33. A weed management plan would be developed as part of the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and the Introductory Weed Management Manual (Richards, 2004) and would include:</p> <ul style="list-style-type: none"> Taxa and potential sources of the weed species (including alligator weed, tropical soda apple and myrtle rust) Weed management priorities and objectives Sensitive environmental areas within or adjacent to the site Location of weed infested areas Mechanical weed control methods such as slashing or mowing, as well as a range of herbicides to avoid the development of herbicide resistance Measures to prevent the spread of weeds A monitoring program to measure the success of weed management Strategic management with adjacent landowners Appropriate disposal of weed infested materials and soils to be identified in the CEMP Communication strategies to improve contractor awareness of weeds and weed management 	<p>To be detailed in CEMP and co-ordinated with landscape documentation</p>
<p>B34. A site assessment by an ecologist or person trained in weed identification would be undertaken to identify the presence and extent of Alligator weeds. If present, management measures in the Weed Management Plan would be in accordance with the DPI Alligator Weed control manual (van Oosterhout, 2007).</p>	<p>To be detailed in CEMP and co-ordinated with landscape documentation</p>
<p>B35 Measures to prevent the introduction and/or spread of pests and disease causing agents such as bacteria and fungi would be incorporated into the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and would include:</p> <ul style="list-style-type: none"> A background search of government-maintained websites for the most up-to-date hygiene protocols for each pathogen Provide vehicle and boot wash down facilities and ensure vehicles and footwear is free of soil before entering or exiting the site The risk of spreading pathogens and the mitigation measures required on site should be regularly communicated to staff and contractors during inductions and toolbox talks Construction works would be programmed to move from uninfected areas to any known infected areas Restrict vehicles to designated tracks, trails and parking areas 	<p>To be detailed in CEMP and co-ordinated with landscape documentation</p>
<p>B40 Streams to be crossed perpendicular to flow and where possible crossing sites selected to avoid unstable banks, bends in the channel, deep pools and confluences with other channels</p>	<p>Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6</p>
<p>B62 Ancillary facilities would be sensitively location to avoid removal of any Threatened Ecological Community.</p>	<p>Ancillary Facilities Management Plan prepared by Pacific Complete and Chapter 6, Sub-chapter 6.8</p>
<p>B63 Stockpiles would be managed in accordance with RTA's Stockpile Site Management Guideline.</p>	<p>CEMP and Chapter 8, Sub-chapter 8.5.2</p>

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APPENDIX C THREATENED SPECIES MANAGEMENT PLANS COMPLIANCE

THREATENED SPECIES MANAGEMENT PLAN COMPLIANCE	DOCUMENT REFERENCE
THREATENED FISH MANAGEMENT PLAN	
Mitigation measures relate to :	
Suitable design of temporary and permanent waterway crossings	Chapter 8, Sub-chapter 8.6
Construction measures including timing, method of construction and erosion control	Chapter 8, Sub-chapter 8.6, CEMP
Aquatic habitat management measures including revegetation of disturbed areas of waterway	Chapter 8, Sub-chapter 8.6 and 8.7.3
Development of a monitoring program to monitor impacts, the effectiveness of mitigation measures and incorporate adaptive management actions where impacts noted.	CEMP
THREATENED FLORA MANAGEMENT PLAN	
Provision of exclusion fencing to protect in situ threatened flora populations	Clearing and topsoil documentation, CEMP, Chapter 8, Sub-chapter 8.4
Management of indirect impacts to these in situ populations during construction	CEMP
Water quality, erosion and sediment control	CEMP
Weed management; and	CEMP, Chapter 8, Sub-chapter 8.4.10 and Landscape Management Plan
Targeted revegetation of disturbed areas adjoining in situ threatened flora including translocation strategy.	CEMP, Landscape documentation
THREATENED FROG MANAGEMENT PLAN	
Provision of exclusion fencing; both temporary, to exclude frogs from construction activities, but also permanent frog fencing, to prevent frogs from accessing the road during the operation of the road and often strategically aligned to fauna underpasses capable of facilitating movement and maintaining habitat connectivity.	CEMP, Fencing documentation and Chapter 8, Sub-chapter 8.7
In particular provide: frog exclusion fencing in Woolgoolga to Ballina Section 10 (ch148300-148750) for the eastern side of the carriageway due to the close proximity of populations in this area	
Using of sediment and erosion control measures.	CEMP
Water quality controls.	CEMP and Drainage design
Provision of crossing structures including bridges and culverts.	Drainage design
Pest and pathogen management.	CEMP
Re-establishment of threatened frog habitat at approaches to crossing structures.	Chapter 8, Sub-chapter 8.7
Compensatory habitat (ponds) where habitat has been removed by construction activities and is considered locally important as recognised by a frog expert.	N/A
Development of a monitoring program to monitor impacts on the populations of threatened frogs and assess the effectiveness of mitigation measures, incorporating adaptive management actions where impacts are recorded.	CEMP
THREATENED INVERTEBRATE MANAGEMENT PLAN	
The objectives of the management strategy include:	
Development of a sound method for undertaking pre-clearing surveys	CEMP, Clearing and Topsoil documentation
A suitable fauna handling procedure	CEMP

THREATENED SPECIES MANAGEMENT PLAN COMPLIANCE	DOCUMENT REFERENCE
Provision of exclusion fencing to protect areas of invertebrate habitat to be retained during construction	CEMP, Clearing and Topsoil documentation
A staged habitat removal process	CEMP, Clearing and Topsoil documentation
A method for the re-use of woody debris and bedrock (habitat for Atlas Rainforest Ground Beetle	CEMP and Landscape documentation
Identification of procedures for habitat rehabilitation and revegetation of suitable habitat near the project to minimise the potential for indirect impacts and inform the design of appropriate buffers between the habitat and the project; and	Chapter 8, Sub-chapter 8.4 and landscape documentation
Develop a monitoring program to monitor impacts on the populations of threatened invertebrates and the effectiveness of mitigation measures and incorporate adaptive management actions where impacts are noted.	CEMP
Management of artificial light spill on surrounding known and potential breeding habitat for Southern Pink Underwing Moth and Atlas Rainforest Ground Beetle.	Lighting documentation, Chapter 8, Sub-chapter 8.3.4
THREATENED GLIDER MANAGEMENT PLAN	
The aim of the mitigation measures is to ensure the continued viability of Squirrel Glider and Yellowbellied Glider populations in the project area by achieving the following goals:	
Targeted rehabilitation to direct glider movements across connectivity structures or locations where a natural crossing may be possible (with the goal to reduce road mortality) without compromising road safety provisions. Targeted rehabilitation plans are detailed within the Urban Design and Landscape Plan (UDLP)	Landscape Concept Plans Chapter 7 and Chapter 8, Sub-chapter 8.7; Landscape documentation
Minimise clearing through appropriate location of ancillary facilities (supported by ancillary impact assessment report as an addition to the SPIR, 2014)	Clearing and Topsoil documentation,
Implementation of a staged habitat removal process consistent with the Roads and Maritime Biodiversity Guidelines (RTA 2011)	CEMP
Revegetation of areas disturbed during construction and installation of nest boxes in accordance with the NBMP	Landscape Concept Plans Chapter 7 and Chapter 8, Sub-chapter 8.7; Landscape documentation; and CEMP
An updated Connectivity Strategy(s) detailing arboreal crossing structures and widened medians with retained vegetation that has been informed by targeted surveys undertaken for Squirrel Glider and Yellow-bellied Gliders in 2014/15 by glider experts from Sandpiper Ecology (Appendix C and Appendix D	CEMP
The minimum design and locations of crossing structures for threatened gliders will be based on the principles outlined in the EIS, expert feedback and the process for managing connectivity requirements described in the Fauna Connectivity Strategy; and	Landscape Concept Plans Chapter 7
Management of light, dust and noise will be in accordance with the CEMP.	CEMP
THREATENED MAMMAL MANAGEMENT PLAN	
In general these mitigation measures related to:	
Exclusion zones to protect adjoining habitats during construction	Clearing and topsoiling documentation; CEMP

THREATENED SPECIES MANAGEMENT PLAN COMPLIANCE	DOCUMENT REFERENCE
Fauna Connectivity Strategy and mitigation measures (arboreal crossing structures, widened medians, dedicated overpasses and underpasses and combined drainage / fauna crossing structures). The strategy is to be informed by targeted surveys for threatened mammals to refine crossing structures and their final location. The minimum design and locations of crossing structures for threatened mammals will be based on the principles outlined in the EIS and the process for managing connectivity requirements described in the Fauna Connectivity Strategy	Appendix I; Chapter 8, Sub-chapter 8.7
Permanent fauna exclusion fencing to minimise road mortalities and direct to crossing structures	Fencing documentation; Chapter 8, Sub-chapter 8.3
Sensitive pre-clearing and clearing procedures to consider animal welfare and translocation from clearing areas	Clearing and topsoiling documentation; CEMP
Minimise clearing through appropriate location of ancillary facilities, implementation of a staged habitat removal process consistent with the Roads and Maritime Biodiversity Guidelines (RTA 2011), revegetation of areas disturbed during construction and installation of nest boxes	Ancillary Facilities Management Plan prepared by Pacific Complete, Chapter 8, Sub-chapter 8.4
Management of light, dust and noise will be in accordance with the Construction Environment Management Plan (CEMP)	CEMP
Establish a comprehensive monitoring program to assess the effectiveness of mitigation measures and allow for ongoing updates to these measures based on the results of monitoring	CEMP
Engagement of appropriate stakeholders to identify appropriate predator and pest control actions; and	Chapter 3
Revegetation of suitable habitat along areas disturbed by construction and land bridge crossings including reuse of woody debris and bush rock.	Chapter 8, Sub-chapter 8.7, CEMP and Landscape documentation
Focus for Section 10 long-nosed potoroo: Exclusion fence all potential wet and dry heath habitats bordering the highway footprint in the Wardell heath area	Landscape Plans Chapter 7
THREATENED RAINFOREST AND RAINFOREST PLANTS MANAGEMENT PLAN	
Mitigation measures related to EPBC listed lowland Rainforest in Sub tropical Australia is limited to Sections 10 and 11 of the highway upgrade. EPBC listed Littoral Rainforest is limited to Section 10 of the highway upgrade. In ADDITION, Cryptocarya foetida (v), Macadamia tetraphylla (v), Syzygium hodgkinsonia (v) and Sreblus pendulinus (E) are found in Section 10.:	
Provision of exclusion fencing to protect in situ threatened flora populations	Fencing documentation, Clearing and Topsoil documentation
Management of indirect impacts to these in situ populations during construction	CEMP
Weed management; and	CEMP, Chapter 8, Sub-chapter 8.4.10 and Landscape Management Plan
Targeted revegetation of disturbed areas adjoining in situ threatened flora. Including: Revegetation with native species reflective of the local area and pre-disturbed vegetation communities where possible will occur post construction. Revegetation design of areas adjacent to in situ threatened plant populations will ensure the plantings will not impact on the species (e.g. will not compete for light or moisture) and are consistent with their habitat requirements. Further details of areas for revegetation and native species to be used, will be provided in the Urban Design and Landscape Plan (UDLP) for each section of the project	Chapter 7, Chapter 8, Sub-chapter 8.4, Appendix B and Landscape documentation
BALLINA KOALA PLAN	
Fully closed highway fencing system	Fencing documentation, Chapter 8, Sub-chapter 8.3
Connectivity structures	Chapter 8, Section 8.7, Appendix I
130 ha New Habitat	Koala Revegetation Strategy (2015) and Landscape Plans Chapter 7

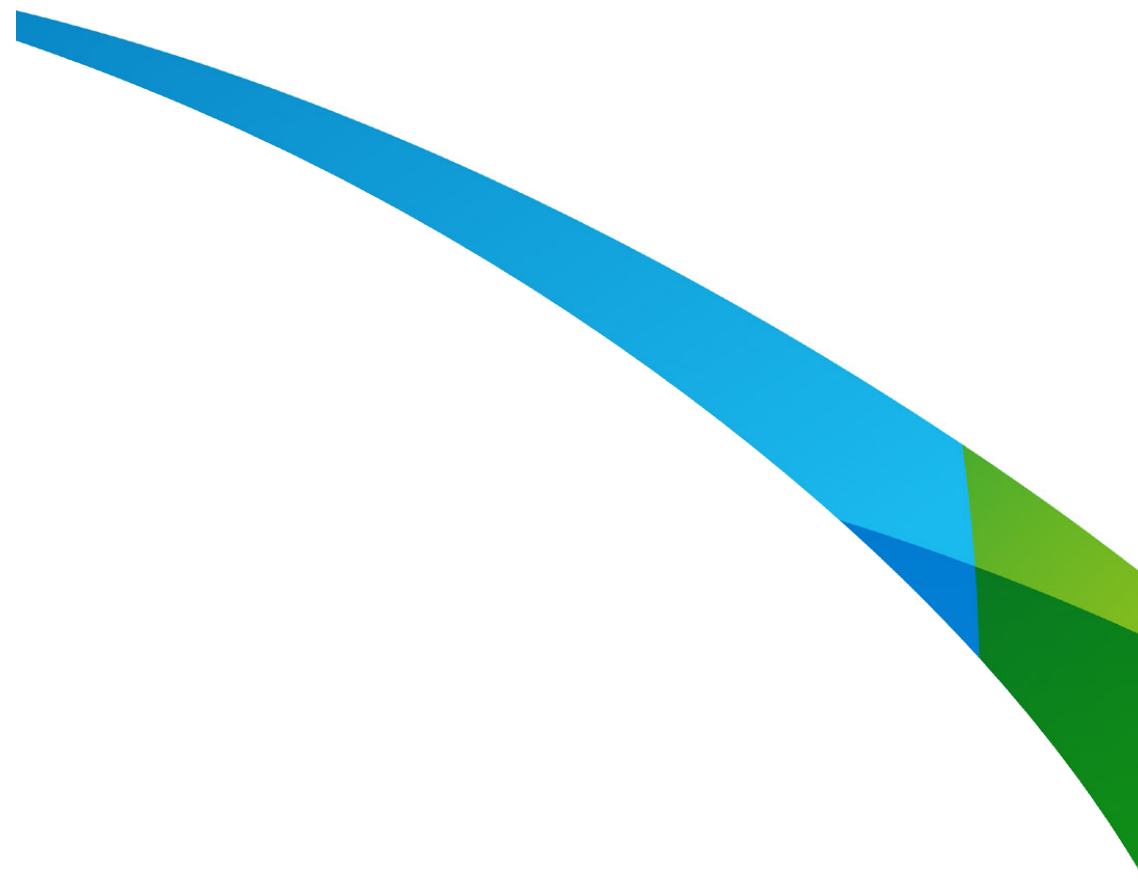
APPENDIX D COMMUNITY CONSULTATION REPORT



Woolgoolga to Ballina, Pacific Highway upgrade

Community Consultation Report for the Urban Design and Landscape Plans

February 2017



Executive summary

The Woolgoolga to Ballina Pacific Highway upgrade will duplicate about 155 kilometres to four-lane divided road from about six kilometres north of Woolgoolga (north of Coffs Harbour) to about six kilometres south of Ballina. The project does not include the completed Devils Pulpit and Glenugie upgrades.

Community feedback was sought on the draft urban design and landscape management plans for the area from Glenugie to the Ballina bypass, excluding the new bridges over the Clarence and Richmond rivers.

The community was able to provide feedback on the plans from 1 August to 29 August 2016. Consultation activities during this time involved:

- sending more than 500 letters to stakeholders with property within 750 meters of the project alignment
- distributing a community update to more than 20,000 residents
- staffed displays at 11 locations
- static displays at 27 locations
- updating the project website to with the draft urban design and landscape management plans, community update as well as an online survey and collaborative mapping tool to capture feedback
- emailing and SMS messages to more than 1000 stakeholders registered in the project database
- advertising in four local newspapers.

A total of 12 responses were received, six written and six survey. Survey responses were anonymous. Written responses included:

- five from individuals and one from a community organisation
- three responses relating to the Richmond River to Ballina area, two relating to Glenugie to Maclean and one related to Devils Pulpit to Richmond River

The six survey responses provided overall comment on the urban design and landscape plans. One respondent offered general support, two respondents did not offer general support and four respondents offered no position.

Key issues raised by the community include the visual amenity, vegetation types, noise and koala management, visual screening, landscaping design and the community consultation process. In response to community feedback the public display period was extended from 19 August to 29 August 2016.

The project team appreciates the time groups and individuals have taken to review the information and the feedback received will assist us in finalising the urban design and landscape plans.

The community also provided feedback on proposed design refinements. These issues have been addressed in the proposed design refinement community consultation report, which will be made publically available on the project website.

A separate consultation process was carried out for the draft urban design and landscape plan for the new bridge over the Clarence River at Harwood. Consultation activities and key issues raised will be made publically available on the project website in the community consultation report for the urban design and landscape plan for the new bridge over the Clarence River at Harwood.

A separate consultation process will also be carried out for the draft urban design and landscape plan for the new bridge over the Richmond River at Broadwater.

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1. Introduction

Draft urban design and landscape plans prepared for the Woolgoolga to Ballina, Pacific Highway upgrade include:

- Glenugie to Maclean
- Maclean to Devils Pulpit
- Devils Pulpit to Richmond River
- Richmond River to Pimlico.

These plans outline the proposed visual identity for the project, providing information about:

- the design vision visually linking the Woolgoolga to Ballina upgrade to the rest of the Pacific Highway
- urban design and landscaping objectives
- assessment of visual precincts and potential impacts
- proposed vegetation types, road furniture and lighting and along the alignment.

1.1. The purpose of this report

This report documents the consultation carried out as part of the public display of the urban design and landscape plan. It records the key issues raised and provides responses to the feedback received.

2. Consultation approach

2.1. Consultation objectives

Consultation with the community and stakeholders was carried out to obtain feedback from the about proposed urban design and landscaping to consider and where appropriate include in the final urban design.

2.2. Values

The Woolgoolga to Ballina upgrade team values collaborating with communities and key stakeholders to create better outcomes for the Woolgoolga to Ballina Pacific Highway upgrade.

2.3. How consultation was done

Consultation activities during the public display period, from 1 August to 29 August 2016 focused on:

- providing information about the urban design and landscape plans
- providing opportunities to discuss the plan with the Woolgoolga to Ballina upgrade team
- inviting feedback.

Table 1 details the consultation approach for the urban design and landscape management plans.

Table 1: Consultation approach

Consultation Approach	Consultation Outcome
Letter to affected stakeholders	Letters were distributed to more than 500 potentially affected stakeholders advising of the public display of urban design and

	landscape plans and opportunity to provide feedback.
Community update	August 2016 project update with latest project information was distributed to more than 20,000 households along the alignment.
Staffed pop-up sessions	11 staffed pop-up sessions provided the opportunity to ask the Woolgoolga to Ballina upgrade team questions about the urban design and landscape plans. Pop-up sessions were held at New Italy, Tucabia, Wardell, Yamba, Harwood, Woodburn, Evans Head, Grafton, Maclean, Ashby and Meerschaum Vale.
Static displays	Static displays were set-up in 27 locations. There were two types of display – primary and satellite. Primary display locations were Ballina Shire Council, Ballina Library, Richmond Valley Council, Evans Head Library, Clarence Valley Council, Grafton Library, Pacific Highway Office, Maclean Library, Clarence Valley Council. Consultation material provided at the nine primary displays included: one copy of each urban design and landscape plan (4), community updates, display poster advising how to provide comment, feedback survey. Consultation material provided at the 18 satellite displays included a copy of the urban design and landscape management plan specific to the display location, community updates and display poster advising how to provide comment.
Webpage	The urban design and landscape plans were available on the Roads and Maritime project website additional information available included the August 2016 community update, collaborative mapping tool and feedback survey which did not provide any response.
Newspaper advertisements	The display locations and website link were advertised in Woolgoolga Advertiser, Grafton Daily Examiner, Grafton Coastal Views and Lismore Northern Star.

Community members and key stakeholders were encouraged to provide their feedback at staffed displays, by completing feedback surveys or providing a response by mail, email or phone. Feedback on the plans was accepted until 5.00pm, Monday 29 August 2016.

The feedback surveys were anonymous and sought to confirm general support for the draft urban design and landscape plans. Feedback surveys included free text fields. The free text fields were reviewed to understand any issues that may have provided additional information, or correlated with written submissions.

Table 2 lists the written submission respondent groups and response number and where these issues are address in the urban design and landscape plans. Where similar issues have been raised in different submissions, only one response has been provided.

Table 2: Written responses, assigned identification number and issues addressed

Respondent	Identification number	Where issues are addressed in urban design and landscape plans
Individual 1	1	Glenugie to Maclean: 6.6, 7, 7.4.2
Individual 2	2	Glenugie to Maclean: 6.6, 7
Friends of the Koala Inc	3	Richmond River to Ballina: 2.3, 2.4, 2.5 , 6.3.3, 7, 8.3.1.2
Individual 4	4	Richmond River to Ballina: 2.5, 4, 7
Individual 5	5	Devils Pulpit to Richmond River: 7, 8.1.8
Individual 6	6	Richmond River to Ballina: 4, 7

3. Consultation summary

3.1 Overview of feedback

A total of 12 responses were received about the urban design and landscape plans. This included six written submissions and six anonymous feedback surveys.

Written responses included:

- five responses from individuals and one from a community organisation
- three responses relating to the Richmond River to Ballina area, two relating to Glenugie to Maclean and one related to Devils Pulpit to Richmond River

The six survey responses provided overall comment on the urban design and landscape plans. One respondent offered general support, two respondents did not offer general support and four respondents offered no position.

2.3. Overview of issues raised

Key issues identified by frequency include:

- visual screening and vegetation types (three respondents)
- noise and koala management (two respondents)
- visual amenity, landscaping and community consultation (single respondents).

A number of survey respondents highlighted the community consultation process, specifically the time available to comment on the plans. In response to this feedback the public display period was extended from 19 August to 5.00 pm, Monday 29 August 2016. This extension was communicated through three media releases and more than 1000 SMS and email updates to the project's stakeholder distribution list.

Table 3 outlines the issues raised, the Woolgoolga to Ballina upgrade team response and respondents identification number.

Table 3 Response to issues raised in written submissions

Issue	Description	Response	Identification number
Visual Screening	Screening for properties through preserving vegetation and proposed revegetation.	Modifications to the landscape design have been made to provide additional plantings within the corridor to assist with visual screening in the Whytes Lane area.	4, 5 and 6
	Headlight glare potentially affecting a property adjacent to Woodburn Evans Head Road overpass	Chapter 7 of the Richmond River to Ballina plan includes the revisions to drawings which show landscape screening in the Whytes Lane area. This will provide vegetation screening on the west side of the highway within the corridor, from the properties on the Blackwall Range. It should be noted that the landscape will take five to eight years from the time of planting to provide visual screening. The project team has assessed the respondent's proximity to the location of the overpass and considered the likelihood of impacts relating to headlight glare, Upgrading the Pacific Highway Design Guidelines, March 2015. Detailed information about the overpass and visual screening is available in Chapters 7 and 8 of the Devils Pulpit to Richmond River urban design and landscape plan.	

Vegetation Type	<p>Use of palm trees in the Glenugie section</p> <p>Preference for native species of vegetation, vegetation screening and mounds</p> <p>Vegetation near rear of properties should be limited to small trees and bushes</p> <p>Vegetation planning to support Koala population</p>	<p>The project team confirms that palm trees have not been proposed in the landscape plan in the Glenugie area. However, native species of palm trees may be considered or selected as a feature tree for limited use, such as at rest areas and interchanges in other parts the new highway alignment.</p> <p>The project team can also confirm that the existing trees near a respondent's property at (between the upgrade and the property) are identified to be retained. Landscaping within the upgrade at this location is proposed to be mixed shrubs. Every effort is being made in this area and across the project to reduce clearing impacts.</p> <p>With respect to vegetation planning to support Koala population, the Ballina Koala Plan (which includes a detailed population viability analysis) and the subsequent Koala Management Plan was approved in August 2016, as part of the project's Conditions of Approval. This approval was received during the proposal's public display period. The approved plans contain a Koala Revegetation, which outline the location and species of additional plantings, and support the finalisation of the Connectivity Strategy. These documents are being prepared by specialist consultants to ensure their applicability and relationship to the Ballina Koala Plan. It is acknowledged that some of the connectivity structures are specifically located to take advantage of plantings in the future. The Ballina Koala Plan, Koala Management Plan and associated documents are available through the project website. The project team acknowledges the interest and the need for ongoing consultation with stakeholders and landowners to foster understanding and best management of the koala during the construction process.</p> <p>Landscaping including vegetation screening has been included in the draft Urban Design and Landscape Plan, noting that earth mounds may be utilised as part of the construction process where it meets Environmental Protection Authority requirements.</p>	1, 2 and 3.
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Noise and acoustic assessment	Noise - assessment and monitoring	Noise assessments have been carried out as part of the EIS and impacted properties have been identified. In line with the EIS, the upgrade design has not incorporated noise walls. However, the project team can confirm that the detailed design process has included additional acoustic assessment for proposed changes identified during the design refinement process. This additional assessment aims to ensure that any changes in noise impacts are mitigated in accordance with Roads and Maritime Services guidelines.	2 and 5
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Koala management	Management of species, habitat and connectivity as part of the upgrade	<p>The project team acknowledges the relationships that have been established with Friends of the Koala Inc, adjacent landowners and other key stakeholders along the project alignment, and its commitment to continue to engage with interested stakeholder groups and project neighbours relating to koala management as part of the project's delivery.</p> <p>The Ballina Koala Plan (which included a detailed population viability analysis) and the subsequent Koala Management Plan was approved in August 2016, as part of the project's Conditions of Approval. This approval was received during the proposal's public display period. The approved plans contain a Koala Revegetation Strategy and Koala Habitat Planting Strategy, which outline the location and species of additional plantings, and support the finalisation of the Connectivity Strategy. These documents are being prepared by specialist consultants to ensure their applicability and relationship to the Ballina Koala Plan. It is acknowledged that some of the connectivity structures are specifically located to take advantage of plantings in the future. The Ballina Koala Plan, Koala Management Plan and associated documents are available through the project website.</p> <p>The details of the number and locations of connectivity structures are outlined in the approved Threatened Species Management Plans for the project. They are included in the approved Koala Management Plan and the Ballina Koala Plan.</p> <p>In terms of the proposed koala habitat tree planting, documents developed by Corkery Consulting outline the plan for land owned by Roads and Maritime Services and exclude a series of identified residential development lots.</p> <p>The Connectivity Strategy will detail the approach to connectivity structures and fauna fencing, utilising the baseline ecological survey information and investigations conducted as part of the Koala Management Plan. The issue of connectivity was addressed by Niche Environment & Heritage, who prepared the Koala Habitat Planting Strategy on behalf of Roads and Maritime Services. The location of fauna fencing is reflected in the urban design and landscape plan, and the project team will consult affected landowners before fences are installed.</p> <p>The project team acknowledges the interest and the need for ongoing consultation with stakeholders and landowners to foster understanding and best management of the koala</p>	3 and 6
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Visual amenity	Change to visual amenity	<p>The project team acknowledge the upgrade will result in a change in landscape, particularly in areas where the new highway is built away from the current highway alignment. The environmental impact statement (EIS) assessed a number of visual precincts along the new highway alignment. It should be noted that the project team has clarified these assessments in specific reference to the submissions received.</p> <p>As detailed in the EIS, these areas have been assessed as appropriate for the project. With regards to submissions from the northern sections of the project, there significant amounts of plantings occurring both within the corridor and on adjacent Roads and Maritime Services land. These include additional Koala Food Tree plantings. The project team have assessed distances of households from the new road, the topography and the additional land to provide mitigation against direct visual impacts.</p> <p>Landscaping including vegetation screening has been included in the draft Urban Design and Landscape Plan for each section of the upgrade. Native plant and tree species (local to this area) have been selected for use in landscaping along the project alignment, with the project team also seeking to support landscape regeneration of the existing seedbank in topsoil in suitable locations.</p>	6
Community and stakeholder consultation approach	<p>Timeframe for responses to the proposals</p> <p>Providing ongoing opportunities for community participation</p>	<p>Public display of the urban design and landscape plans was 1-19 August 2016.</p> <p>The public display period was extended to 5.00 pm, Monday 29 August 2016 in response to community feedback.</p> <p>This extension was communicated through three media releases, more than 1000 SMS and email updates to the project's stakeholder distribution list.</p> <p>The project team acknowledges the level of interest that community members and organisations have in the development and delivery of the Woolgoolga to Ballina upgrade.</p> <p>Community members, stakeholder groups and organisations are encouraged to contact the project team by phone or email to be included on the project stakeholder distribution list.</p>	3


4. Next steps

In response to community feedback changes to the urban design and landscape plans include additional plantings within the corridor to assist with visual screening.

The revised urban design and landscape plans and supporting documentation will now be submitted to the NSW Department of Planning and Environment for consideration and approval.

 rms.nsw.gov.au/W2B

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 Customer feedback
Roads and Maritime
Locked Bag 928,
North Sydney NSW 2059

February 2017
RMS XX.XXX
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APPENDIX E STAKEHOLDER COMMENTS



AGENCY DESIGN REVIEW			
Document title:		D-84-LX-01 Richmond River to Ballina August 2016	Document no. GEC-W2B-SNM-GEC-000057-W2B-SMC-D-LX-UDL-00001 SDD UDLP
Designer/originator:			Lot No.
Agency		DPI, EPA, Richmond Valley Council	
Reviewer comment summary and close-out (insert additional rows as required)			
Agency	Reference/item	Reviewer comment (refer attached sheets where applicable)	Designer/originator response
NSW DPI Fisheries		NSW DPI Fisheries had no comment on this design package	
EPA		The EPA notes that the fencing specifications are under review and will be finalised for IFC. The EPA supports fauna fencing being placed as close to the pavement as possible.	EPA comments on fencing principles noted.
EPA		The EPA Biodiversity team are particularly concerned about details of the proposed fauna path treatments and Riparian revegetation. We would like to see these details captured in construction drawings or in an early (UDLP) attachment that can be issued with the design drawings to enable progressive riparian revegetation from as early a stage in construction as possible.	The support for early establishment and rehabilitation of creek zones is noted. RMS is committed to install the landscape treatments as outlined in the UDLP. Where reasonable and feasible the establishment of creeks zones treatments will be early in the construction process. This is subject to the construction program and future works at those locations potentially impacting on rehabilitated works.
EPA		In both Riparian revegetation and fauna path treatment the EPA supports the use of soil/jute mat/plantings and the use of woody debris where possible and appropriate.	EPA support for the soft scour treatments and use of woody debris is noted.
Ballina Shire Council		No formal response was received from Ballina Shire Council	
Record of task completion and agreement of comments			
Designer/originator – The above verification comments have been addressed and incorporated or responded to as appropriate.			
Designer/originator			
Signature:			
Date:			

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APPENDIX F PLANTING AND SEEDING SCHEDULES

PLANTING MIXES

All plant and seed tables are subject to further development, including confirmation that seeds/ material are commercial available.

MIX TYPE	COMMUNITY / ASSOCIATION	DOMINANT CANOPY SPECIES	OTHER CANOPY SPECIES	DOMINANT SHRUB SPECIES	GROUNDCOVER SPEICES
01	Swamp Forest				
Composed of:	Swamp Mahogany Swamp Forest of the Coastal Lowlands	<i>Banksia aemula</i>	<i>Banksia aemula</i>	<i>Acmena smithii</i>	<i>Blechnum indicum</i>
		<i>Banksia ericifolia</i>	<i>Elaeocarpus reticulatus</i>	<i>Alphitonia excelsa</i>	<i>Cyperus polystachyos</i>
		<i>Callistemon salignus</i>	<i>Eucalyptus pilularis</i>	<i>Callistemon pachyphyllus</i>	<i>Gahnia sieberiana</i>
	Paperbark Swamp Forest	<i>Casuarina glauca</i>	<i>Lophostemon suaveolens</i>	<i>Leptospermum trinervium</i>	<i>Imperata cylindrica</i>
		<i>Eleocarpus reticulatus</i>		<i>Ottochloa gracillima</i>	<i>Juncus usitatus</i>
		<i>Eucalyptus microcorys</i>		<i>Solanum mauritianum</i>	<i>Lomandra longifolia</i>
		<i>Eucalyptus pilularis</i>		<i>Solanum nigrum</i>	<i>Pteridium esculentum</i>
		<i>Eucalyptus robusta</i>			<i>Viola hederacea</i>
		<i>Eucalyptus tereticornis</i>			
		<i>Melaleuca linariifolia</i>			
		<i>Melaleuca quinquenervia</i>			
		<i>Melaleuca sieberi</i>			
		<i>Melaleuca styphelioides</i>			

MIX TYPE	COMMUNITY / ASSOCIATION	DOMINANT CANOPY SPECIES	OTHER CANOPY SPECIES	DOMINANT SHRUB SPECIES	GROUNDCOVER SPEICES
02	Dry Forest				
Composed of:	-Banksia-Callitris Dry Heathy Woodlands and Heaths	<i>Acacia</i> spp.	<i>Allocasuarina littoralis</i>	<i>Acacia concurrens</i>	<i>Acacia ulicifolia</i>
		<i>Banksia aemula</i>	<i>Angophora floribunda</i>	<i>Acacia maidenii</i>	<i>Aristida vagans</i>
	-Scribbly Gum - Needlebark Stringbark Heathy Open Forest	<i>Banksia ericifolia</i>	<i>Angophora woodsiana</i>	<i>Acacia melanoxyton</i>	<i>Baloskion tetraphyllum</i>
		<i>Callitris columellaris</i>	<i>Corymbia gummifera</i>	<i>Acacia suaveolens</i>	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>
		<i>Corymbia gummifera</i>	<i>Corymbia intermedia</i>	<i>Acacia ulicifolia</i>	<i>Cymbopogon refractus</i>
	-Blackbutt - Pink Bloodwood Shrubby Open Forest	<i>Corymbia henryi</i>	<i>Eucalyptus baileyana</i>	<i>Allocasuarina littoralis</i>	<i>Desmodium rhytidophyllum</i>
		<i>Corymbia variegata</i>	<i>Eucalyptus eugenioides</i>	<i>Allocasuarina torulosa</i>	<i>Dianella caerulea</i>
		<i>Eucalyptus moluccana</i>	<i>Eucalyptus fibrosa</i>	<i>Alphitonia excelsa</i>	<i>Dichondra repens</i>
		<i>Eucalyptus pilularis</i>	<i>Eucalyptus pilularis</i>	<i>Banksia oblongifolia</i>	<i>Entolasia stricta</i>
		<i>Eucalyptus propinqua</i>	<i>Eucalyptus resinifera</i>	<i>Banksia</i> spp.	<i>Eragrostis brownii</i>
		<i>Eucalyptus siderophloia</i>	<i>Eucalyptus signata</i>	<i>Banksia spinulosa</i> var. <i>collina</i>	<i>Eustrephus latifolius</i>
		<i>Eucalyptus signata</i>	<i>Eucalyptus tereticornis</i>	<i>Breynia oblongifolia</i>	<i>Glycine clandestina</i>
			<i>Eucalyptus umbra</i>	<i>Callistemon salignus</i>	<i>Goodenia hederacea</i>
			<i>Lophostemon confertus</i>	<i>Gompholobium pinnatum</i>	<i>Hardenbergia violacea</i>
			<i>Lophostemon suaveolens</i>	<i>Jacksonia scoparia</i>	<i>Hibbertia scandens</i>
			<i>Syncarpia glomulifera</i>	<i>Lambertia formosa</i>	<i>Hibbertia vestita</i>
				<i>Leptospermum juniperinum</i>	<i>Homoranthus virgatus</i>
				<i>Leptospermum polygalifolium</i>	<i>Homoranthus virgatus</i>
				<i>Leptospermum</i> spp.	<i>Imperata cylindrica</i> var. <i>major</i>
				<i>Leptospermum trinervium</i>	<i>Jasminum suavissimum</i>
				<i>Leucopogon lanceolatus</i>	<i>Lepidospermum laterale</i>
				<i>Lomatia silaifolia</i>	<i>Lomandra longifolia</i>
				<i>Melaleuca nodosa</i>	<i>Lomandra multiflora</i>
				<i>Melaleuca sieberi</i>	<i>Melaleuca nodosa</i>
				<i>Persoonia stradbokensis</i>	<i>Oplismenus aemulus</i>
				<i>Persoonia tenuifolia</i>	<i>Panicum simile</i>
				<i>Phyllanthus hirtellus</i>	<i>Pratia purpurascens</i>
				<i>Pimelea linifolia</i>	<i>Pteridium esculentum</i>
				<i>Pultenaea</i> spp.	<i>Themeda australis</i>
				<i>Trochocarpa laurina</i>	<i>Vernonia cinerea</i>
				<i>Xanthorrhoea latifolia</i>	

MIX TYPE	COMMUNITY / ASSOCIATION	DOMINANT CANOPY SPECIES	OTHER CANOPY SPECIES	DOMINANT SHRUB SPECIES	GROUNDCOVER SPEICES
03	Wet Schelrophyll Forest				
3A	Blackbutt Grassy Open Forest	<i>Eucalyptus grandis</i>	<i>Angophora woodsiana</i>	<i>Acacia</i> spp.	<i>Adiantum hispidulum</i>
		<i>Eucalyptus microcorys</i>	<i>Corymbia intermedia</i>	<i>Acmena smithii</i>	<i>Blechnum cartilagineum</i>
3B	Narrow-leaved Red Gum Woodlands	<i>Eucalyptus pilularis</i>	<i>Eucalyptus acmenoides</i>	<i>Allocasuarina littoralis</i>	<i>Cissus antactica</i>
		<i>Eucalyptus resinifera</i> subsp. <i>hemilampra</i>	<i>Eucalyptus pianchoniana</i>	<i>Allocasuarina torulosa</i>	<i>Cissus hypoglauca</i>
		<i>Eucalyptus resinifera</i> subsp. <i>resinifera</i>	<i>Eucalyptus propinqua</i>	<i>Archontophoenix cunninghamiana</i>	<i>Dianella caerulea</i>
		<i>Livistonia australis</i>	<i>Eucalyptus siderophloia</i>	<i>Banksia oblongifolia</i>	<i>Dichondra repens</i>
		<i>Lophostemon confertus</i>	<i>Syncarpia glomulifera</i>	<i>Breynia oblongifolia</i>	<i>Entolasia stricta</i>
		<i>Lophostemon suavolens</i>		<i>Cordyline stricta</i>	<i>Geitonoplesium cymosum</i>
		<i>Melaleuca quinquinervia</i>		<i>Cryptocarya microneura</i>	<i>Hardenbergia violacea</i>
				<i>Cryptocarya rigida</i>	<i>Hibbertia scandens</i>
				<i>Dioscorea transversa</i>	<i>Imperata cylindrica</i> var. <i>major</i>
				<i>Elaeocarpus reticulatus</i>	<i>Ischaemum australe</i>
				<i>Endiandra sieberi</i>	<i>Lepyrodia scariosa</i>
				<i>Glochidion sumatranum</i>	<i>Lomandra longifolia</i>
				<i>Guioa semiglauca</i>	<i>Morinda jasminoides</i>
				<i>Jagera pseudorhus</i>	<i>Pratia purpurascens</i>
				<i>Leptospermum polygalifolium</i>	<i>Ptilothrix deusta</i>
				<i>Melaleuca sieberi</i>	<i>Smilax australis</i>
				<i>Melicope elleryana</i>	<i>Smilax glyciophylla</i>
				<i>Persoonia stradbrokensis</i>	<i>Themeda australis</i>
				<i>Pultenaea</i> spp.	
				<i>Synoum glandulosum</i>	
				<i>Syzigium oleosum</i>	
				<i>Trochocarpa laurina</i>	
				<i>Wilkiea huegeliana</i>	

MIX TYPE	COMMUNITY / ASSOCIATION	DOMINANT CANOPY SPECIES	OTHER CANOPY SPECIES	DOMINANT SHRUB SPECIES	GROUNDCOVER SPEICES
04	Lowland Rainforest				
	-White Booyang - Fig Subtropical Rainforest	<i>Backhousia myrtifolia</i>	<i>Archontophoenix cunninghamina</i>	<i>Acacia maidenii</i>	<i>Adiantum formosum</i>
		<i>Dendrocnide excelsa</i>	<i>Castanospermum australe</i>	<i>Acacia melanoxylon</i>	<i>Calochlaena dubia</i>
	-Tuckeroo - Riberry - Yellow Tulipwood Littoral Rainforest	<i>Euphomatia laurina</i>	<i>Cryptocarya obovata</i>	<i>Acacia suaveolens</i>	<i>Cordyline stricta</i>
		<i>Ficus macrophylla</i>		<i>Alphitonia excelsa</i>	<i>Elatostema reticulatum</i>
		<i>Ficus coronata</i>	<i>Daphnandra micrantha</i>	<i>Cordyline petiolaris</i>	<i>Geitonoplesium cymosum</i>
		<i>Ficus watkinsiana</i>	<i>Dendrocnide excelsa</i>	<i>Cyathea leichhardtiana</i>	<i>Helmholtzia glaberrima</i>
		<i>Flindersia bennettiana</i>	<i>Dysoxylum fraserianum</i>	<i>Harpullia alata</i>	<i>Hibbertia aspera</i>
		<i>Flindersia schottiana</i>	<i>Dysoxylum muelleri</i>	<i>Linospadix monostachya</i>	<i>Hibbertia scandens</i>
		<i>Glochidion sumatranum</i>	<i>Endiandra pubens</i>	<i>Neolitsea dealbata</i>	<i>Lastreopsis spp.</i>
		<i>Guioa semiglauca</i>	<i>Flindersia schottiana</i>	<i>Wilkiea austro-queenslandica</i>	<i>Oplismenus aemulus</i>
		<i>Heritiera trifoliolatum</i>	<i>Sloanea australis</i>		<i>Pteris umbrosa</i>
		<i>Lophostemon confertus</i>	<i>Toona australis</i>		
		<i>Syzygium smithii</i>			
		<i>Tristaniopsis laurina</i>			
05	Grassland				
					<i>Austrodanthonia richardsonii</i> var. <i>Hume</i>
					<i>Imperata cylindrica</i>

SEED MIXES

Seed Mix - WSF_F_1.0 WET SCHLEROPHYLL FOREST
SHRUBS
<i>Acacia disparrima</i> subsp. <i>Disparrima</i>
<i>Acacia ulicifolia</i>
<i>Breynia oblongifolia</i>
<i>Dodonaea triquetra</i>
<i>Hovea acutifolia</i>
<i>Indigofera australis</i>
<i>Leptospermum polygalifolium</i> subsp. <i>cismontanum</i>
<i>Leucopogon lanceolatus</i>
<i>Ozothamnus diosmifolius</i>
<i>Pultenaea retusa</i>
GROUNDCOVERS
<i>Carex appressa</i>
<i>Dianella caerulea</i>
<i>Dichanthium sericeum</i>
<i>Dichelachne micrantha</i>
<i>Hardenbergia violacea</i>
<i>Imperata cylindrica</i>
<i>Kennedia rubicunda</i>
<i>Lomandra longifolia</i>
<i>Microlaena stipoides</i>
<i>Parsonsia straminea</i>
<i>Themeda triandra</i>

Seed Mix - DSF_F_2.0 DRY FOREST
SHRUBS
<i>Acacia complanata</i>
<i>Acacia concurrens</i>
<i>Acacia falcata</i>
<i>Acacia myrtifolia</i>
<i>Acacia suaveolens</i>
<i>Acacia terminalis</i> subsp. <i>Long inflorescences</i>
<i>Acacia ulcifolia</i>
<i>Banksia oblongifolia</i>
<i>Banksia spinulosa</i> var <i>collina</i>
<i>Daviesia ulicifolia</i>
<i>Daviesia umbellulata</i>
<i>Dodonaea viscosa</i>
<i>Gompholobium virgatum</i>
<i>Leptospermum polygalifolium</i> subsp. <i>cismontanum</i>
<i>Pultenaea retusa</i>
<i>Pultenaea spinosa</i>
<i>Pultenaea villosa</i>
GROUNDCOVERS
<i>Cymbopogon refractus</i>
<i>Dichanthium sericeum</i>
<i>Dichelachne micrantha</i>
<i>Gahnia aspera</i>
<i>Imperata cylindrica</i>
<i>Lomandra longifolia</i>
<i>Themada triandra</i>

Seed Mix - FW_F_3.0 FORESTED WETLAND
SHRUBS
<i>Acacia leiocalyx</i> subsp. <i>Leiocalyx</i>
<i>Callistemon citrinus</i>
<i>Callistemon pachyphyllus</i>
<i>Leptospermum juniperinum</i>
<i>Leptospermum polygalifolium</i> subsp. <i>cismontanum</i>
<i>Melaleuca nodosa</i>
<i>Melaleuca sieberi</i>
<i>Melaleuca thymifolia</i>
<i>Oxylobium robustum</i>
<i>Pultenaea retusa</i>
<i>Pultenaea villosa</i>
GROUNDCOVERS
<i>Carex appressa</i>
<i>Cynodon dactylon</i>
<i>Cyperus polystachyos</i>
<i>Gahnia sieberiana</i>
<i>Hardenbergia violacea</i>
<i>Juncus usitatus</i>
<i>Kennedia rubicunda</i>
<i>Lomandra longifolia</i>
<i>Microlaena stipoides</i>
<i>Parsonsia straminea</i>
<i>Schoenoplectiella mucronata</i>

SEED MIXES

Seed Mix - FM_6.0 NATIVE GRASS
<i>Austrodanthonia fulva</i>
<i>Capillipedium spicigerum</i>
<i>Chloris truncata</i>
<i>Cymbopogon refractus</i>
<i>Cynodon dactylon</i>
<i>Dichanthium sericeum</i>
<i>Dichelachne micrantha</i>
<i>Imperata cylindrica</i>
<i>Lomandra longifolia</i>
<i>Microlaena stipoides</i>
<i>Themeda triandra</i>

Seed Mix - FM_6.1 PASTURE/ EXOTIC GRASSLAND
<i>Axonopus tissifolius (for wetter area)</i>
Coolabah oats
<i>Cymbopogon refractus</i>
<i>Cynodon dactylon</i>
Eclipse rye
Secate cereate “sterile”
<i>Trifolium pratense</i>

Seed Mix - FM_6.2 SWALE/SEDGE MIX
<i>Baumea rubiginosa</i>
<i>Bolboschoenus caldwellii</i>
<i>Bolboschoenus fluviatilis</i>
<i>Carex appressa</i>
<i>Ficinia nodosa</i>
<i>Gahnia sieberiana</i>
<i>Juncus usitatus</i>
<i>Philydrum lanuginosum</i>
<i>Schoenoplectiella mucronata</i>
<i>Schoenoplectus validus</i>

APPENDIX G LANDSCAPE MANAGEMENT PLAN

Woolgoolga to Ballina Pacific Hwy. Upgrade - Landscape Management Plan

1. Introduction

A key component of the Pacific Highway upgrade between Woolgoolga and Ballina is the creation of a high quality, robust and sustainable landscape that is integrated with the different landscape types that the highway corridor passes through. The required landscape outcomes that described in the Project EIS include:

- Retain the strong contrasting experience of driving through forest and open agricultural land as a feature of the Pacific Highway experience
- Acknowledge and celebrate the small and medium sized coastal towns that mark progress along the coastal Pacific Highway journey
- Highlight and celebrate the numerous minor and major creek and river crossings that punctuate the Pacific Highway journey across the coastal floodplains
- Acknowledge and preserve the natural and cultural landscapes and landmarks identified along the full length of the Pacific Highway journey.

The Conditions of Consent issued for the Project also include a number of conditions that relate specifically to achieving the landscape outcomes, which include:

UD3 Landscaping and planting strategy

The project will be carried out in accordance with the urban design and landscaping strategy, as identified in Section 11.4.1 of this EIS.

Detailed landscape design for all project batters and median planting areas will be developed in accordance with the Landscape Guidelines (RTA, 2008), the requirements of the Working Paper – Biodiversity (Section 5.2.2) and the landscape strategy to provide a robust, successful and effective planting design.

UD13 Monitoring of landscaping and rehabilitation

Landscape and rehabilitation works will be monitored and remedial measures implemented where required until vegetation has stabilised.

The Urban & Landscape Design Plan Report to which this LMP forms an appendix describes how the landscape design responds to the conditions of consent and the required landscape outcomes.

The landscape works to be carried out as part of the Woolgoolga to Ballina Upgrade will take decades to fully develop as the new vegetation is established and matures. Consequently the landscape will need to be managed throughout the establishment period as well as over the longer term in order to ensure the project objectives are achieved.

This Landscape Management Plan (LMP) sets out how the highway corridor is to be managed in order to promote the cost effective and consistent management of roadside landscape vegetation established by the Pacific Highway upgrade. The primary approach is to encourage the establishment of local native plant species and focus on the more dominant and important species within the project.

The program of landscape management set out in this LMP aims to maximise the performance and appearance of the upgrade works, particularly at interchanges, overbridges, underpasses and rest areas.

Woolgoolga to Ballina Pacific Hwy. Upgrade - Landscape Management Plan

The LMP covers the period from construction completion, which includes the initial landscape management by Pacific Complete, and long term landscape management after responsibility is transferred to RMS, Councils and other organisations for various components of the landscape works.

This LMP is to be read in conjunction with the *Vegetation Management Clearing and Grubbing and Weed Management Plan*, which forms part of the *Construction Environmental Management Plan (CEMP)* for the Woolgoolga to Ballina section of the Pacific Highway upgrade.

2. Landscape Maintenance

Details of landscape maintenance works are contained in an Appendix to Specifications R178 - Vegetation and R179 - Landscape Planting for the project. In general maintenance activities are to focus on the roadside, in the medians, along fences, footpaths, cycleways and at intersections, where visual and safety issues for both vehicle, cycle and pedestrian movement need to be constantly addressed.

Landscape management will take account of the different treatments used to implement the landscape works, which include:

- Revegetation by application of site specific seed mixes
- Planting
- Respreading recovered bushland topsoil

In addition, landscape management must respond to different requirements resulting from the different treatments applied to:

- Cut batters
- Fill embankments
- Basins
- Fauna crossings

Maintenance activities include:

- Management and removal of non-frangible vegetation (trees within safety zones)
- Pruning of vegetation for safety (sight lines, overhanging branches, clearance to fencing etc)
- Control of weeds
- Rubbish removal
- Pests and diseases control
- Watering during establishment
- Replacement planting and /or reseeding due to failure.

Thinning operations will be carried out where necessary to reduce the density of vegetation or restore the required balance of plant species in particular areas of revegetation.

In addition to the landscape management requirements contained in the LMP, which apply to whole of the Woolgoolga to Ballina Upgrade project, a number of landscape situations within the highway corridor have particular maintenance requirements to achieve special visual, ecological or heritage performance outcomes; these are dealt with in the appendices to the R178 and R179 Specifications for each portion of the upgrade project.

Woolgoolga to Ballina Pacific Hwy. Upgrade - Landscape Management Plan

3. Threatened Species Management Plans

A series of Threatened Species Management Plans that address specific fauna species or fauna categories have been prepared for the project as required by the Conditions of Consent. These Plans include requirements for monitoring the habitat restoration performance.

In situations where the monitoring identifies the need for remediation activities they are to be coordinated with landscape management being carried out in accordance with this LMP in order to avoid any detrimental impacts on fauna or their habitat.

4. Weed Management

Noxious weeds as required to be removed in accordance with the *Noxious Weeds Act 1993*. Weeds are declared noxious under Section 7 -Weed Control Orders of the *Noxious Weeds Act 1993 no. 11*. Lists of noxious weeds for local government areas are generated from Orders published in the NSW Government Gazette.

Environmental weeds that compete with and suppress growth of vegetation established by the landscape works are to be removed without damaging other plants.

5. Vegetation Pests & Disease

Regular inspections of the landscape works are to include identification of any outbreaks of pests or disease. Where necessary samples are to be collected and sent for testing to confirm the pest species or type of disease. A program of control based on recommendations of the testing organisation is to be implemented and monitored to confirm effective control has been achieved.

6. Soil Conditions

Unsatisfactory vegetation growth and plant death may result from poor soil conditions that may include nutrient deficiencies or physical condition of the soil. Testing of soil and plant material will be required to determine the cause of the problem and identify appropriate remediation measures to be implemented.

In some situations plant die back may result from the spread of root pathogens such as *Phytophthora cinnamomi*. If testing confirms the presence of this pathogen then a Threat Management Plan is to be prepared to protect threatened species and ecological communities listed under the EPBC Act and other vegetation communities associated with the highway corridor landscape.

The Plan will include:

- strategies to prevent the pathogen from spreading into areas that are not infected
- strategies to reduce the impacts in infested areas
- recovery actions for the conservation of biodiversity assets currently being affected.

The management activities will be monitored to confirm that effective control has been achieved.

Woolgoolga to Ballina Pacific Hwy. Upgrade - Landscape Management Plan

7. Bushfire Management

Bushfire management within the highway corridor is to be coordinated with the relevant Rural Fire Services Brigade. Access tracks used by fire fighting vehicles will be maintained to ensure they are trafficable at all times. Where necessary the level of fuel will be reduced in collaboration with the RFS.

8. Flood Damage

Landscape works may be subject to damage by flooding, particularly scouring within the riparian zone as well as on cut slopes and fill embankments. Landscape management will include a procedure for inspections following flooding to identify areas of landscape damage. Particular attention is to be given to riparian zones and fauna underpasses as well as drains and basins.

Remediation works are to be carried out immediately in order to avoid further damage and to restore the ecological function of the area. Planning and implementation of the remediation works will aim to ensure the landscape outcomes are in accordance with the relevant Conditions of Consent and as described in the UDLP Report.

9. Slope Failure

In situations where vegetated slopes fail and surface soil and vegetation are damaged, the remediation works are to include revegetation with the same species mix as applied in the initial landscape works. Details of the slope treatment, including subsoil preparation, top soil depths, surface treatment and drainage are to be reviewed and modified if necessary to avoid the risk of future slope failure.

10. Climate Change

Climatic conditions are expected to change over the establishment period and throughout the subsequent decades over which the landscape matures.

The combination of changing rainfall patterns and temperature regimes together with changes in storm event frequency and severity are expected to have significant implications for the suitability of some plant species and vegetation communities within the Woolgoolga to Ballina highway corridor. The implications of climate change for the health and viability of vegetation communities and their habitat function will need to be monitored and reviewed with the involvement of a qualified ecologist who has relevant expertise in this field.

Severe drought conditions have the potential to result in a substantial number of plant deaths, particularly during the establishment period. A comprehensive assessment is to be carried out during periods of severe drought to identify dead or dying vegetation. If it is apparent that a particular species has suffered significantly higher death rates than the option of replacing the species is to be discussed with an ecologist to ensure there will be no significant impact on habitat values of site. Revegetation will generally be carried out with the same mix of species as the original landscape works.

Woolgoolga to Ballina Pacific Hwy. Upgrade - Landscape Management Plan

11. Monitoring

Monitoring procedures will be adopted to assess if the revegetation has achieved an acceptable standard as measured against defined benchmarks. Areas of landscape that have failed will be clearly identified and the nature of the failure documented.

Based on the results of the monitoring program appropriate remedial action will be determined and implemented until vegetation has stabilised and the required standard of landscape standard is achieved.

Details of the monitoring program are presented in the Landscape Maintenance Plan that forms an Appendix to the Pacific Complete Specifications R178 - Vegetation and R179 - Landscape Planting for each Portion of the Woolgoolga to Ballina section of the Pacific Highway Upgrade.

Monitoring of the landscape works will commence from the time of installation and extend until maintenance responsibilities for various portions of the project are handed over to RMS or Councils.

Monitoring will be carried out in two phases:

- Initial maintenance period – monitoring to assess the trajectory of the outcomes after approval of the work until practical completion; the purpose is to enable timely intervention or corrective actions if required to ensure vegetation growth.
- Post-completion and pre-handover period – monitoring will continue for a period of three years from practical completion; the purpose is to ensure that each landscape area has reached a condition that indicates a high probability that the intended mature outcome will be achieved in the longer term and the area is in a condition to be handed over to RMS or to a the relevant Council, even if the landscape is semi-mature.

The monitoring program will include:

- Monthly audit using Score Card Method
- Quarterly (3 monthly) assessments using a Landscape Functional Analysis process involving a series of transects
- Annual reporting on the monitoring program outcomes together with recommendations for any required actions.

Monitoring will be carried out by an Assessment Group at pre-determined locations. The timing of the assessments will take account of the period since completion of the works and the landscape type. It is expected that some areas will need longer monitoring periods due to the vegetation type and method of establishment.

12. Landscape Management Responsibilities

Pacific Complete will be responsible for the initial management period that will extend for three years after completion of the highway upgrade works. At the end of the initial management period responsibility for various components of the project will be transferred to following organisations:

RMS

Woolgoolga to Ballina Pacific Hwy. Upgrade - Landscape Management Plan

- Main alignment corridor including medians
- Water quality basins

Local Council

- Local roads and roundabouts
- Rest areas and public areas

Services providers

- Corridors and easements for access to power, water and communications infrastructure that may have vegetation clearance requirements will be coordinated with landscape management along the highway corridor.

13. Landscape Management Staff

A landscape management team will be established and led by a suitably experienced manager. All members of the team will be required to have the necessary knowledge and skills to effectively carry out the various landscape management tasks for which they are responsible.

Training will be carried out where necessary to ensure all members of the landscape management team have a clear understanding of the intended outcome of the landscape revegetation program. In addition, all field staff will receive training as necessary to ensure they can recognise weed species as well as native species that form part of the revegetation program.

The landscape management team will seek advice from a revegetation specialist as necessary to address specific issues. The landscape management team will also obtain advice from suitably qualified ecologists who will provide specific advice on the coordination of landscape management activities with the various Threatened Species Management Plans applicable to the Woolgoolga to Ballina section of the Pacific Highway Upgrade.

14. Built Elements Maintenance

Policy regarding maintenance of built elements (bridges, retaining walls and such elements) is provided by the RMS Infrastructure Maintenance Program. Information about the Policy is available on-line at:

<http://www.rms.nsw.gov.au/projects/key-build-program/maintenance/index.html>

Maintenance of built elements that are specific to the Woolgoolga to Ballina section of the Pacific Highway Upgrade is dealt with in the Maintenance Access Strategy for each Section of the project and is monitored by RMS.

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APPENDIX H WEED SPECIES LIST

WEED SPECIES

SCIENTIFIC NAME	COMMON NAME	NATIONAL SIGNIFICANCE	NOXIOUS WEEDS BALLINA
<i>Asparagus aethiopicus</i>	Asparagus Fern	x	4
<i>Asparagus plumosus</i>	Climbing Asparagus Fern	x	4
<i>Ageratina adenophora</i>	Crofton Weed		4
<i>Ageratina riparia</i>	Mistflower		4
<i>Ambrosia artemisiifolia</i>	Annual Ragweed		5
<i>Baccharis halimifolia</i>	Groundsel Bush		3
<i>Chrysanthemoides monilifera subsp. rotundata</i>	Bitou Bush	x	4
<i>Senecio sp.</i>	Fireweed		4
<i>Senecio madagascariensis</i>	Fireweed	x	4
<i>Bryophyllum pinnatum</i>	Live Plant		4
<i>Cinnamomum camphora</i>	Camphor Laurel		4
<i>Ligustrum lucidum</i>	Large-leaf Privet		4
<i>Ligustrum sinense</i>	Small-leaf Privet		4
<i>Salvinia molesta</i>	Salvinia	x	3
<i>Lantana camara</i>	Lantana	x	4

- Noxious Weed Class Requirements
- 3. Reduce the area and the impact of those plants in parts of NSW
 - 4. Minimise the negative of those plants on the economy, community or environment of NSW
 - 5. Prevent the introduction of those plants within NSW or from NSW to another jurisdiction

SECTION	CHAINAGE REFERENCE	DESIGN CHAINAGE	NAME	STRUCTURE NUMBER	LENGTH (M)	WIDTH (M)	HEIGHT (M)	FUNCTIONALITY	FAUNA STRUCTURE TYPE	COMMENTS
10	146000		Back channel road / Richmond River Bridge northern abutment				4.0	COMBINED	Minimum clearance	Removed
10	146280	146252	Unknown		29.28	3.0	3.0	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 29.28m.
10	146390	146361	Unknown		32.94	3.0	3.0	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 32.94m
10	146630	146604	Unknown	D50	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Chainage adjustment
10	146980	146840	Unknown	D51	15 (along mainline)		2.4	DEDICATED	Bridge with fauna furniture beneath	Koala Structure, Location moved to align better with existing koala habitat (refer RFI response from PC 3-Feb-16)
10	147100	147072	Unknown		35.38	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased length from 40 m to 35.38 m, Chainage adjustment
10	147600	147600	Unknown					GLIDER CROSSING	Rope Bridge	The Glider MP Version 2.1, required a rope bridge where the landbridge was located at SPIR chainage 147600. Final position to be as close to the previous overbridge as possible. The bridge is in a large cutting which may make it difficult to span
10	148620	148592	Unknown		37.82	3.0	3.0	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 37.82m, 5 cell culvert., Chainage adjustment
10	149250	149218	Bingal Creek	D04	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath Minimum clearance 2.4 m	Koala Structure, Decreased in length from 50m to 37.82m., 5 cell culvert., Chainage adjustment
10	150080	150035	Unknown	D52	20 (along mainline)		2.4	COMBINED	Bridge with fauna furniture beneath Minimum clearance 2.4 m	Koala Structure, Chainage adjustment
10	150580	150549	Unknown		39.04	2.4	2.4	COMBINED	Culvert with fauna furniture	Koala Structure Decreased in length from 50m to 39.04m Chainage adjustment
10	150630	150603	Unknown	D53	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Previously a dedicated structure, Chainage adjustment
10	151220	151196	Unknown		37.82	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Chainage adjustment, Length decreased from 40 m to 37.82 m
10	151825	151795	Wardell Viaduct 6	D05	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath Minimum clearance 2.4 m	Koala Structure, Previously a dedicated structure , Chainage adjustment
10	152050	152050	Unknown		36.6	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Now a dedicated crossing
10	152750 Wardell Rd (CH466)	152750/CH450 (On Wardell Road west not on Mainline)	Unknown		19.52	2.4	2.4	DEDICATED	Culvert with fauna furniture	Now off Mainline on Wardell Road west to achieve sufficient cover (refer RFI response 3-Feb16). Length has decreased from 40 m to 19.52m., Koala Structure
10	152970 Wardell Rd (CH150)	152940/CH140 (On Wardell Road west not on Mainline)	Unknown		19.52	2.4	2.4	DEDICATED	Culvert with fauna furniture	On Wardell Road, Koala Structure, Decreased in length from 40m to 19.52m, Chainage adjustment
10	153090	153058	Unknown		36.6	3.0	3.0	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 36.6m, Two structures
10	153620	153591	Unknown		48.8	3.0	3.0	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 48.8m, Chainage adjustment, Four structures

APPENDIX I FAUNA CONNECTIVITY SCHEDULE

SECTION	CHAINAGE REFERENCE	DESIGN CHAINAGE	NAME	STRUCTURE NUMBER	LENGTH (M)	WIDTH (M)	HEIGHT (M)	FUNCTIONALITY	FAUNA STRUCTURE TYPE	COMMENTS
10	153900	153882	Unknown	D55	15 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Previously a dedicated structure
10	154030	154041	Unknown	D56	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Chainage adjustment
10	154770	154738	Unknown		36.6	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased in length from 40m to 36.6m, Chainage adjustment, Lumleys Lane culvert now removed
10	155500	155280	Unknown		36.6	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 36.6m, Re-located to avoid opening in private property., Chainage adjustment
10	155950	155920	Unknown		32.94	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased in length from 40m to 32.94m, Chainage adjustment
10	156000	155978	Unknown		45			DEDICATED	Single Rope	Glider Structure; length of structure noted is typical road width, Chainage adjustment
10	156300	156263	Unknown	D57	32	2.4	2.4	COMBINED	Bridge with fauna furniture beneath	Koala Structure, Formerly 20m in length along mainline, Chainage adjustment
10	156970	156937	Unknown		36.6	2.4	2.4	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 40m to 36.6m, Chainage adjustment, Two structures
10	157250	157191	Unknown		39.04	2.4	2.4	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 40m to 39.04m.
10	157630/ CH190 (Not on Mainline on Coolgardie Rd)	157580	Unknown		24.6	3.6	2.4	COMBINED	Culvert with fauna furniture	Koala Structure, Change to dimensions and location. Six structures, On Coolgardie ramp east of mainline approx. Ch190.
10	157780	157745	Unknown		39.4	2.4	2.4	COMBINED	Culvert with fauna furniture	Koala Structure. Insitu raised headwalls required to keep culvert length to 40m, Decreased in length from 40m to 39.4m Chainage adjustment, Three structures
10	157900	157857	North Wardell Viaduct 7: Randles Creek	D10	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Chainage adjustment
11	158900	158868	Unknown		56.12	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure Chainage adjustment.



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