M1 Pacific Motorway extension to Raymond Terrace

URBAN DESIGN REPORT AND LANDSCAPE CHARACTER AND VISUAL IMPACT ASSESSMENT

Transport for New South Wales | June 2021

NSW | Transport for NSW

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CONTENTS

List of acronyms

Acronym	Meaning
ACHAR	Aboriginal Cultural Heritage Assessment Report, Appendix L of the EIS
AS	Ancillary facility
BAR	Biodiversity Assessment Report, Appendix I of the EIS
CEMP	Construction Environmental Management Plan
CPTED	Crime Prevention Through Environmental Design
DPIE	NSW Department of Planning, Industry and Environment
DUAP	Former NSW Department of Urban Affairs and Planning
EEC	Endangered Ecological Community
EIA-N04	Guideline for landscape character and visual impact assessment, Environmental impact assessment practice note EIA-N04 (TfNSW 2020)
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
LCZ	Landscape character zone
LEP	Local Environmental Plan
LGA	Local Government Area
LHFC	Lower Hunter Freight Corridor
NB#	Noise barrier #
NPW Act	*National Parks and Wildlife Act 1974*
PAD	Potential archaeological deposit
PCT	Plant community type
PHUDF	Pacific Highway Urban Design Framework
SEARs	Secretary's Environmental Assessment Requirements
Transport	Transport for NSW
VEM	Visual envelope map

EXECUTIVE SUMMARY

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Executive summary

Background

Transport for New South Wales (Transport) proposes to construct the M1 Pacific Motorway extension to Raymond Terrace (the project). Approval is sought under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and Part 9, Division 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The project would connect the existing M1 Pacific Motorway at Black Hill and the Pacific Highway at Raymond Terrace within the City of Newcastle and Port Stephens Council local government areas. The project would provide regional benefits and substantial productivity benefits on a national scale.

Performance outcomes

This assessment has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) (SSI 7319) relating to urban design and visual amenity for key SEAR 10 and SEAR 11.

The desired performance outcomes for urban design and visual amenity generally relate to the need for the project to:

- Complement the visual amenity, character and quality of the surrounding environment
- Contribute to the accessibility and connectivity of communities
- Minimise the adverse impacts of the project on the visual amenity of the built and natural environment (including public open space) and capitalise on opportunities to improve visual amenity.

The performance of the project against the SEARs is documented through the landscape character and visual impact assessment process.

Overview of landscape character and visual impacts

This assessment provides the basis for an integrated design process, and to ensure the implementation of the urban design principles and objectives during detailed design of the project. The urban design objectives form the basis for the concept design, guiding the resolution of project elements. The urban design concept presented in this assessment would continue to be refined during detailed design (where relevant) to further minimise landscape character and visual impacts and in response to feedback received during exhibition of the project's environmental impact statement (EIS).

Landscape character and visual impacts during construction would both range from moderate-low to high. The degree of impact is not expected to be continuous throughout the construction period but fluctuate with workflows and activities being carried out at the time.

During operation, impacts on the landscape character of the study area would vary across the project. Identified landscape character impacts include:

- Built form changes including the project infrastructure duplicating existing road corridors in some areas and extending through greenfield locations in others
- Altered vistas and visual amenity of non-Aboriginal heritage items such as the Glenrowan Homestead
- Clearing of remnant native vegetation resulting in changes to the spatial character and localised fragmentation of bushland
- Changes to the spatial character more broadly, altering the outlook and views.

The project would result in a number of beneficial landscape character outcomes including:

- Enhanced access and connectivity
- Improved flood immunity
- Reduced congestion and a reduction in freight movements in existing road corridors and urban centres
- A more direct and continuous cycle route along the project road shoulders between Black Hill and Raymond Terrace
- Enhanced town centre amenity in Heatherbrae as a result of reduced traffic, in particular freight traffic
- Opportunities for new views over the open Hunter River floodplain landscape, enhancing the experience for motorists and cyclists with improved orientation and wayfinding.

Impacts of the project on views and vistas in the study area would vary throughout the study area. Higher impact ratings generally occur in instances where project elements would change a large portion of a view's composition, in particular where the altered portions of the composition are comprised of elements that would be highly sensitive to change. An example would be the removal of remnant bushland and replacement with a bridge and associated fill embankments that take up a large portion of a view at Black Hill.

Management measures

A number of environmental management measures have been identified to potentially further reduce the project's landscape character and visual impacts during both construction and operation of the project.

Conclusions

The project seeks to enhance access and connectivity in the study area. The project's design has been developed in recognition of existing natural, built and community values and has sought to minimise adverse impacts of the project on the visual amenity of the built and natural environment (including public open space), while capitalising on opportunities to improve visual amenity. This has been achieved as the project has been located as much as possible within or near to existing road corridors.

New vegetation installed as part of the project and the design quality of structures would assist in integrating the project within the landscape setting and minimise impacts on views as it matures. In open floodplain and grazing areas impacts would be higher as there is limited scope for the project to be absorbed within the existing setting, resulting in permanent changes to the outlook and spatial character.

Transport would continue to develop the design in accordance with the urban design objectives and principles during detailed design of the project. Once operational, the project would achieve the desired performance outcomes in complementing the visual amenity, character and quality of the surrounding environment, contributing to the accessibility and connectivity of communities, minimising the adverse impacts of the project on the visual amenity of the built and natural environment (including public open space) and capitalising on opportunities to improve visual amenity.

1 INTRODUCTION

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1.

Introduction

1.1 Background

Transport for New South Wales (Transport) proposes to construct the M1 Pacific Motorway extension to Raymond Terrace (the project). Approval is sought under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and Part 9, Division 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The project would connect the existing M1 Pacific Motorway at Black Hill and the Pacific Highway at Raymond Terrace within the City of Newcastle and Port Stephens local government areas (LGA). The project would provide regional benefits and substantial productivity benefits on a national scale. The project location is shown in **Figure 1–1** within its regional context.

1.2 Project description

The project would include the following key features:

- A 15 kilometre motorway comprised of a four lane divided road (two lanes in each direction)
- Motorway access from existing road network via four new interchanges at:
  - Black Hill: connection to the M1 Pacific Motorway
  - Tarro: connection and upgrade (six lanes) to the New England Highway between John Renshaw Drive and the existing Tarro interchange at Anderson Drive
  - Tomago: connection to the Pacific Highway and Old Punt Road
  - Raymond Terrace: connection to the Pacific Highway.
- A 2.6 kilometre viaduct over the Hunter River floodplain including new bridge crossings over the Hunter River, the Main North Rail Line and the New England Highway
- Bridge structures over local waterways at Tarro and Raymond Terrace, and an overpass for Masonite Road in Heatherbrae
- Connections and modifications to the adjoining local road network
- Traffic management facilities and features
- Roadside furniture including safety barriers, signage, fauna fencing and crossings and street lighting
- Adjustment of waterways, including at Purgatory Creek at Tarro and a tributary of Viney Creek
- Environmental management measures including surface water quality control measures
- Adjustment, protection and/or relocation of existing utilities
- Walking and cycling considerations, allowing for existing and proposed cycleway route access
- Permanent and temporary property adjustments and property access refinements
- Construction activities, including establishment and use of temporary ancillary facilities, temporary access tracks, haul roads, batching plants, temporary wharves, soil treatment and environmental controls.

A detailed project description is provided in Chapter 5 of the Environmental Impact Statement (EIS). The locality of the project is shown on **Figure 1–1** while an overview of the project is shown on **Figure 1–2** and **Figure 1–3**.

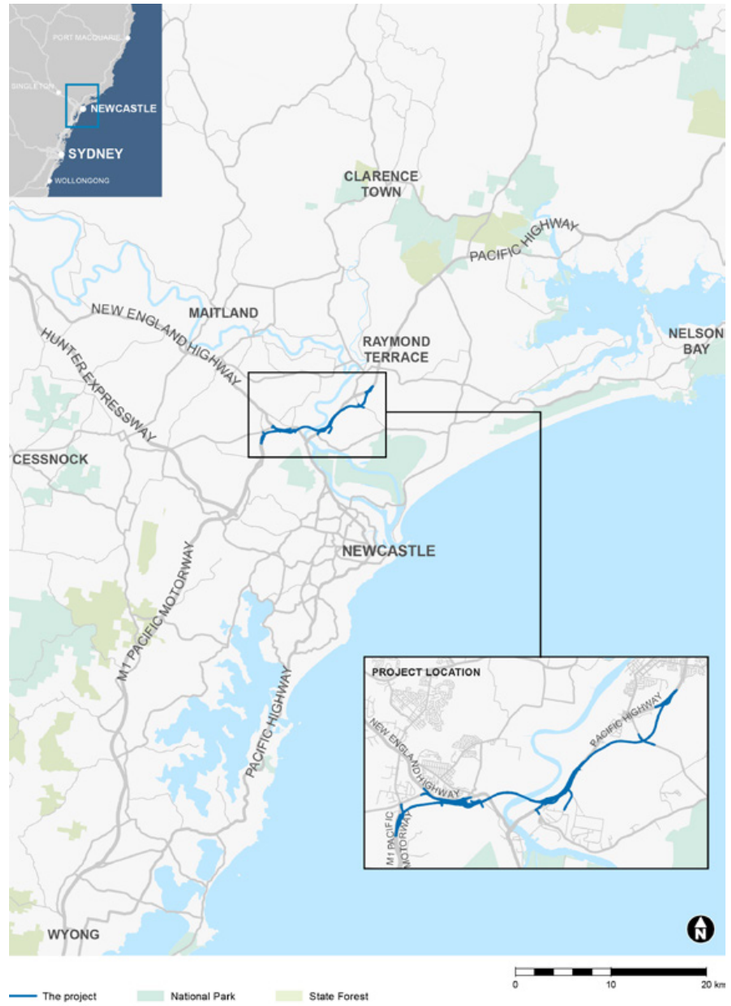

Figure 1–1 Regional context of the project

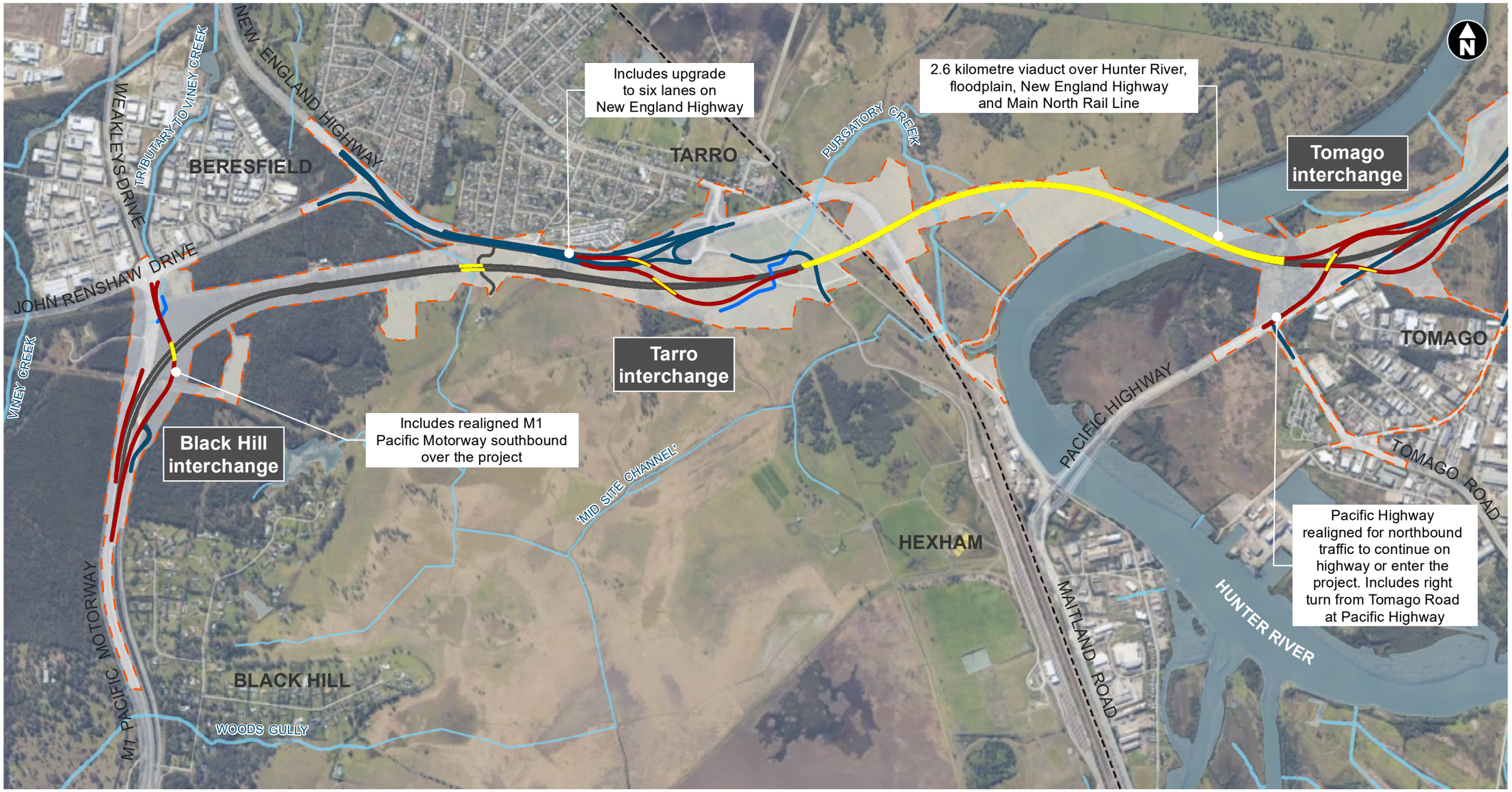

Figure 1–2 Project key features (Page 1 of 2)

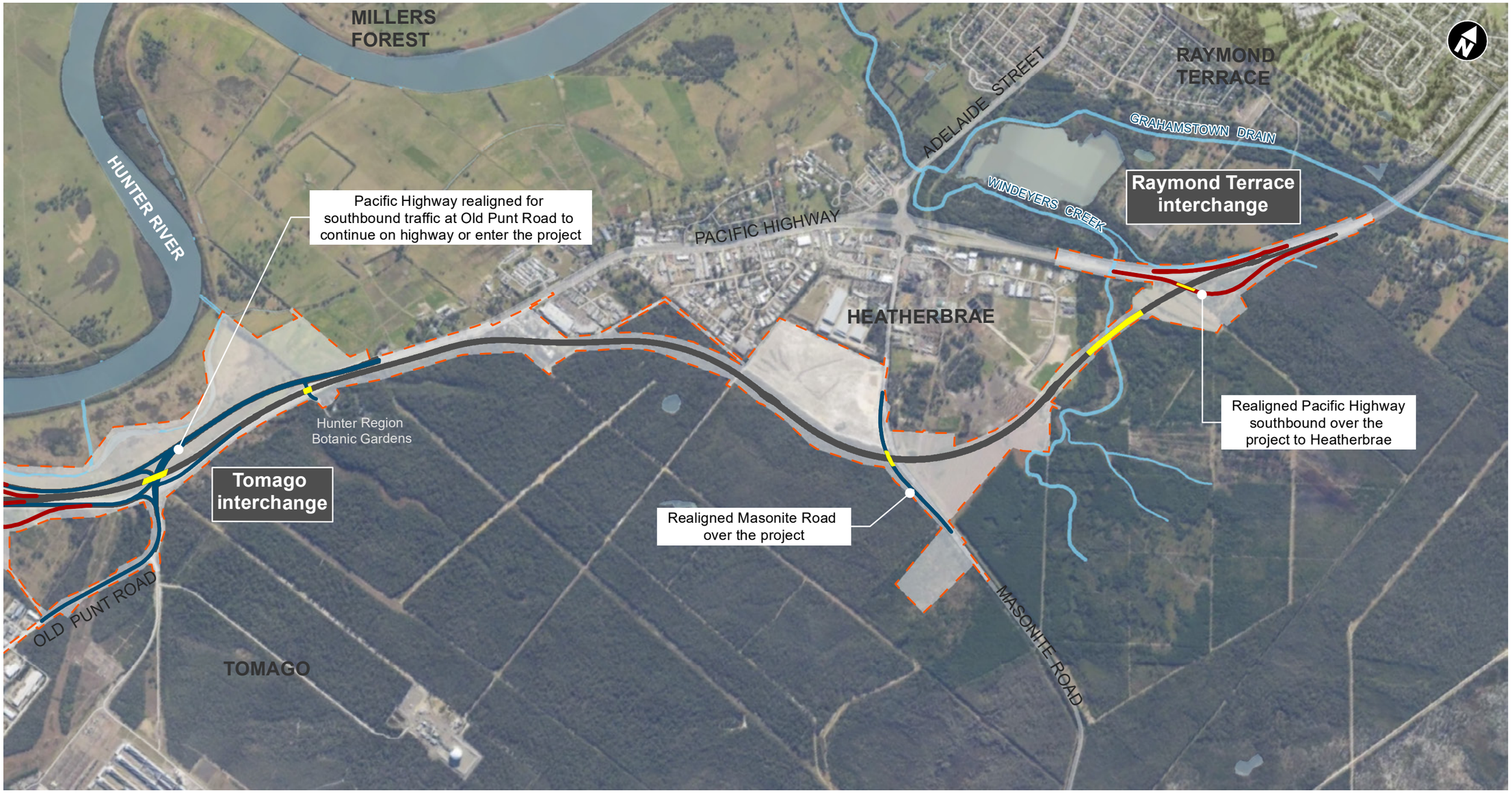

Figure 1–3 Project key features (Page 2 of 2)

1.3 Performance outcomes

The desired performance outcomes for urban design and visual amenity include:

- The project design complements the visual amenity, character and quality of the surrounding environment (**Section 5.3**, **Chapter 7** and **Chapter 8**)
- The project contributes to the accessibility and connectivity of communities (**Section 5.3**)
- The project minimises adverse impacts on the visual amenity of the built and natural environment (including public open space) (**Chapter 7** and **Chapter 8**) and capitalises on opportunities to improve visual amenity (**Section 5.3**, **Chapter 6** and **Chapter 11**).

1.4 Secretary's Environmental Assessment Requirements

This assessment forms part of the EIS for the project. The EIS has been prepared under Division 5.2 of the EP&A Act. This assessment has been prepared to address the SEARs (SSI 7319) relating to urban design and visual amenity and will assist the NSW Minister for Planning and Public Spaces to make a determination on whether or not to approve the project. It details the urban design strategy and urban design concept, provides an assessment of impacts of the project on landscape character and views and outlines proposed management measures.

In 2019, revised SEARs were issued for the project, which included urban design and visual amenity as key issues. **Table 1–1** outlines the SEARs relevant to this assessment along with a reference to where these are addressed.

Table 1–1 SEARs relevant to urban design and visual amenity

Requirement	Where addressed in this report
10. Urban design	
1. The proponent must:	
(a) identify the urban design and landscaping aspects of the project and its components, including interchanges, bridge and viaduct structures, embankments, noise barriers (including walls and mounds), ancillary buildings, and road infrastructure facilities and services	**Chapter 5** outlines the overarching urban design strategy for the project including an urban design vision (**Section 5.2.1**) and urban design objectives and principles (**Section 5.2.2**). **Chapter 6** provides a description of the urban design concept. The project urban design is fully illustrated by a series of concept design drawings in **Section 6.12**. The landscape design aspects of the project are described in **Section 6.10** and illustrated by the concept design drawings in **Section 6.12**. As described in Chapter 4 of the EIS, a number of interchange arrangements were investigated as part of project development. The final design of the interchanges were based on improvements to traffic conditions, road safety, reducing property/land use impacts and access arrangements. Interchanges are described in Chapter 5 of the EIS and illustrated in the urban design plans in **Section 6.12.1**. Bridges and the viaduct structures are described in **Section 6.12** and illustrated in the bridge drawings in **Section 6.12.3**. Retaining walls are described in **Section 6.3** and illustrated in the retaining wall drawings in **Section 6.12.4**. Information on noise barriers is provided in **Section 6.4**. Other road infrastructure includes earthwork formations (cuttings and embankments) (**Section 6.5**), drainage and stormwater infrastructure (**Section 6.6**), roadside furniture (**Section 6.7**), pedestrian, cyclist and public transport infrastructure (**Section 6.8**), and property access and residual land (**Section 6.9**). The project does not include any permanent ancillary buildings. Construction ancillary facilities are described in Chapter 5 of the EIS and considered in the assessment of construction impacts in **Section 7.2.2** and **Section 8.2**. A detailed description of the project design is provided in Chapter 5 of the EIS.
(b) assess the impact of the project on the urban, rural and natural fabric, including residual land treatment, and demonstration of how the proposed hard and soft urban design elements of the project would be consistent with the existing and desired future character of the area traversed or affected by the project	The project's impact on the fabric of the area is assessed as part of the landscape character assessment in **Chapter 7**. This has considered the degree to which the project would be consistent with the existing and desired future character of the area that the project is situated in. Residual land retained by Transport would be vegetated as outlined in **Section 6.10.2**. The provision of access to residual property parcels is described in **Section 6.9**. This section also outlines the process for resolution of any other residual land parcels. **Chapter 5** constitutes the urban design strategy and includes objectives and principles (**Section 5.2.2**) to maximise integration of the project with the character of the area. This is further elaborated in the urban design approach (**Section 5.3**) and the urban design concept in **Chapter 6**. Consistency of hard project elements including bridges, retaining walls, noise barriers and roadside furniture with the existing and desired future character of the area is described in **Section 6.2** to **Section 6.4** and **Section 6.7**. Consistency of soft project elements with the existing and desired future character of the area is described in **Section 6.5**, **Section 6.6** and **Section 6.10**.
(c) explore the use of Crime Prevention Through Environmental Design (CPTED) principles during the design development process, including natural surveillance, lighting, walkways, signage and landscaping	**Section 2.2.4** provides an overview of CPTED and introduces the CPTED principles of surveillance, access control, territorial reinforcement and space management. **Section 6.11** describes how the CPTED principles have been explored by and integrated with the urban design concept.
(d) identify urban design strategies to enhance healthy, cohesive and inclusive communities directly impacted by the project	The project urban design strategy is described in **Chapter 5** and includes a series of strategies to enhance healthy, cohesive and inclusive local communities (**Section 5.3**) that build on the urban design objectives and principles (**Section 5.2.2**).

Requirement	Where addressed in this report
(e) describe urban design and landscape mitigation measures, having regard to the urban design and landscape objectives for the project.	The urban design and landscape mitigation strategy is provided in **Chapter 11**. It includes a description of management measures embedded in the project design in **Section 11.1**, and a series of environmental management measures (**Section 11.1.1**). Urban design opportunities to further enhance project outcomes are suggested in **Appendix A**.
11. Visual amenity	
1. The Proponent must assess the visual impact of the project and any ancillary infrastructure (including noise barriers) on:	
(a) views and vistas;	The impact of the project on a range of views and vistas in the study area is described and assessed in **Chapter 8**. **Section 8.2** comprises the assessment of visual impacts during project construction. The assessment of the project's visual impacts once operational is contained in **Section 8.3**.
(b) streetscapes, key sites and buildings;	The impact of the project on streetscapes, key sites and buildings is described and assessed in **Chapter 8**. Changes to streetscapes associated with the project are limited to existing road corridors including the New England Highway and Pacific Highway. Changes to the corridors would be consistent with their existing infrastructure character. These changes are assessed through the visual impact assessment for a range of viewpoints in **Section 8.3.1**, **Section 8.3.2**, **Section 8.3.4**, **Section 8.3.9**, **Section 8.3.11**, **Section 8.3.13**, **Section 8.3.15**, **Section 8.3.16**, **Section 8.3.18** and **Section 8.3.19**. Key sites near the project include the Hunter Region Botanic Gardens and Tarro Railway Station. Visual impacts of the project on these sites are assessed in **Section 8.3.7** and **Section 8.3.15**. Key buildings include heritage listed buildings and structures such as the residence at 29 Eastern Avenue in Tarro, the Pumping Station in Tarro and the historic Hexham Bridge over the Hunter River. Visual impacts of the project on these buildings are assessed in **Section 8.3.5**, **Section 8.3.6** and **Section 8.3.10**.

Requirement	Where addressed in this report
(c) heritage items including Aboriginal places and environmental heritage; and	There are no Aboriginal places in the study area that meet the definition under the *National Parks and Wildlife Act 1974* (**Section 4.7**). The visual impact of the project on non-Aboriginal heritage items within or next to the project's operational footprint is assessed for a range of viewpoints in **Section 8.3.5**, **Section 8.3.6** and **Section 8.3.10**. Changes to the landscape character of the study area including its environmental heritage are described and assessed in the landscape character assessment in **Chapter 7.** This includes an assessment of impacts during both construction (**Section 7.2**) and operation of the project (**Section 7.3** to **Section 7.9**).
(d) the local community (including view loss and overshadowing).	Community impacts including view losses are captured by responses to SEAR 4(a), 4(b) and 4(c) above. Overshadowing impacts have been assessed for three focus areas at Beresfield, Tarro and the Hunter Region Botanic Gardens where receivers would be sensitive to overshadowing (**Chapter 9**). **Appendix B** provides an assessment of shadowing impacts that would result from an increase in the height of noise barriers, should this be required. Shadow diagrams supporting the assessment in **Chapter 9** and **Appendix B** are included in **Appendix C**.
(e) The Proponent must provide artist impressions and perspective drawings of the project from a variety of locations along and adjacent to the route to illustrate how the project has responded to the visual impact through urban design and landscaping.	Nineteen photomontages were prepared to illustrate the project. They correspond with the viewpoints assessed in the visual impact assessment in **Section 8.3**. The photomontages show how the project has responded to the visual impacts through urban design and landscaping. An additional four artist impressions of the project are included in Chapter 5 of the EIS and illustrate the interchanges along the project from an oblique aerial perspective.

1.5 Report structure

This report has been prepared in accordance with Transport policy, as set out in Guideline for landscape character and visual impact assessment, Environmental impact assessment practice note EIA-N04 (TfNSW 2020a), hereafter referred to as EIA-N04. The report is structured are as follows:

- **Chapter 1 Introduction**
  Introduces the project and project background, details the project description, performance outcomes, SEARs and report structure
- **Chapter 2 Policy and planning framework**
  Describes the strategic planning policies, land use planning framework and policies and guidelines used to inform the assessment
- **Chapter 3 Methodology**
  Describes the methodology used to carry out the landscape character and visual impact assessments for the project
- **Chapter 4 Existing environment**
  Describes the existing environment through a description and analysis of the project's setting and its built and natural features
- **Chapter 5 Urban design strategy**
  Presents the urban design approach adopted for the project including the urban design vision, objectives and principles which underpin the project design
- **Chapter 6 Urban design concept**
  Describes and illustrates the project and provides concepts for major built elements such as bridges and retaining walls. The urban design concept addresses how the project fits into the surrounding area, how it supports local connections and how it contributes to communities and their natural setting
- **Chapter 7 Landscape character impact assessment**
  Introduces the landscape character zones identified as a result of the contextual analysis in **Chapter 4**. Assesses the project's impacts on the identified landscape character zones by analysing how well the project fits into the built, natural and community landscape
- **Chapter 8 Visual impact assessment**
  Identifies the areas from where the project would be visible. Assesses how well the design responds to what people currently see from a range of viewpoints
- **Chapter 9 Shadowing assessment**
  Provides an assessment of shadowing impacts associated with the project in areas with sensitive receivers
- **Chapter 10 Cumulative impacts**
  Describes the cumulative landscape character and visual impacts that may arise from the interaction of construction and operation activities of the project and other approved or proposed projects in the area
- **Chapter 11 Mitigation strategy**
  Outlines the management measures embedded in the project design and makes commitments about how future stages of the project manage ongoing impact
- **Chapter 12 Conclusion**
  Provides a summary of the likely landscape character and visual impacts that would be associated with the project, and how they could be further reduced through the application of the mitigation strategy outlined in **Chapter 11**
- **Chapter 13 References**
  Lists the documents referred to in this report
- **Appendix A: Urban design opportunities**
  Suggested urban design opportunities for further investigation in future stages of the project
- **Appendix B: Assessment of impacts from increased noise barrier heights**
  Provides an assessment of shadowing impacts that would result from an increase in the height of noise barriers
- **Appendix C: Shadow diagrams**
  Contains figures illustrating shadowing of the project elements during different times of the day and year, to support the shadowing assessment in **Chapter 9**.

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2 POLICY AND PLANNING SETTING

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2.

Policy and planning setting

2.1 Planning framework

2.1.1 Strategic planning and policy framework

A number of strategic planning and policy documents apply to the project, and are discussed in Chapter 3 of the EIS. Chapter 3 of the EIS outlines the consistency of the project with these documents.

Of specific relevance to this report is the Hunter Regional Plan 2036 (Department of Planning and Environment (DPIE) 2016) and the Hunter Regional Plan Vision (DPIE 2018). Together they outline the vision and structure for the Greater Newcastle and Hunter Regions that describes the desired future urban form and function of the regions, as well as their integration with the landscape setting.

Integral to this vision and of relevance to the project urban design is the need for a connected network of strategic centres with enhanced inter-regional transport connections to boost recreation, commuting and business and industry growth. In addition, the plan identifies a biodiversity-rich natural environment as a key strategic goal in realising its vision for Greater Newcastle and the Hunter Region. This goal has been integrated into the project urban design strategy (**Section 5.1**) and urban design concept (**Section 6.1**).

2.1.2 Land use planning framework

Land use in the study area for the landscape chapter and visual impact assessment (refer to **Figure 3–1** in **Section 3.2** for the study area) is regulated by the:

- Port Stephens Local Environmental Plan 2013: Areas east and north of the Hunter River including Tomago, Heatherbrae and Raymond Terrace
- Newcastle Local Environmental Plan 2012: Areas south of the Hunter River including Beresfield and Tarro
- Maitland Local Environmental Plan 2011: Areas west of the Hunter River including Woodberry. These areas would not be directly impacted by the project but form part of the study area as the project would be visible from Woodberry.

The local environmental plans (LEPs) provide a statutory framework for the way that land is used through land use zoning. For detailed information on land use zoning, LEP land use zoning objectives and consistency of the project with the land use planning framework, refer to the Land Use and Property Working Paper (Appendix N of the EIS).

Relevance for urban design

Each land use zone is associated with a number of objectives that guide planning decisions. An understanding of the LEP zoning objectives is key to developing the project in a manner that aligns with the existing and desired future built, natural and community context. The objectives of environmental management and conservation zones have informed the project urban design which seeks to protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values where possible, consistent with LEP zoning objectives.

2.2 Relevant standards and guidelines

This assessment has been prepared in accordance with Transport's Beyond the Pavement 2020 - Urban design approach and procedures for road and maritime infrastructure planning, design and construction' (Beyond the Pavement) (TfNSW 2020b). In addition to the overarching principles established in Beyond the Pavement, Transport has several guidelines, dealing with specific issues and elements which have also formed the basis of the urban design principles for the project.

The SEARs also identify standards and guidelines for urban design and visual impacts to be considered as part of the EIS, including:

- Australian Standard AS4282-1997 Control of the obtrusive effects of outdoor lighting (AS4282), (Standards Australia 1997)
- NSW Sustainable Design Guidelines Version 3.0 (Sustainable Design Guidelines), (TfNSW 2013a)
- Crime prevention and the assessment of development applications (Department of Urban Affairs and Planning (DUAP) 2001)
- Crime Prevention through Environmental Design (Queensland Government 2007)
- Urban Green Cover in NSW. Technical Guidelines (Urban Tree Cover), (Office of Environment and Heritage 2015)
- Healthy Urban Development Checklist (NSW Health 2009)
- Pacific Highway Urban Design Framework 2013 (Pacific Highway Urban Design Framework), (TfNSW 2013b).

These documents and their relevance to the project are detailed in the following sections.

2.2.1 Beyond the Pavement

In Beyond the Pavement (TfNSW 2020b), Transport defines best practice for road infrastructure projects in NSW, outlining the goals, expectations, process and responsibilities for urban design for Transport projects.

Beyond the Pavement describes nine urban design principles that should govern the planning and design of road infrastructure in order to deliver safe, efficient and high quality infrastructure:

1. Contributing to urban structure, urban quality and the economy
2. Fitting with the built fabric
3. Connecting modes and communities and promoting active transport
4. Fitting with the landform
5. Contributing to green infrastructure and responding to natural systems
6. Connecting to Country and incorporating heritage and cultural contexts
7. Designing an experience in movement
8. Creating self-explaining roads that safely respond to their role and context
9. Achieving integrated and minimal maintenance design.

The urban design for the project has been developed based on the above principles. This is elaborated further in **Chapter 5**.

2.2.2 Australian Standard AS4282-1997 Control of the obtrusive effects of outdoor lighting

The installation of outdoor lighting commonly involves an amount of light spilling onto other properties, either directly or by reflection. AS4282 provides a common basis for the assessment of the likely effects of developments that involve the provision of outdoor lighting. It is used by lighting designers and other professionals to ensure that spill light does not become obtrusive. The primary application of AS4282 would be during detailed design.

2.2.3 Sustainable Design Guidelines

The Sustainable Design Guidelines (TfNSW 2013a) are now in their fourth version (TfNSW 2017a). They are a tool developed to help realise sustainable public transport outcomes. The project does not constitute a public transport project; therefore these guidelines do not apply. Beyond the Pavement (**Section 2.2.1**) is Transport's relevant design guideline for the project urban design.

2.2.4 Crime prevention and the assessment of development applications

Crime Prevention and the Assessment of Development Applications (DUAP 2001) constitutes a set of guidelines published in respect of section 79C of the EP&A Act. They are intended to help local councils identify crime risk and minimise opportunities for crime through the appropriate assessment of development proposals. The NSW Police Force through its Safer By Design guidelines provides further information in respect of the CPTED principles (NSW Police Force 2020).

Crime prevention through environmental design (CPTED) seeks to influence the design of buildings and places by:

- Increasing the perception of risk to criminals by increasing the possibility of detection, challenge and capture
- Increasing the effort required to commit crime by increasing the time, energy or resources which need to be expended by prospective criminals
- Reducing the potential rewards of crime by minimising, removing or concealing 'crime benefits'
- Removing conditions that create confusion about required norms of behaviour.

CPTED involves four key principles that interact with each other, as well as with other basic principles of good urban design. The CPTED principles are:

- Surveillance
- Access control
- Territorial reinforcement
- Space management.

In accordance with Crime Prevention and the Assessment of Development Applications and Safer By Design, the urban design concept developed for the project has applied the CPTED principles selectively and flexibly to address potential crime risks as a result of the project. **Section 6.11** outlines the consideration of crime prevention in the design.

2.2.5 Urban Green Cover in NSW Technical Guidelines

The Urban Green Cover in NSW Technical Guidelines (Office of Environment and Heritage 2015) provide practical information and typical details on how to adapt the urban environment to climate change through increased urban green cover. They provide a low-cost approach to cooling cities and towns while providing multiple benefits. The range of strategies advocated by the guidelines is aimed at design projects in urban areas and is therefore of limited relevance to the project. Where possible, the guidelines' principles have been integrated into the project urban design.

2.2.6 Healthy Urban Development Checklist

The Healthy Urban Development Checklist (NSW Health 2009) seeks to increase NSW Health staff capacity to support the planning and development of built environments that contribute to the community's health and well-being.

The checklist is aimed at the built environment of urban areas and considers matters such as density, walkability, street layouts and locations of new developments relative to existing urban areas. It seeks to inform the design of projects to reduce health risks through appropriate design of urban areas. The Healthy Urban Development Checklist does not provide guidance in respect of major infrastructure projects and in respect of projects located outside of established urban areas. The checklist is therefore of limited relevance to the project.

However, one of the health risk factors addressed by the Healthy Urban Development Checklist is relevant to the project, namely 'Transport and physical connectivity'. There is a need to consider how the development proposal reduces car dependency and encourages walking and cycling. The project responds to this requirement by making provision for cycle access within road shoulders along the length of the main alignment, resulting in a more direct and convenient route for cyclists between Black Hill and Raymond Terrace.

2.2.7 Pacific Highway Urban Design Framework

The Pacific Highway Urban Design Framework (PHUDF) was published by Transport's Road and Maritime Services in 2013 (TfNSW 2013b) and applies to the Pacific Highway between Hexham and Tweed Heads on the Queensland border. It constitutes an updated version of the initial framework developed in 2004 to guide the Pacific Highway Upgrade Program. Its aims are to ensure a high quality Pacific Highway and consistency between various sections of the highway upgrade program. To this end, the PHUDF provides an urban design vision as well as urban design objectives and principles to help achieve the vision

The urban design vision for upgrading of the Pacific Highway 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 (PHUDF, p 35).

The six urban design objectives are to:

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

The PHUDF does not strictly apply to the project. Noting the proximity and partial overlap of the project with the PHUDF study area, the project urban design strategy in **Chapter 5** has been developed giving regard to the PHUDF.

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3 METHODOLOGY

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3.

Methodology

3.1 Overview

This assessment has been completed in accordance with EIA-N04. The assessment involved:

- A review of relevant guidelines, planning and policies (**Chapter 2**)
- A desktop review of existing conditions to allow for the contextual analysis of the existing environment (**Chapter 4**)
- Site inspections in 2015, 2016 and again in 2020, to ground-truth and confirm the study area (**Section 3.2**), existing conditions, landscape character and views
- Identification of landscape character zones (described in **Section 7.1**)
- Development of the project urban design strategy including urban design objectives and principles (**Chapter 5**), building on the overall project objectives (Chapter 3 of the EIS) and the contextual analysis in **Chapter 4**. The urban design strategy was used to develop the urban design concept (**Chapter 6**)
- Assessment of construction and operational landscape character impacts. Refer to **Section 3.3** for further detail on the landscape character assessment methodology and to **Chapter 7** for the impact assessment
- Assessment of visual impacts during construction and operation. Refer to **Section 3.4** for further detail on the visual impact methodology and to **Chapter 8** for the visual impact assessment
- Assessment of shadow impacts on sensitive receiver views for three focus areas (**Section 3.5**) and as detailed in **Chapter 9**
- Cumulative impact assessment (**Chapter 10**)
- Development of a mitigation strategy (**Chapter 11**).

As per EIA-N04, the landscape character and visual impact assessment has several purposes:

- To inform the development of the concept design so the project can avoid and minimise impact up front
- To measure and report on how well the design fits into the built, natural and community landscape and how well it responds to what people see
- To inform Transport, other agencies and the community about the landscape character and visual impacts of the project as well as of impact avoidance and management strategies.

The assessment differentiates between landscape character assessment - the overall impact of a project on an area's character and sense of place, and visual impact assessment - the project's impacts on views.

3.2 Study area definition

For the purpose of the landscape character and visual impact assessment, the study area is based on views and topography. As shown on **Figure 3–1** the study area can be up to two kilometres from the operational footprint of the project. The study area has been adopted in consideration of where the project would be visible from.

3.3 Landscape character assessment

Landscape character refers to the combined quality of the built, natural and cultural aspects of an area which shape its unique sense of place. Landscape character zones (LCZ) were identified based on the contextual analysis (**Chapter 4**) and confirmed during ground-truthing. They are defined as areas of distinct character, generally grouping together similar characteristics in terms of natural, built and community elements such as land use, vegetation cover, topography, heritage or scenic values.

The purpose of dividing the study area into LCZs is to make sure that the impacts assessed are representative for each zone based on its distinct characteristics. The LCZs identified for the study area are described in **Section 7.1**.

The operational landscape character assessment for each LCZ is in **Section 7.3** to **Section 7.9** and comprises:

- A list of the major project elements in the LCZ
- The landscape character assessment comprising a side-by-side description of the existing landscape character and of likely changes as a result of the project, based on the following landscape character attributes:
  - Landform and vegetation cover
  - Built form and heritage
  - Spatial quality
  - Public domain and key activity areas
  - Connectivity and access
  - Sensitivity to shadow impacts.
- A landscape character impact assessment summary including:
  - An assessment of the sensitivity of the area's landscape character, that is its inherent capability to absorb change of the order of the project
  - An assessment of the magnitude of change in the LCZ that would result from the project.

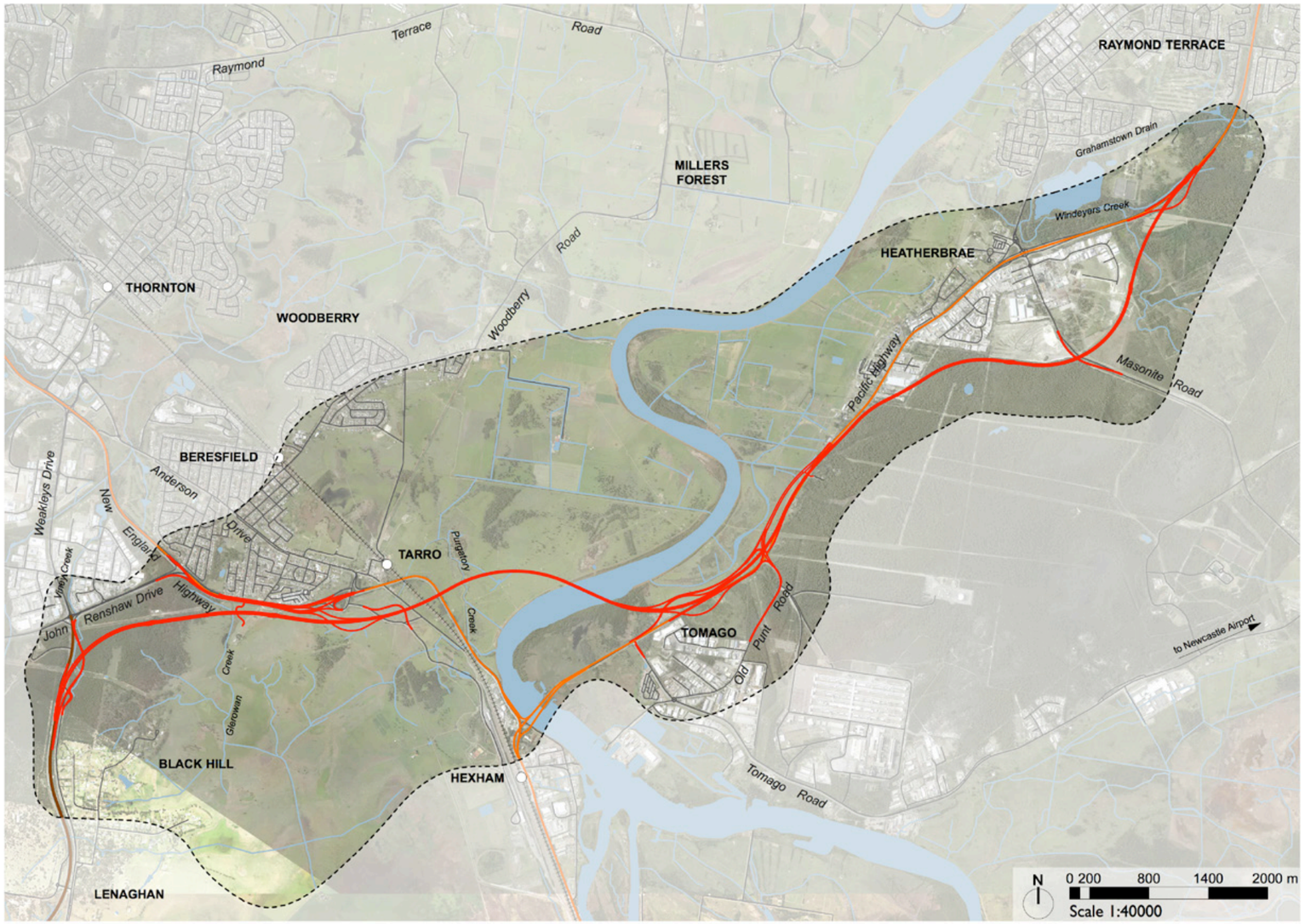

Figure 3–1 Study area for urban design and visual amenity

Within each LCZ the landscape character impact is derived from the sensitivity of the zone and the magnitude of the project in that zone where:

- Sensitivity refers to how sensitive the existing character of the setting is to the proposed nature of the change. This can also be understood as the setting's inherent capacity to absorb change of the nature of the project. For example, a pristine natural environment would likely be more sensitive to change of the nature of a four lane motorway than a built up industrial area. Sensitivity is influenced by both professional judgement and objective measures. For example, an area's listing on a State level heritage register would mean a higher level of sensitivity
- Magnitude measures the design quality of a project including its physical scale, form and character of the project and the contrast it presents to the existing condition. For example, a large intersection would have a greater magnitude than a localised road widening, and therefore have a greater impact on the landscape character.

The combination of sensitivity and magnitude ratings determines the rating of the project's landscape character impacts. This is illustrated in the landscape character and visual impact rating matrix provided in EIA-N04 (**Table 3–1**).

A summary of the landscape character impacts during construction and operation is provided in **Section 7.2** and **Section 7.3** respectively.

3.4 Visual impact assessment

Visual impact is the measure of the change that new interventions would have on existing views.

The visual impact assessment (**Chapter 8**) involves identifying an estimated visual catchment through desktop analysis of the existing environment (**Chapter 4**) and ground truthing to ascertain the theoretical area from where the project would be visible, considering factors such landform, direction of travel or direction of the view, built structures and vegetation. Vegetation, while often obscuring views, is not considered a permanent obstruction. This area is known as the visual catchment or visual envelope and is illustrated in a Visual Envelope Map (VEM) (**Figure 8–1**).

In addition to theoretical visibility, distance is also an important factor when assessing visual impacts. With increased viewing distance, the project may appear smaller and less detail can be made out. For this reason, very large visual envelopes are often defined by zones or bands of proximity from the project.

Within the visual envelope viewpoints were selected for assessment, located both within and outside the project's operational footprint (**Figure 8–1**). Viewpoints were chosen to represent a range of views including views from residential properties, public buildings and spaces, heritage items, businesses and existing road corridors. For each viewpoint, the assessment in **Section 8.3** discusses:

- The location of the viewpoint, and who the likely viewers would be
- Permanent project elements visible in the view
- The sensitivity of the view to change. Sensitivity refers to the quality of the view and is measured by assessing the composition of the view, its capacity to absorb change of the nature of the proposal. Determining sensitivity involves identifying sensitive or visually valuable elements in the view, and the length of exposure to the view. Sensitivity also considers the type of viewer and the number of viewers
- The magnitude of change to the existing view. Magnitude refers to the physical character, size and scale of the project and its proximity to the viewer. For example, a development situated one kilometre from the viewpoint would have a much reduced visual impact relative to a development 100 metres away
- The combination of sensitivity and magnitude provides the rating of the visual impact. Visual impact is calculated using the landscape character and visual impact rating matrix provided in the practice note (**Table 3–1**).

The ratings for visual sensitivity and magnitude are measured relative to each other within the scope of the project, rather than to an absolute scale covering all potential forms of impact. Through this process, the visual impact of the project as a whole has been identified. Refer **Section 8.3.20** for a summary of the visual impact assessment during project operation. The summary of visual impacts during project construction is provided in **Section 8.2.1**.

Table 3–1 Landscape character and visual impact rating matrix

SENSITIVITY	MAGNITUDE: HIGH	MAGNITUDE: MODERATE	MAGNITUDE: LOW	MAGNITUDE: NEGLIGIBLE
HIGH	HIGH	HIGH-MODERATE	MODERATE	NEGLIGIBLE
MODERATE	HIGH-MODERATE	MODERATE	MODERATE-LOW	NEGLIGIBLE
LOW	MODERATE	MODERATE-LOW	LOW	NEGLIGIBLE
NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE

3.5 Shadowing impact assessment

Determining locations for assessment

Shadowing impacts as a result of the project during operation have been assessed in **Chapter 9**. To determine the locations for the shadow assessment, two main factors were considered:

- The three-dimensional form of the project, that is the height of project elements relative to adjoining areas which would inform the extent of over-shadowing
- The presence of sensitive users that may be affected by over-shadowing due to their proximity to the project. Based on the extent of shadowing caused by the project (**Appendix C**), sensitive receivers located at a distance greater than 50 metres from the project have been excluded.

On this basis, three focus areas were selected for the shadow analysis. The focus areas comprise bridge structures or other three-dimensional project elements, located within 50 metres of sensitive receivers, that could potentially cause overshadowing of adjacent properties with sensitive receivers. The focus areas include:

1. Beresfield
2. Tarro
3. Hunter Region Botanic Gardens.

Shadow analysis

The shadow analysis was carried out using a 100 metre wide corridor extending either side of the operational footprint (Jacobs, 2020). The 100 metre corridor was adopted based on the generally low built form of the project. This width provides a safeguard for assessment, in the unlikely event that taller project elements such as bridges would cast shadows beyond a distance of 20 metres.

A 3D model of the existing terrain was created from contours at one metre intervals with adjacent building footprints. Project elements, including proposed landform and bridge structures, were modelled to determine the extent of shadowing at 9am, noon and 3pm on the two equinoxes (20 March and 20 September) and the two solstices (20 June and 20 December). This demonstrates the extent of shadowing during key daylight hours year round.

Overshadowing impacts from the project are detailed in **Chapter 9**. Supporting shadow diagrams are provided in **Appendix C**.

3.6 Cumulative impact assessment

Cumulative impacts are those that result from successive, incremental, and/or combined effects of a project when added to other existing, planned, and/or reasonably anticipated future projects. The cumulative effect of multiple projects may decrease or intensify the landscape and visual impacts on a particular receiver or area.

A review of the cumulative impacts of this project has been completed taking into account other projects near to the project that are in planning, have been approved but where construction has not commenced and have commenced construction (**Chapter 10**).

3.7 Mitigation strategy

The mitigation strategy comprises, principles or treatments recommended to manage the identified landscape character and visual impacts of the project. They include:

- Measures embedded in the project design that have already mitigated landscape character and visual impacts. They include a strategy and design principles that continue to provide guidance during detailed design and construction in order to minimise landscape character and visual impacts (**Section 11.1**)
- Environmental management measures to manage landscape character and visual impact (**Section 11.1.1**).

The mitigation strategy for the project is described in **Chapter 11**.

3.8 Height of noise barriers assessed

The assessment of landscape character, visual and shadowing impacts in **Chapter 7** to **Chapter 9** assumes a noise barrier height of about 3.8 metres for noise barrier NB02 and about four metres for noise barrier NB03 (noise barrier locations are shown on **Figure 6–4**). The assessment further assumes that the existing noise barriers NB02 would be able to be repaired and retained in place, avoiding the need for vegetation removal and the like. The assessment further assumes that the existing noise barriers NB02 would be able to be repaired and retained in place, avoiding the need for vegetation removal and the like.

An assessment of additional landscape character, visual and shadowing impacts that may result from an increase in noise barrier height is provided in **Appendix B**. Noise barrier NB01 would be relocated at its existing height and does not require further assessment for an alternative height.

4 EXISTING ENVIRONMENT

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4.

Existing environment

4.1 Location

4.1.1 Regional context

The project is situated about 23 kilometres north of Newcastle within the City of Newcastle and Port Stephens Council LGAs (**Figure 1–1**). The study area forms part of the Lower Hunter Region, and is located at an important junction with the Mid North Coast and the coastal regions of Newcastle and Lake Macquarie.

The Hunter Region is a predominantly rural area that constitutes the leading regional economy in NSW. Important land uses in the region include mining, agriculture, Defence services, manufacturing and industrial uses including aerospace industries associated with Newcastle Airport, power generation and tourism. Agricultural uses are diverse and include viticulture, thoroughbred horse breeding and cattle farming. Environmental land uses include the Hunter Wetlands National Park, Hunter River, and the Hunter Region Botanic Gardens at Heatherbrae. Newcastle is the major regional centre near the project and forms the heart of Greater Newcastle. Other important strategic centres include Maitland, Port Stephens and Raymond Terrace.

4.1.2 Local area overview

The project is located between the growth area of East Maitland and the strategic centre of Raymond Terrace, north of Hexham. A number of suburbs surround the project and are shown on **Figure 3–1**.

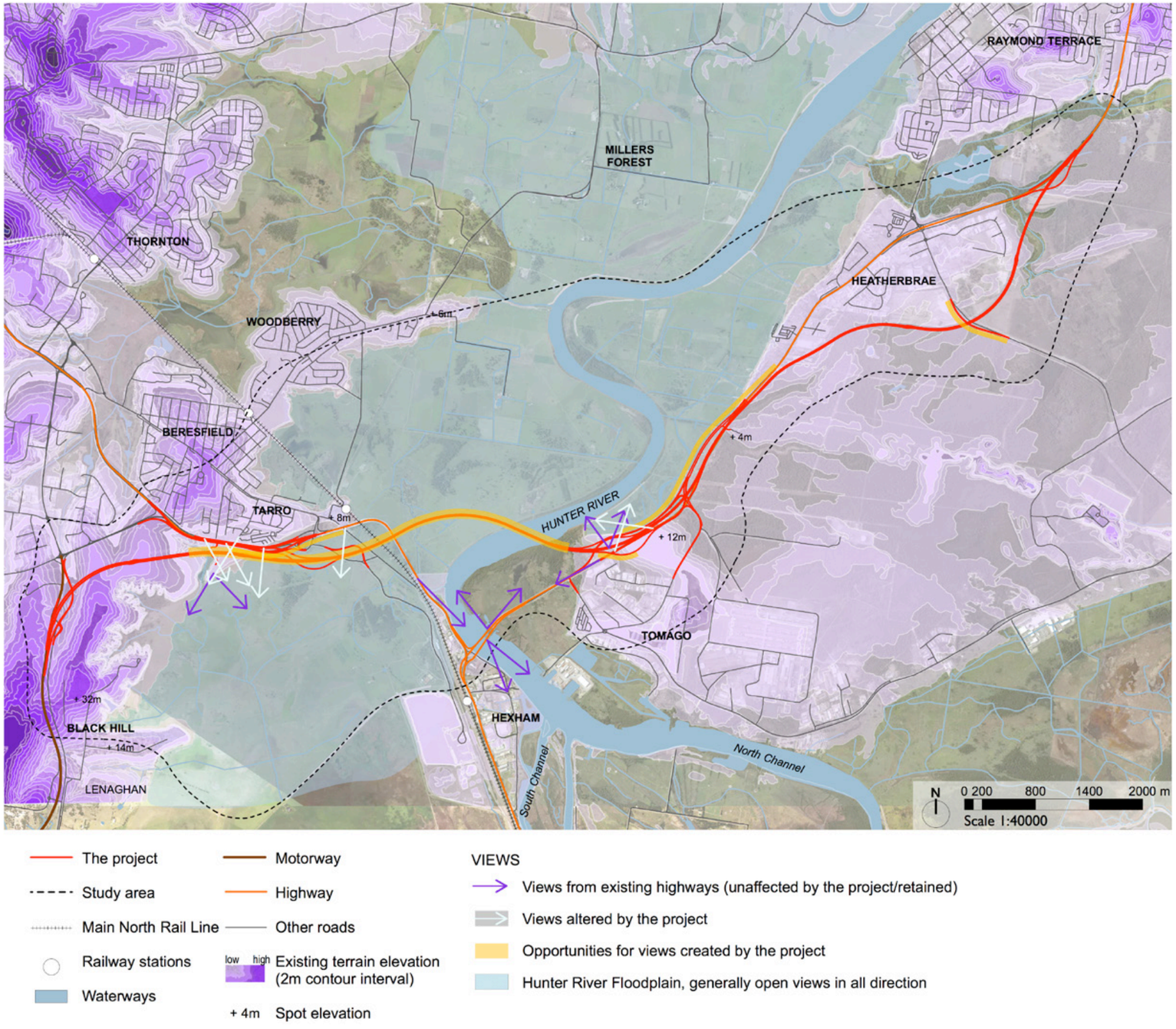

Figure 4–1 Landform and views

4.2 Landform and views

4.2.1 Existing characteristics

The landform and views in the study area are shown on **Figure 4–1**. The following characteristics are of relevance to this report:

- The landform of the area is characterised by its location on the Hunter River and the flat landscape of its wide floodplain
- Surrounding the floodplain are predominantly low rolling hills and wide valleys
- The flat, low-lying and open landscape of the floodplain provides for long-distance views across the mostly cleared rural lands in the floodplain
- Settlements are located on elevated land around the edges of the floodplain
- The rising topography at the edge of the floodplain provides for views over low-lying areas, for example from Black Hill, Beresfield, Tarro, Woodberry, Tomago and Heatherbrae
- Large structures such as high voltage power lines and Hexham Bridge are prominent in the low-lying and open landscape.

4.2.2 Relevance to urban design

- Large structures tend to be prominent within the flat open landscape setting of the floodplain. The rising topography on the edges of the floodplain provides an opportunity to sensitively integrate the project with the landform
- Elevated project elements provide an opportunity to create new views or vantage points over the landscape
- There is a need to consider the project's impact on existing views, in particular on views from residential neighbourhoods around the edges of the floodplain including in Black Hill, Tarro and Woodberry
- There is a need for the urban design to consider existing views and view corridors. This may involve the use of low-growing vegetation in areas with existing long distance views and with views to attractive natural, built and community features.

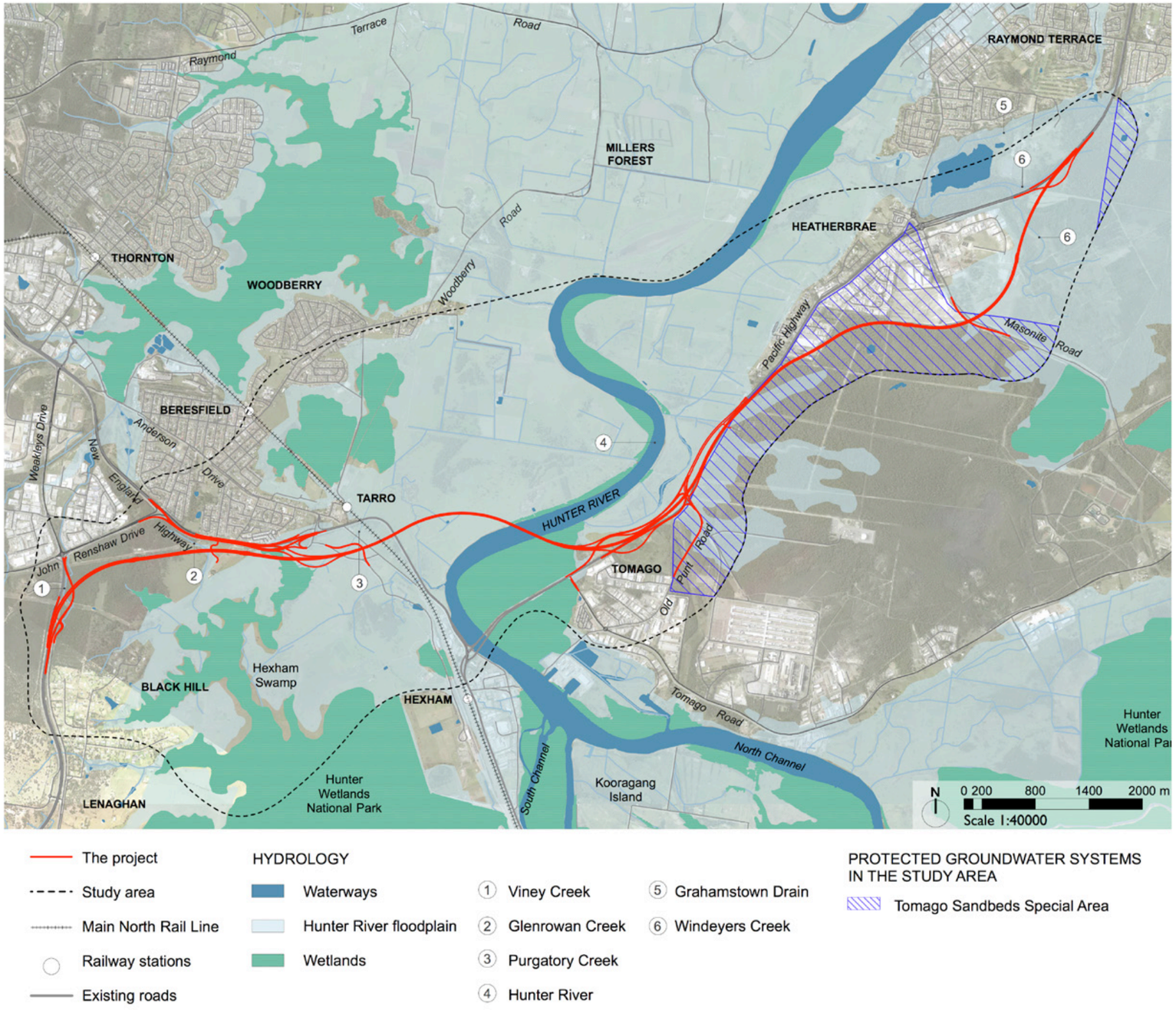

Figure 4–2 Surface water, groundwater systems and flood prone areas

4.3 Surface water, groundwater and flooding

4.3.1 Existing characteristics

Waterway features, groundwater systems and flooding aspects of relevance to urban design include (**Figure 4–2**):

- The Hunter River is a major waterway. Its catchment is the largest coastal catchment in NSW, covering an area stretching from Barrington Tops to the ocean. The project also crosses a number of other smaller creeks
- The Hunter River floodplain separates the urban areas of Black Hill, Beresfield, Tarro and Woodberry in the west from Tomago, Heatherbrae and Raymond Terrace in the east
- The Hunter River flows year-round in the study area and provides fishing grounds for the aquaculture industries i.e. oyster farming and prawn trawling
- The Hunter River floodplain contains wetlands that are important as habitats and for maintaining water quality in rivers and streams
- Other aquatic habitats associated with waterways include mangroves, saltmarsh, streams and tidal creeks
- Flooding along the Hunter River leads to closure of the New England Highway and Pacific Highway at times, disrupting the connectivity between communities and regions
- The Tomago Sandbeds constitute an important groundwater system in the north-eastern study area. The sandbeds are a strategically important underground source of drinking water and are protected as a Hunter Water Corporation 'Special Area' under the *Hunter Water Act 1991*.

The Surface Water and Groundwater Quality Working Paper and the Hydrology and Flooding Working Paper (Appendix K and Appendix J of the EIS respectively) provide further information on water and its characteristics within the study area. For information on the biodiversity associated with waterways refer to the Biodiversity Assessment Report (BAR) (Appendix I of the EIS).

4.3.2 Relevance to urban design

- Improving community connectivity during flood events is a key driver for the project
- There is a need to integrate the project sensitively into the complex hydrological patterns of the floodplains, wetlands and associated aquatic habitats
- Achieving the project flood immunity requires the project to be raised above existing road levels in the floodplain, creating a contrast with the low-lying landscape
- There is a need to protect sensitive wetlands, receiving waterways and groundwater systems from pollution or other contaminants.

4.4 Vegetation

4.4.1 Vegetation types and distribution

Vegetation within the study area comprises a mix of remnant native vegetation, planted (exotic and native) vegetation near established urban areas, and modified and cleared land used for agriculture and horticulture. Broad vegetation types of the study area are shown on **Figure 4–3**, based on height and the type of cover they provide, illustrating the spatial qualities associated with the vegetation of the study area. Vegetation types broadly correspond to the landform of the study area:

- Open forests and woodlands tend to be associated with higher ground in Black Hill, Tomago and Heatherbrae, providing a visual backdrop to mostly open floodplain areas
- Mangroves, saltmarsh and freshwater wetlands occur near the Hunter River, in the centre of the study area
- Planted vegetation including Radiata Pine (*Pinus radiata*) plantations in Heatherbrae.

4.4.2 Biodiversity and plant communities

- Fourteen Plant Community Types (PCTs) have been identified within the project construction footprint and include a number of Endangered Ecological Communities (EECs). EECs occur across both forest/woodland and wetland communities
- A number of biodiversity corridors have been identified in the region and are described in the BAR (Appendix I of the EIS).

For more information on PCTs, EECs and biodiversity corridors in the study area refer to the BAR (Appendix I of the EIS).

4.4.3 Relevance to urban design

- The vegetation of the study area contributes to the sense of place and the motorists' experience when travelling along the project
- The biodiversity of the study area can be supported by maximising integration of the project landscape design with existing PCTs in the area. This serves to maintain and reinforce the diversity of landscape types and plant communities and helps realise the NSW Government goals for Greater Newcastle and the Hunter Region (**Section 2.1.1**). Biodiversity would be further supported through the project Biodiversity Offset Strategy (Appendix I of the EIS)
- There is an opportunity to integrate the project landscape design near urban areas with the character of existing vegetation in streets, gardens and arterial road corridors.

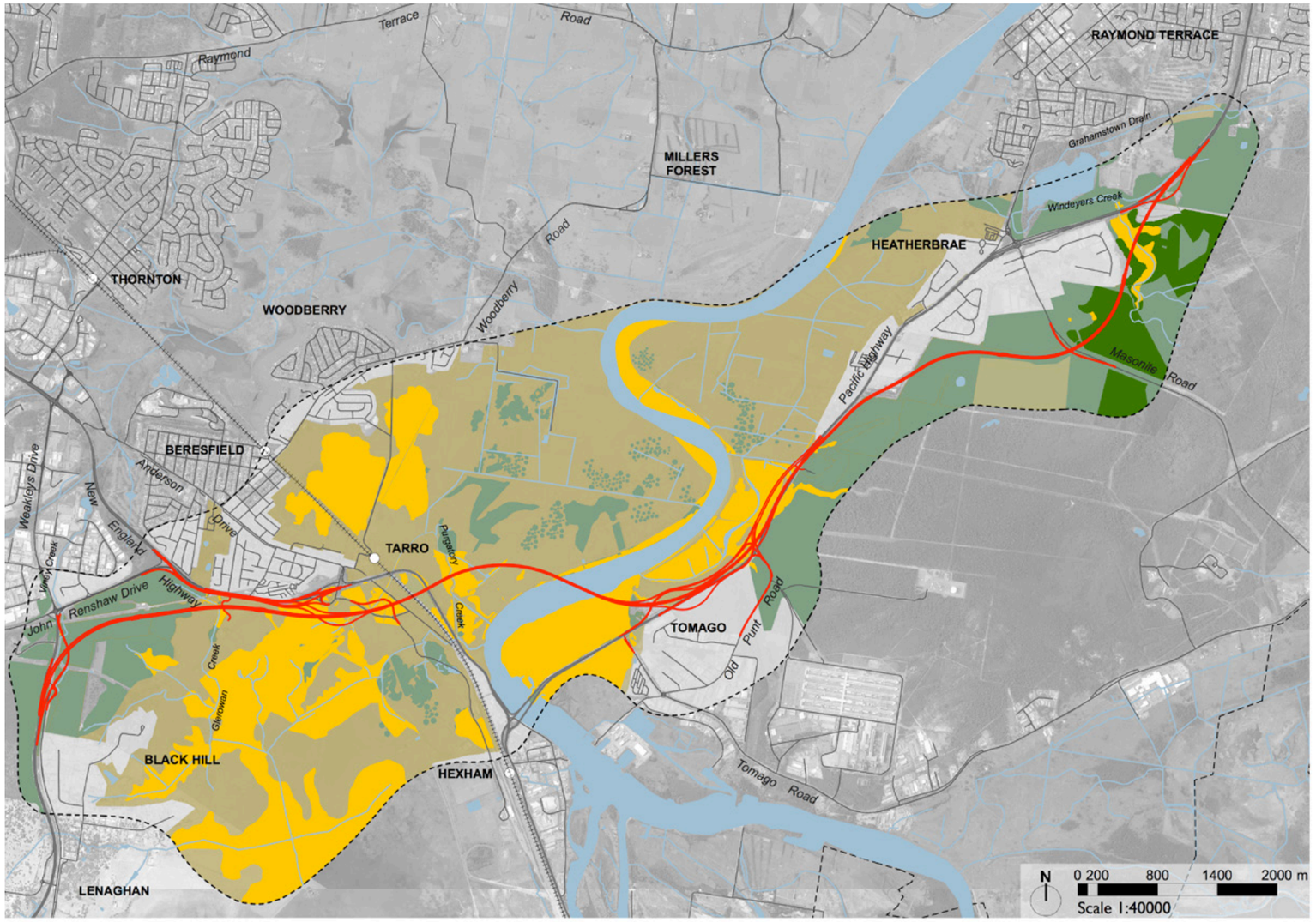

Figure 4–3 Vegetation and biodiversity

4.5 Fauna

4.5.1 Existing characteristics

- The area provides land and water-based habitats and foraging areas for a wide range of species including mammals, birds, reptiles, amphibians and fish
- The study area is home to several threatened animal species including bats, flying foxes, gliders, froglets and owls.

For more information on the fauna and fauna habitat in the study area refer to the BAR (Appendix I of the EIS).

4.5.2 Relevance to urban design

- There is a need for the project to consider and make provision for fauna movement along and across the project
- There is an opportunity for the project to complement existing habitat and foraging areas to support native fauna in areas where it is safe to do so.

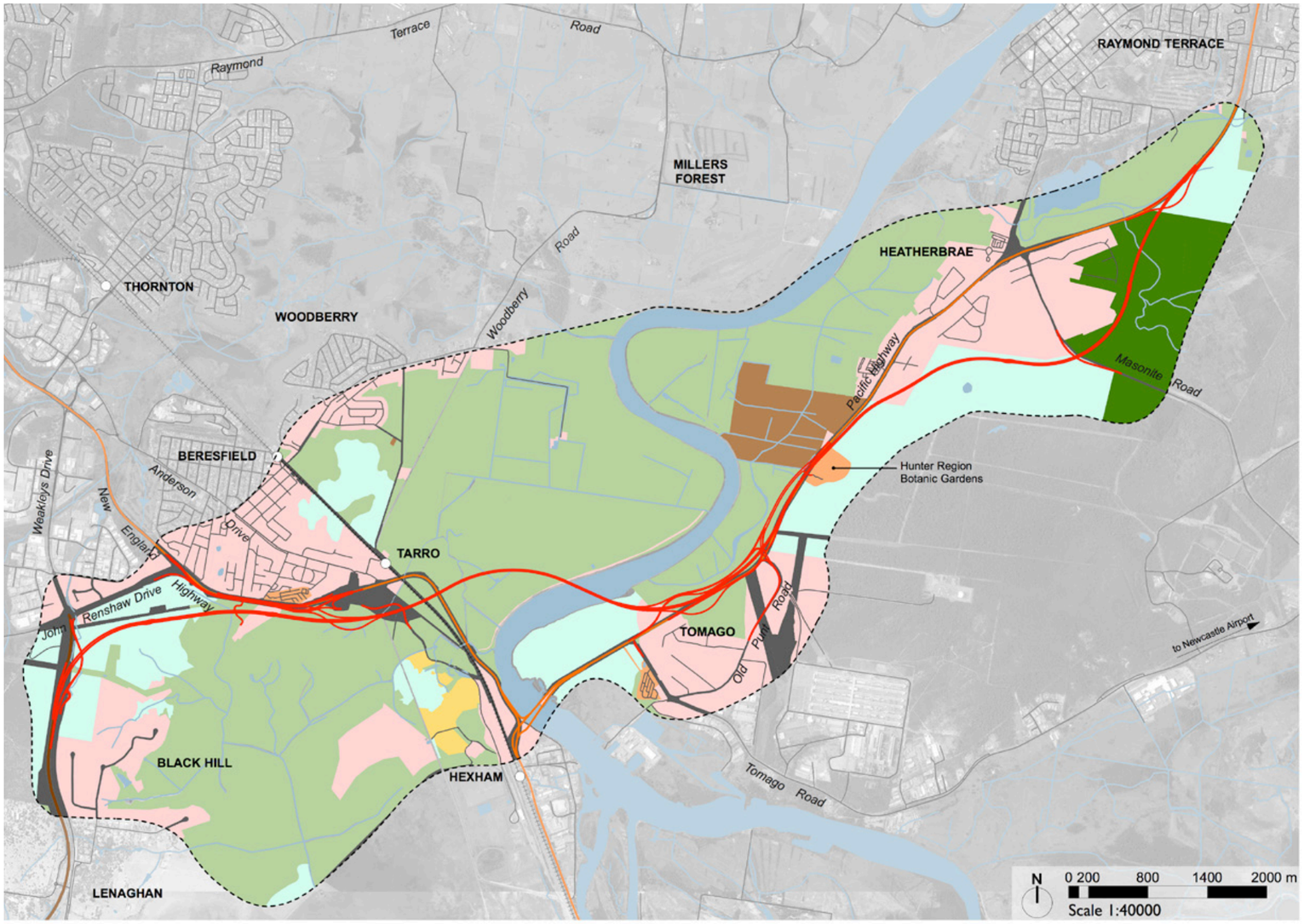

Figure 4–4 Existing land use

4.6 Existing land use

4.6.1 Existing characteristics

The study area is characterised by a mix of land uses. Their distribution is influenced by the topography and flooding regime of the area. Important industries are historically linked to shipping along the Hunter River and mineral resources. Coal mining in turn has given rise to the development of the Main North Rail Line for the transportation of coal to the Port of Newcastle.

Land uses in the study area include (**Figure 4–4**):

- Grazing as the predominant land use
- Other primary production such as plantation forests, irrigated cropping, intensive animal production and horse management activities at Heatherbrae
- Urban and residential uses including:
  - Residential areas comprising mainly low density residential dwellings
  - Community uses such as schools, places of worship and recreational facilities
  - Large lot rural residential living areas
  - Commercial, recreation and cultural services such commercial and business uses including motels and other accommodation services
  - Manufacturing and industrial uses including approved subdivisions and industrial developments.
- Conservation and natural resource protection uses including nature conservation at Black Hill, Tarro, Hexham and Tomago (including the Tomago Sandbeds Catchment Area, refer to **Section 4.3.1**)
- Major utilities and infrastructure corridors including transport infrastructure, electricity transmission, gas storage and distribution and Hunter Water Corporation distribution and water treatment assets (**Section 4.8** and **Section 4.9**)

- Mining and resources uses. Due to limited surface infrastructure, they have little effect on the visual character of the area
- Use of water resources through commercial and recreational fishery activities including aquaculture, oyster farming and commercial prawn trawling of the Hunter River estuary
- Tourism including the Hunter Region Botanic Gardens in Heatherbrae, caravan parks/villages in Tarro and Tomago and ferry charter and cruise boat operations on the Hunter River.

The project would result in permanent land use changes to about 216 hectares of land within the operational footprint. A total of 36 lots held by 18 property owners would need to be acquired for the project, in addition to the 43 lots previously purchased by Transport. Land use characteristics and impacts from the project are assessed in the Land Use and Property Working Paper (Appendix N of the EIS).

4.6.2 Relevance to urban design

There is a need to:

- Develop an urban design strategy to enhance and complement existing land uses
- Carefully consider the interfaces with existing land uses close to the project to minimise project impacts on sensitive receivers such as residential neighbourhoods and tourism businesses
- Consider the need for vegetation or other screening measures between sensitive viewers and the project
- Maintain the functionality and core values of tourism and recreation areas
- Maintain access and connections between urban areas to ensure healthy, cohesive and well-connected local communities
- Integrate the project with the landscape setting. This includes:
  - Reinforcing the predominantly rural setting of the floodplain landscape
  - Visually separating individual road corridors.

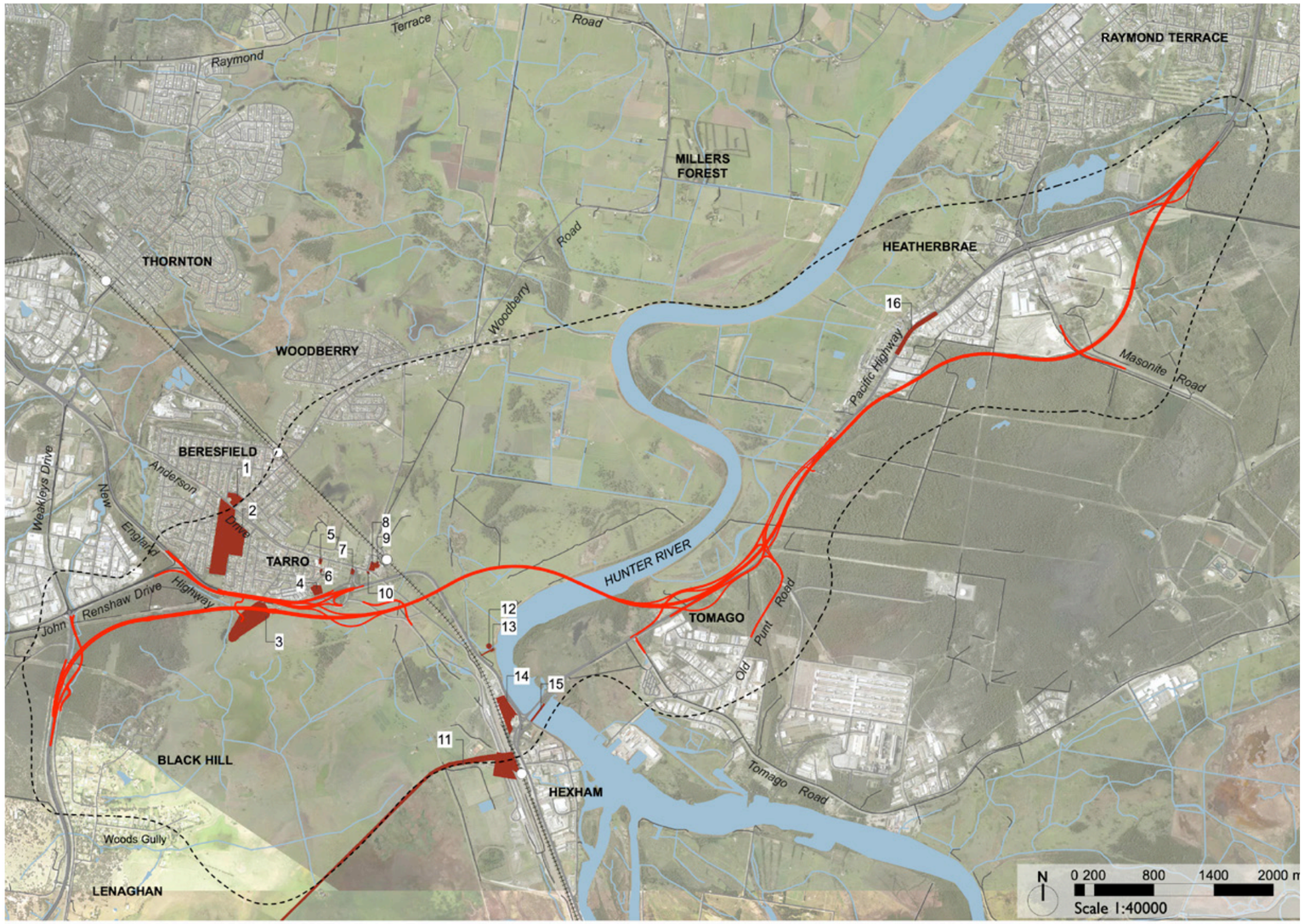

Figure 4–5 Non-Aboriginal heritage

4.7 Heritage

4.7.1 Aboriginal heritage

- Within the Aboriginal heritage study area there are 26 Aboriginal archaeological sites or potential archaeological deposits (PADs). They constitute Aboriginal objects as defined by the *National Parks and Wildlife Act 1974* (NPW Act)
- Identified Aboriginal values in the study area are associated with landform and other culturally significant sites
- There are no Aboriginal places in the study area that meet the definition under the NPW Act, with the closest Aboriginal place located at Anna Bay. There would be no visual impacts from the project on this Aboriginal place.

Due to the sensitivity of surrounding Aboriginal sites, no mapping of Aboriginal sites is included in this assessment. The Aboriginal Cultural Heritage Assessment Report (ACHAR) (Appendix L of the EIS) provides further detail on the location, impacts and management of Aboriginal heritage.

4.7.2 Non-Aboriginal heritage

While there are several non-Aboriginal heritage items within the study area, only nine heritage items are located within or immediately adjoining the project's construction footprint, or would be subject to project-related work (**Figure 4–5**). They have been assessed as part of this report. The items are:

- Hannell Family Vault: A single stone vault structure
- Hexham Shipbuilding Yards: An area north of Purgatory Creek that may have been associated with ship-building
- Glenrowan Homestead, a farm complex comprising (**Figure 4–6**):
  - A single storey farmhouse, sheds, remnant gardens and a driveway (site 1)
  - A weatherboard house (site 2)
  - Subsurface historical archaeological artefacts (site 3).
- Residence at 29 Eastern Avenue, Tarro: A single storey brick building

- Tarro Historic Site: An archaeological site that represents the location of the original township of Upper Hexham including the historic St Stephen Churches and burial ground
- Tarro Substation: A single storey brick building with decorative render and stone features
- Pumping Station in Tarro: A large brick Federation style building purpose-built as a water-pumping station and the most finely constructed building remaining within the Hunter Water Corporation network (**Figure 4–7**)
- Newcastle Crematorium: A building of rendered brick construction on reinforced concrete foundations that is a fine example of the Art Deco style, set in a formally landscaped garden
- Our Lady of Lourdes Church: Single storey facebrick work building with narrow elongated round arched windows positioned between structural buttresses.

The Non-Aboriginal Heritage Working Paper (Appendix Q of the EIS) provides further detail on the location, impacts and management of non-Aboriginal heritage.

4.7.3 Relevance to urban design

- The project needs to consider physical and visual impacts on heritage items within or in close proximity to the construction footprint, including changes to views to and from heritage items
- The project provides opportunity for new views to heritage items in order to:
  - Contribute to visual interest along the project
  - Enhance the sense of place.
- There is an opportunity for the project to draw on the history and heritage of the area in the development of design treatments for project elements such as bridges and retaining walls, including the development of interpretive or community art features.

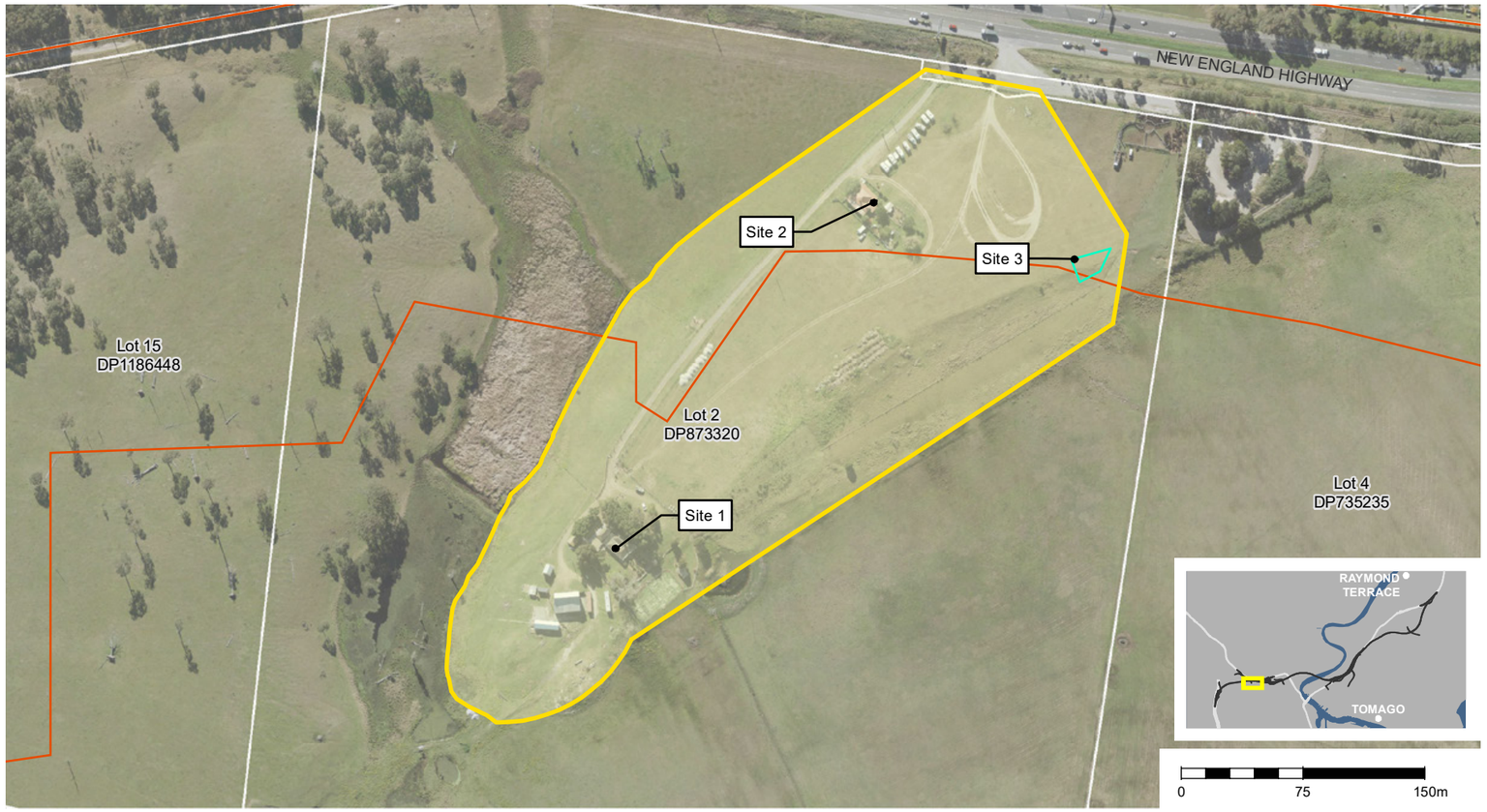

Figure 4–6 Glenrowan Homestead

Figure 4–7 Pumping Station, Tarro

4.8 Transportation networks

4.8.1 Road network

Existing characteristics

The existing road network in the study area is shown on **Figure 1–2** and **Figure 1–3**. The existing road network includes:

- Major roads that constitute an established character element of the study area and include the M1 Pacific Motorway, New England Highway and Pacific Highway. These roads consist of generally dual carriageways with two travel lanes in each direction, consistent with their role in the National Land Transport Network (**Figure 4–8**)
- The absence of a route with seamless flow. This contributes to congestion in the area and adversely affects the existing landscape character
- Major roads that follow the natural landform and are vulnerable to flooding and other disruptions (**Section 4.3**)
- A number of other roads that directly interface with the project and provide local access and connectivity. Comprised of typically one travel lane in each direction, their character is generally consistent with the regional setting.

Figure 4–8 The New England Highway on the approach to Tarro from the north

Further detail on the road network and its performance is provided in the Traffic and Transport Working Paper (Appendix G of the EIS).

4.8.2 Public transport network

Existing characteristics

The existing public transport network of the study area is illustrated in **Figure 4–9**. The following characteristics are of relevance to this report:

- The Main North Rail Line is important for transporting freight, as well as for regional and commuter rail services. Railway stations closest to the project are located at Tarro and Hexham
- Ten local buses operate in the study area providing connections to Newcastle, Raymond Terrace, Newcastle Airport, Nelson Bay and Maitland. Most bus routes in the study area use the lower order road network, with the exception of:
  - Route 140 uses the Pacific Highway and Maitland Road, with several bus stops located in the study area
  - Routes 145, 181 and 182 operate on the New England Highway west of Weakleys Drive
  - Route 181 also operates within Tarro and Beresfield where it does not interface with the project.
- Long-distance coaches and bus services provide inter-regional connections via Maitland Road and the Pacific Highway but do not stop at towns within the study area.

The Traffic and Transport Working Paper (Appendix G of the EIS) provides further detail about the public transport near to the project.

4.8.3 Walking and cycling networks

Existing characteristics

- There is limited pedestrian and dedicated cycling infrastructure. Existing provision includes:
  - Short sections of footpaths on some local roads and signalised pedestrian crossings at the Pacific Highway/ Tomago Road intersection
  - Dedicated cycle lanes at the intersection of Weakleys Drive and John Renshaw Drive. In all other areas cyclists are required to utilise road shoulders and traffic lanes.
- A dedicated off-road cycleway is proposed by the City of Newcastle between Tarro and Shortland, providing a link to Minmi and the proposed Richmond Vale Rail Trail (City of Newcastle, 2012, also refer to the Traffic and Transport Working Paper in Appendix G of the EIS). The alignment of this route would interface with the project and has been considered in the design development and cumulative impact assessment (**Chapter 10**).

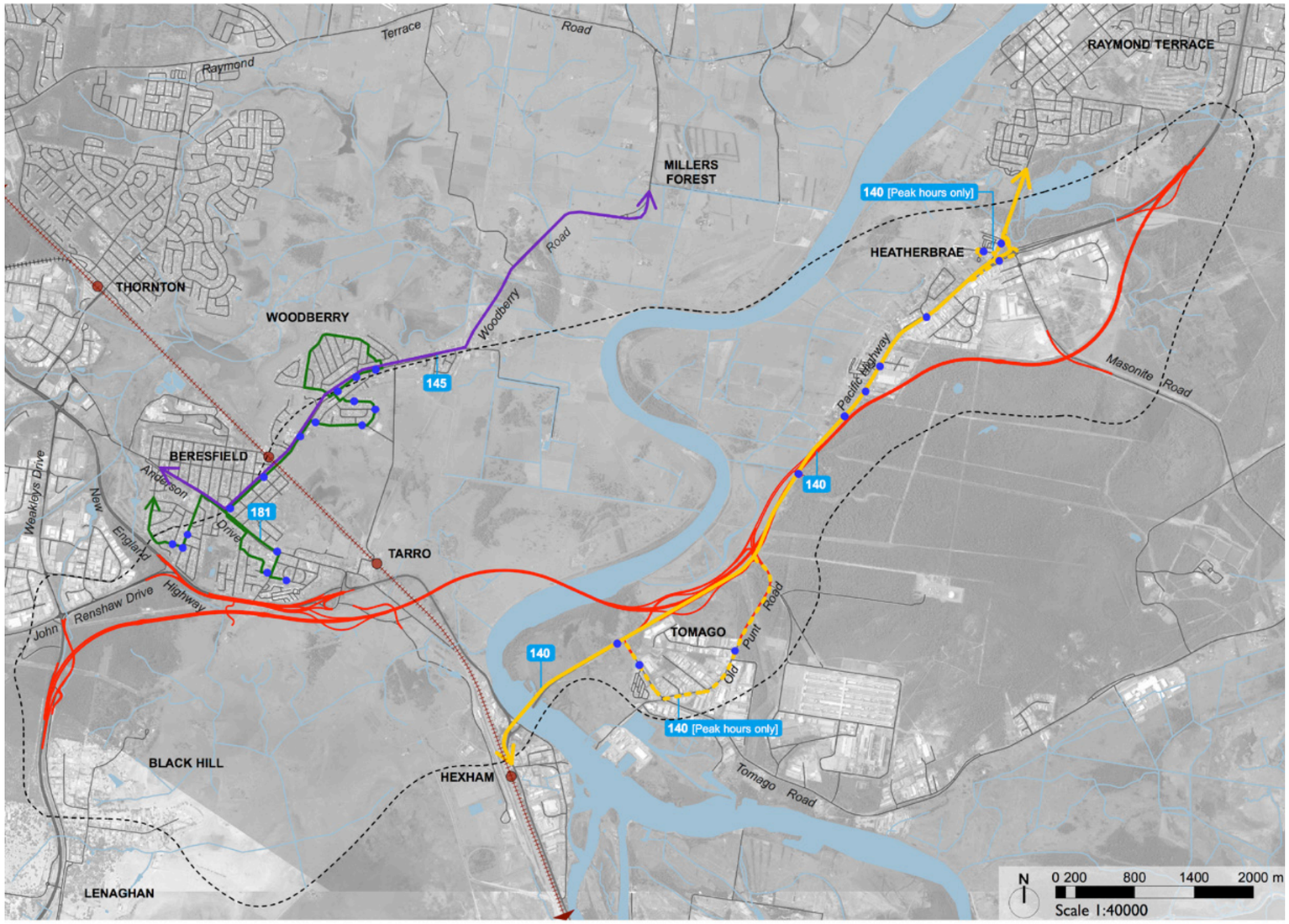

Figure 4–9 Public transport network

4.8.4 Relevance to urban design

- The project represents an opportunity to complete a high-quality route between Sydney and Brisbane and to ease the impacts of traffic and congestion on the communities surrounding the project
- The study area constitutes the junction between the three major road-based transport corridors in the region and would facilitate the merging of the M1 Pacific Motorway, New England Highway and Pacific Highway into a single corridor connecting both sides of the Hunter River floodplain. There is an opportunity to express this junction through the design treatment of major structures
- There is a need to:
  - Maximise the safety, convenience, and ease of access within the study area through direct routes and connections, consistent with the project objectives (Chapter 3 of the EIS)
  - Retain the functionality and connectivity of public transport services including during project construction
  - Ensure the project maintains safe and easy access to public transport and bus stops
  - Maintain local as well as regional access to and between community destinations such as towns, main streets, recreation and tourism areas. The design of interchanges would need to ensure the project contributes to the accessibility and connectivity of the area by providing clear and legible connection points between the main alignment and urban areas, other activity areas and the highway corridors of the New England Highway and Pacific Highway.
- The project provides an opportunity for a more direct and continuous cycle route between Black Hill and Raymond Terrace using the project's road shoulders
- The project would reduce regional and interstate traffic on roads surrounding the project. This may facilitate a more attractive cycling environment
- There is a need to ensure council planned cycle links including the Tarro to Shortland cycleway would be able to be implemented in the future.

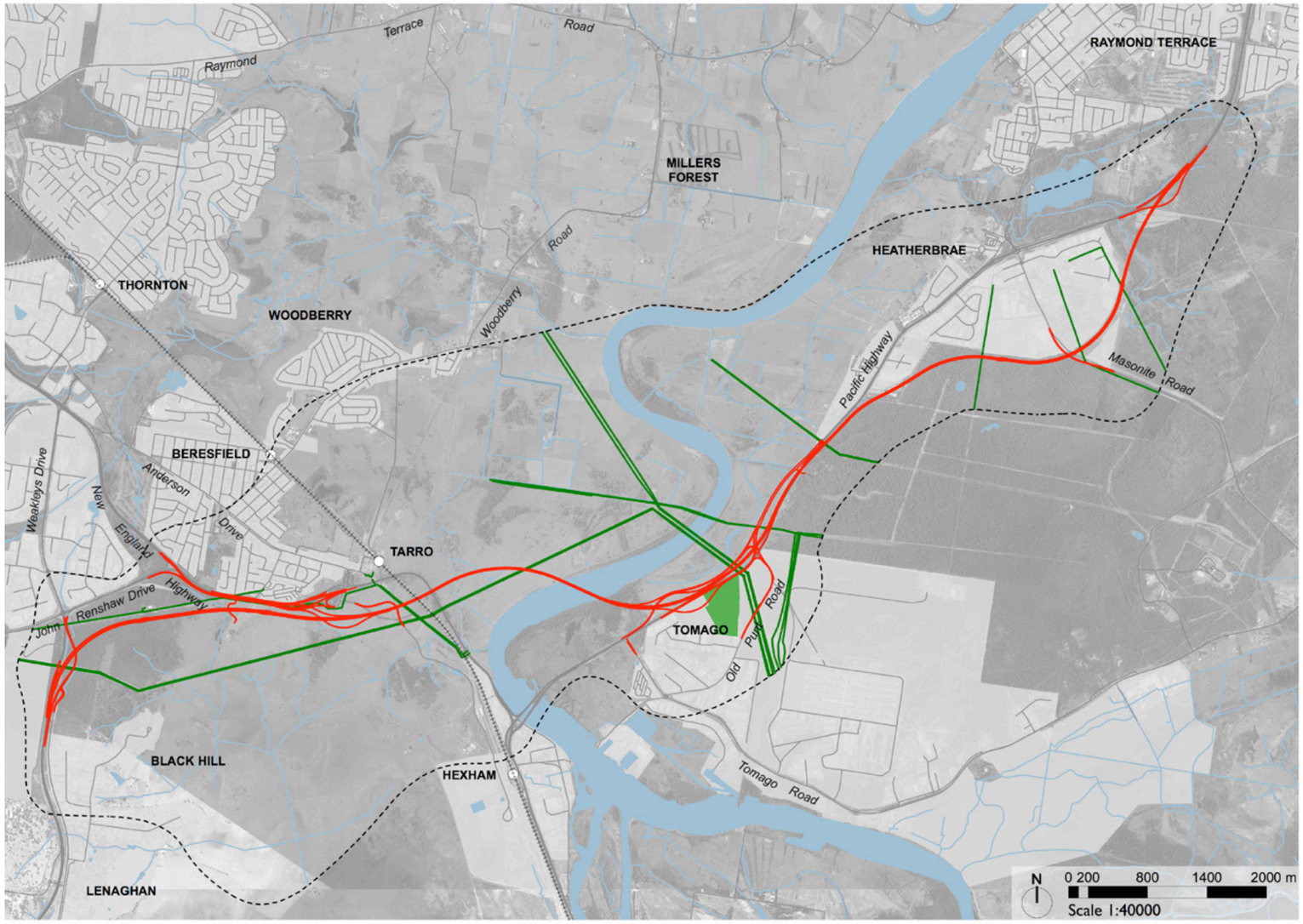

Figure 4–10 Above ground Utilities

4.9 Utility services

4.9.1 Existing characteristics

- A number of major utilities are located in the study area including:
  - Electricity supply and street lighting: Ausgrid and TransGrid including high and low voltage transmission lines
  - Telecommunications: Telstra, Optus, NBN and Nextgen optic fibre and telephone cables
  - Gas: Jemena and AGL pipelines. The Tomago to Hexham gas pipeline is near to the project. In addition, a gas-fired power station is proposed at Tomago between the Pacific Highway and Old Punt Road (**Figure 4–10**)
  - Water and sewer services and infrastructure: Operated by Hunter Water Corporation, and includes the Chichester Trunk Gravity Water Main.
- Power infrastructure including high voltage electricity transmission lines and power stations, is concentrated around Tomago, meeting the needs of Tomago Aluminium (**Figure 4–10**)
- Electricity transmission towers are prominent vertical elements in the generally flat and open landscape (**Figure 4–11**).

Figure 4–11 High voltage electricity transmission tower in the Hunter River floodplain

4.9.2 Relevance to urban design

- Utilities would need to be relocated, adjusted or protected where they may be affected by the project. Utility relocation, adjustment or protection is described in Chapter 5 of the EIS
- Power infrastructure poses a constraint for the project, in terms of vertical and lateral clearance requirements for the project
- Both above and below ground utilities pose a constraint for the landscape design of the project
- There is a need to integrate operational and maintenance access requirements into the project.

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5 URBAN DESIGN STRATEGY

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5.

Urban design strategy

5.1 Introduction

The urban design vision, objectives and principles have been developed having regard to:

- The project objectives (Chapter 3 of the EIS)
- The project SEARs (**Section 1.4**)
- The Pacific Highway Urban Design Framework (PHUDF) (**Section 2.2.7**)
- The principles outlined in Beyond the Pavement (**Section 2.2.1**)
- The contextual analysis of the existing environment in **Chapter 4**.

5.2 Urban design vision

5.2.1 Project-specific urban design vision

The PHUDF vision has been amended for the project. This has been considered appropriate for a number of reasons including:

- The partial application of the PHUDF to the part of the project north of Hexham
- The study area's distinct character in particular its inland setting away from the coast, with the Hunter River as the defining landscape element
- The project plays a unique role in the network at the junction of the New England Highway and the Pacific Highway
- The project would facilitate the merging of the New England Highway and the Pacific Highway corridors into a single high-speed corridor.

The urban design vision adopted for the project is:

Provide a flowing green corridor that integrates sensitively with the natural environment and community setting of the area. The project will capitalise on its setting with expansive views over the Hunter River floodplain with simple and well-designed project elements. The project will provide a clear and legible junction integrating the Pacific Motorway and the New England Highway that improves local, regional and interstate connectivity while contributing to the sense of places of communities along the corridor.

5.2.2 Urban design objectives and principles

Building on the project urban design vision, five urban design objectives were adopted for the project. The objectives have adapted the PHUDF objectives (**Section 2.2.7**) to cover all project elements. They seek to integrate the project sensitively with the surrounding context, taking into account the project corridor and its relationship with surrounding areas and existing natural, built and community values.

Urban design principles link a project's vision and objectives to the urban design concept, setting down the defining approach, ideas and themes. The adopted urban design objectives and principles for the project are shown in **Table 5–1**.

Table 5–1 Project urban design objectives and principles

Urban design objective	Urban design principles
Objective 1: Provide a flowing road alignment that is responsive to and integrated with the landscape	1. Maintain and integrate the road corridor with existing landscape types and characters where possible, considering different woodland, open floodplain and rural landscapes.
Objective 2: Provide a landscaped motorway that integrates with the adjoining natural setting	1. Integrate the road into existing vegetation patterns to maintain the sense of place and help maintain ecological and biodiversity values 2. Use vegetation strategically to guide motorists' views to contribute to and maintain the scenic quality of the route 3. Use planting to visually separate adjoining roadways and to maximise the character of the motorway through the coastal hinterland landscape setting 4. Design cuttings and embankments to maximise opportunities for vegetation to be established.
Objective 3: Provide an enjoyable, interesting motorway	1. Use tree cover and other landscape treatments to provide an interesting sequence of open views and sections of motorway enclosed by vegetation, drawing on existing views, vistas and spatial patterns 2. Take advantage of the opportunities provided by the viaduct and other elevated road infrastructure to provide views of the surrounding landscape 3. Retain and strengthen views to local landmarks including heritage items 4. Design the motorway, interchanges and local road connections to be self-explanatory, legible and easy to navigate 5. Identify opportunities for art and/ or interpretive elements to contribute to place-making, and strengthen local and cultural identities 6. Capitalise on the opportunities offered by the Hunter River bridge and viaduct that provides a positive legacy and a new landmark for both local communities and motorists travelling the length of the M1 Pacific Motorway.
Objective 4: Value the communities and towns along the road	1. Provide an alignment that avoids community severance by skirting the edges of existing townships or settlements 2. Design the project to provide connectivity between the motorway and key populated areas and for ease of access to current and future residential, community, industrial and employment areas 3. Maintain the accessibility and connectivity of surrounding communities for all users including motorists, public transport users, cyclists and pedestrians and ensure connections are safe, convenient, logical and integrate the principles of Crime Prevention Through Environmental Design (CPTED) 4. Support the area's tourism industry by maintaining cultural and landscape values 5. Provide visual buffers to sensitive receivers to enhance the sense of privacy through landscaped areas 6. Design interchanges as attractive decision-making points that highlight the towns and other destinations along and beyond the route. Consider the potential of major project elements to integrate art, interpretation and other place-making features to celebrate local communities and provide contextual interest.
Objective 5: Provide a simplified and unobtrusive road design	1. Place road furniture judiciously to maintain important views and vistas 2. Ensure adjoining land uses and the natural environment remain free of lighting impact 3. Design bridges as simple and elegant structures of contemporary form 4. Maximise consistency of design and detailing for similar types of bridges.

5.3 Urban design approach

The urban design approach for the project derives from the contextual analysis in **Chapter 4** and considers:

5. The travel experience along the project as created by the various project elements and their interaction with the surrounding natural, built and community context
6. The existing character and values of the surrounding natural, built and community context, specifically:
   - The project's landscape setting. The Hunter River and floodplain at the heart of the study area defines the overall landscape character through (**Figure 5–1**):
     - The contrast between the low-lying floodplain and elevated areas with their mix of urban areas and bushland remnants
     - The resulting differences in spatial character and available views ranging from fully enclosed bushland areas, urban interface areas with views over the floodplain to one side of the project and open floodplain areas with views in all directions.
   - The road network context. The multiple interactions between the M1 Pacific Motorway, the New England Highway and the Pacific Highway facilitate a complex array of local and regional transport movements (**Figure 5–1**). The implementation of the project would allow the road network to function as one elongated network interchange. This provides an urban design opportunity to:
     - Highlight the project's network role through urban design that is distinct from adjoining network corridors
     - Assist legibility, way-finding and orientation by clearly distinguishing the project's main alignment from the New England and Pacific Highway corridors through the design of major project elements.
   - Local communities. The project seeks to value communities along the project. Specific measures to enhance healthy, cohesive and inclusive communities include:
     - Designing the project to avoid community severance
     - Providing connectivity between the project and key populated areas including current and future residential, community and employment areas
     - Enhancing walking and cycling connectivity
     - Supporting the tourism industry by maintaining accessibility as well as cultural and landscape values.
   - Providing buffers to sensitive receivers.

Urban design strategy plans

The purpose of the urban design strategy plans is to further illustrate and describe the urban design approach. There are four interrelated elements:

1. **Integration with existing features and vistas in the study area**
   Figure 5–2 summarises a number of opportunities for the project to respond to existing views and features of the study area
2. **Spatial character and views**
   Figure 5–3 illustrates the relationship between vegetation/ spatial enclosure and views in the study area. It highlights long-distance views from the project that contribute to the motorists' experience and provide a connection to the study area. The diagram identifies strategies for enhancing the existing spatial character and views over the Hunter River floodplain
3. **Cycle connections**
   Figure 5–4 illustrates existing and planned council cycle routes and their relationship to the project. It highlights planned connection points between the project and the surrounding road network to supplement the existing network and support walking and cycling in the study area, thereby contributing to the accessibility and connectivity of communities
4. **Place-making**
   Figure 5–5 identifies opportunities provide an overall sense of place for the project though a consistent approach to the design of bridges and potential place-making opportunities. Bridges are categorised by type according to their location. This provides the basis for the development of the bridge design strategy (**Section 6.2**) and identifies opportunities for urban design treatments to highlight particular areas along the project. This includes the major project opportunity to provide sweeping views over the landscape setting from the Hunter River bridge and viaduct (B05).

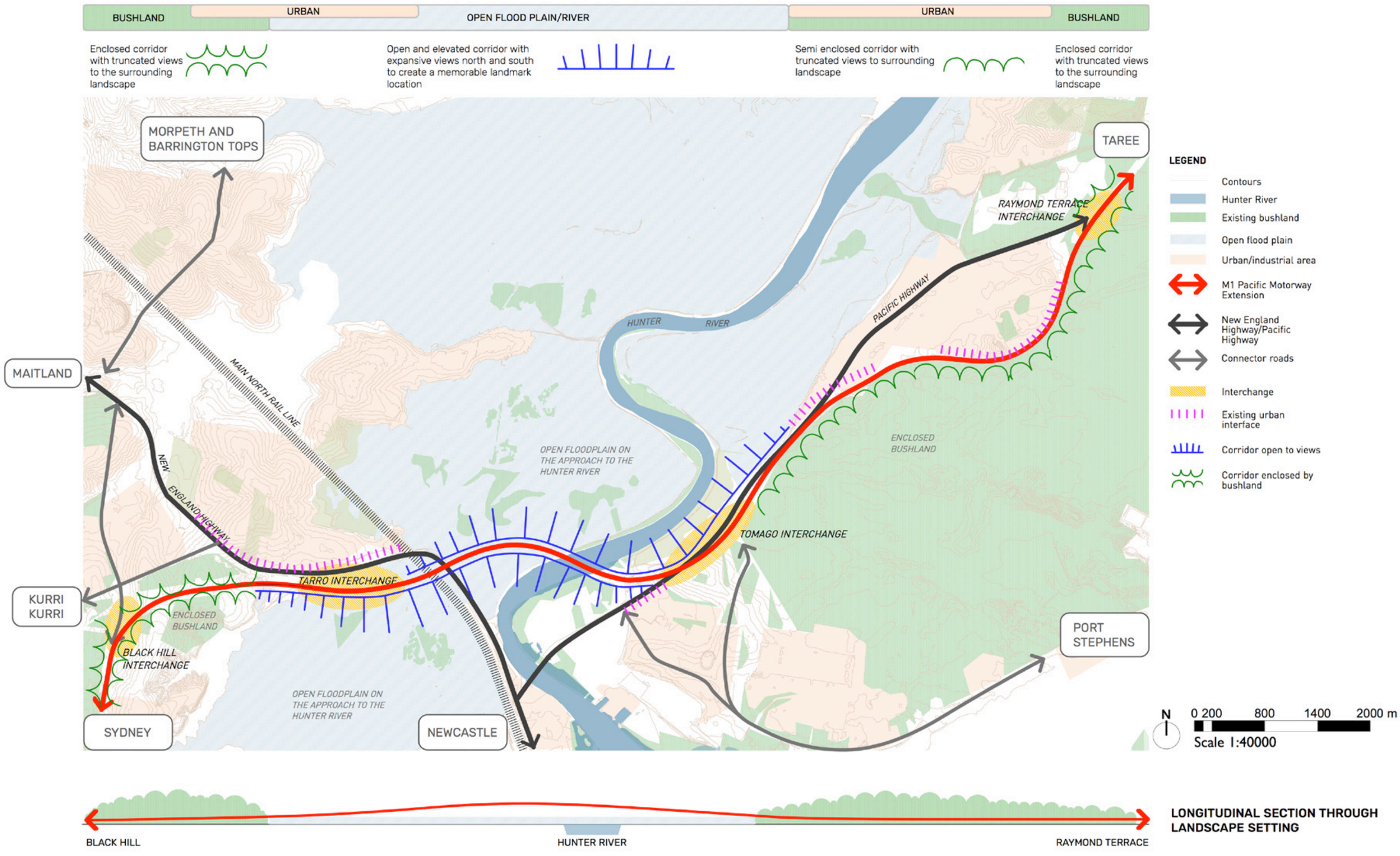

Figure 5–1 Landscape setting diagram

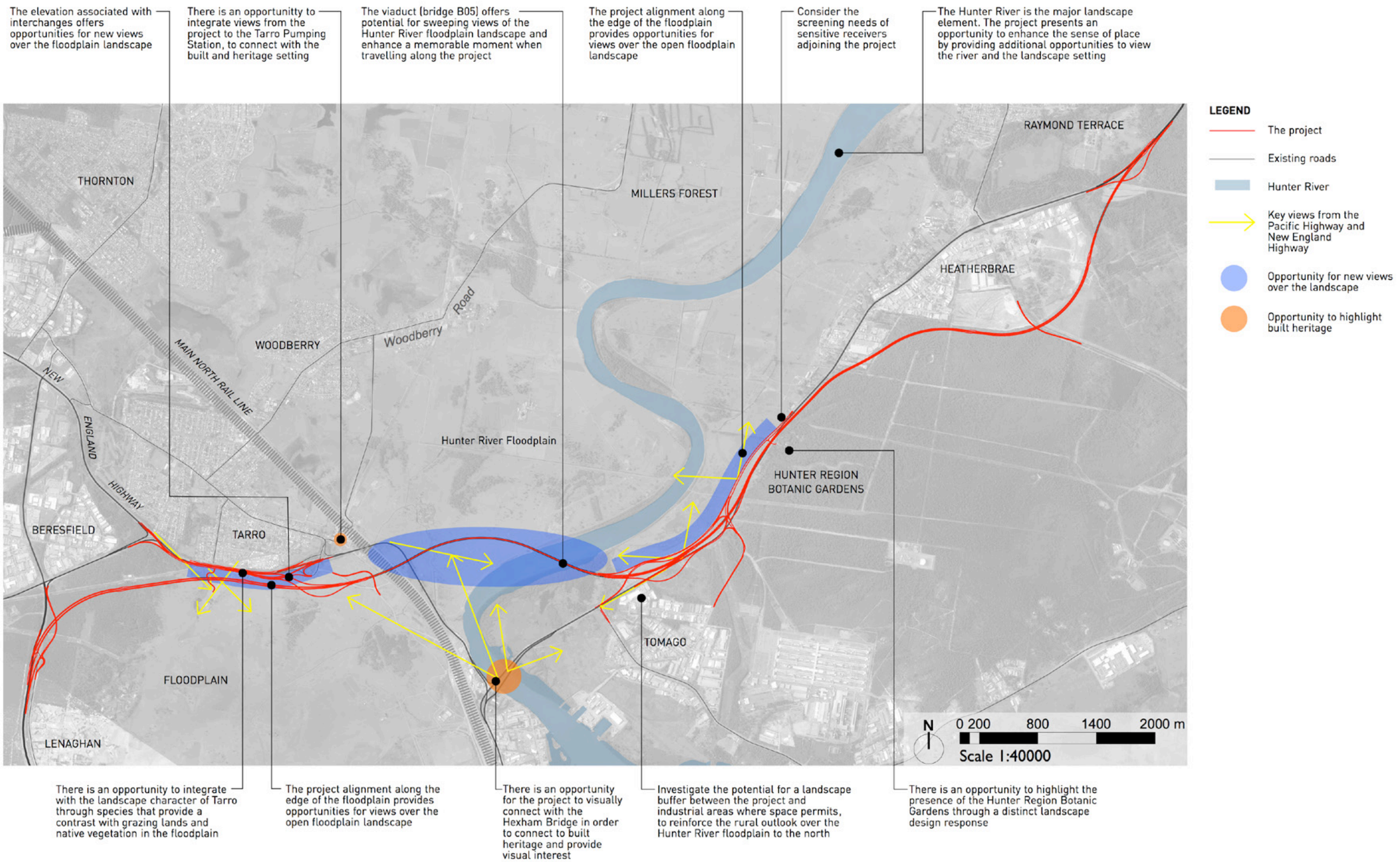

Figure 5–2 Urban design strategy: integration with existing features

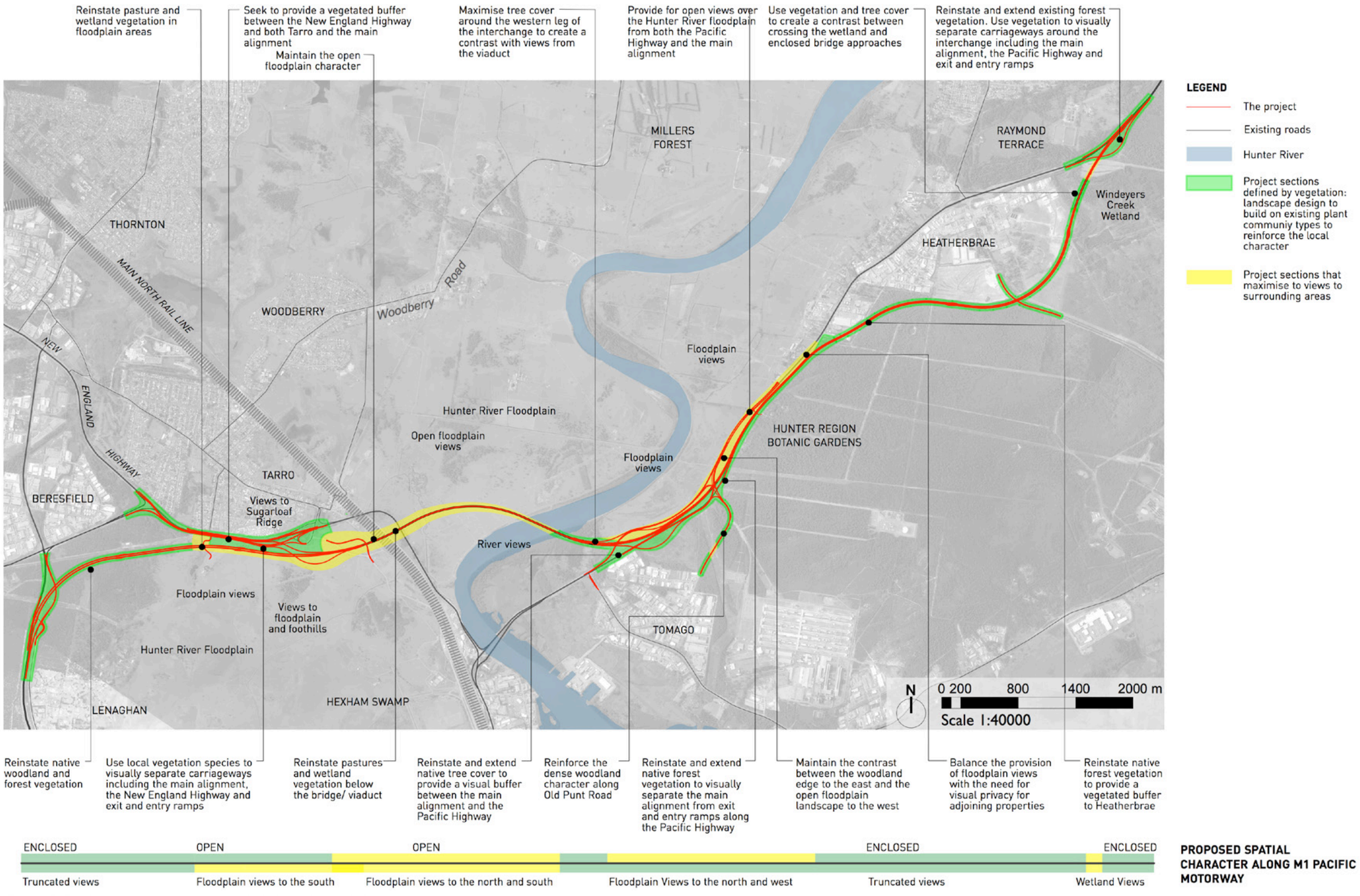

Figure 5–3 Urban design strategy: spatial character and views

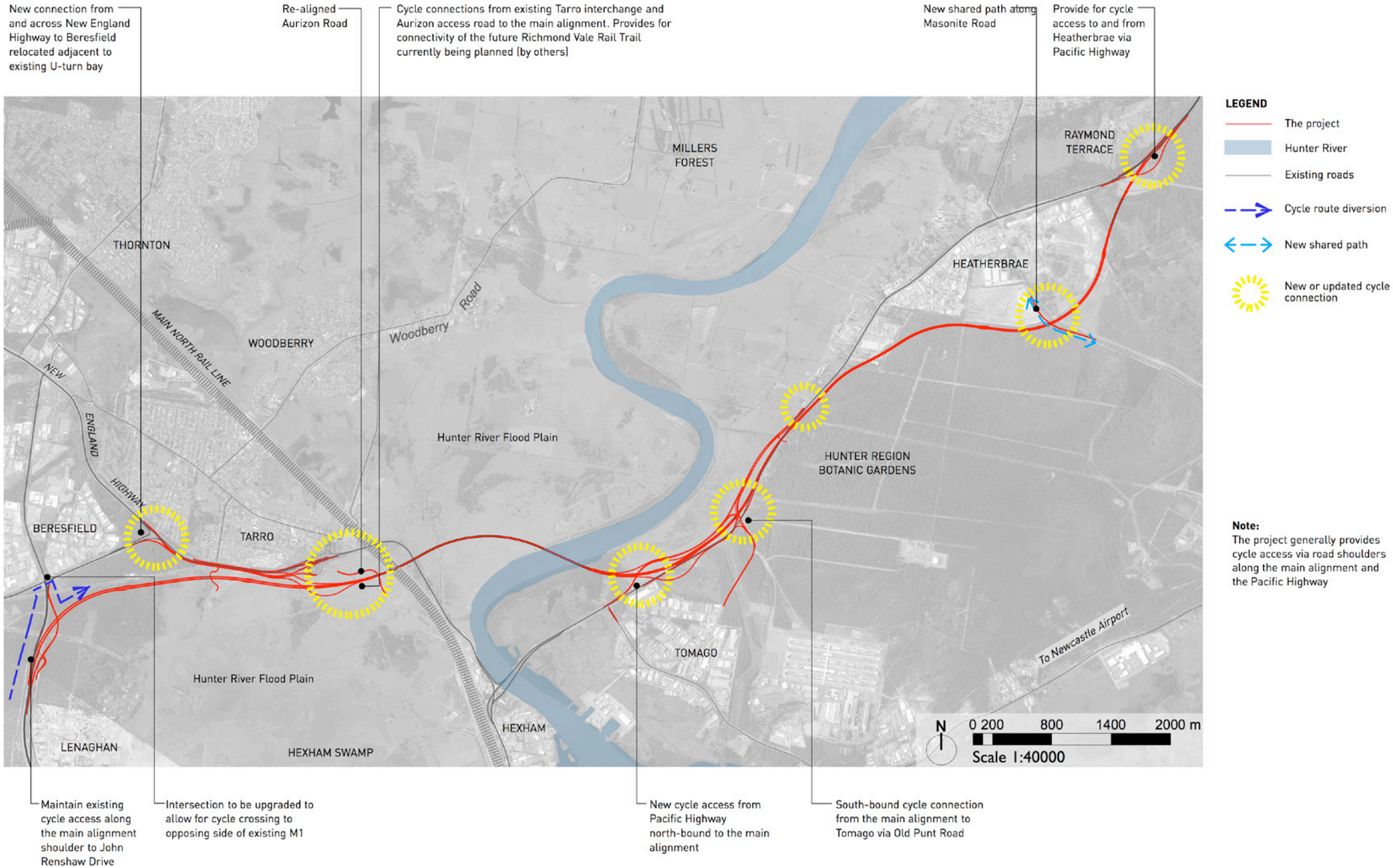

Figure 5–4 Urban design strategy: cycle connections

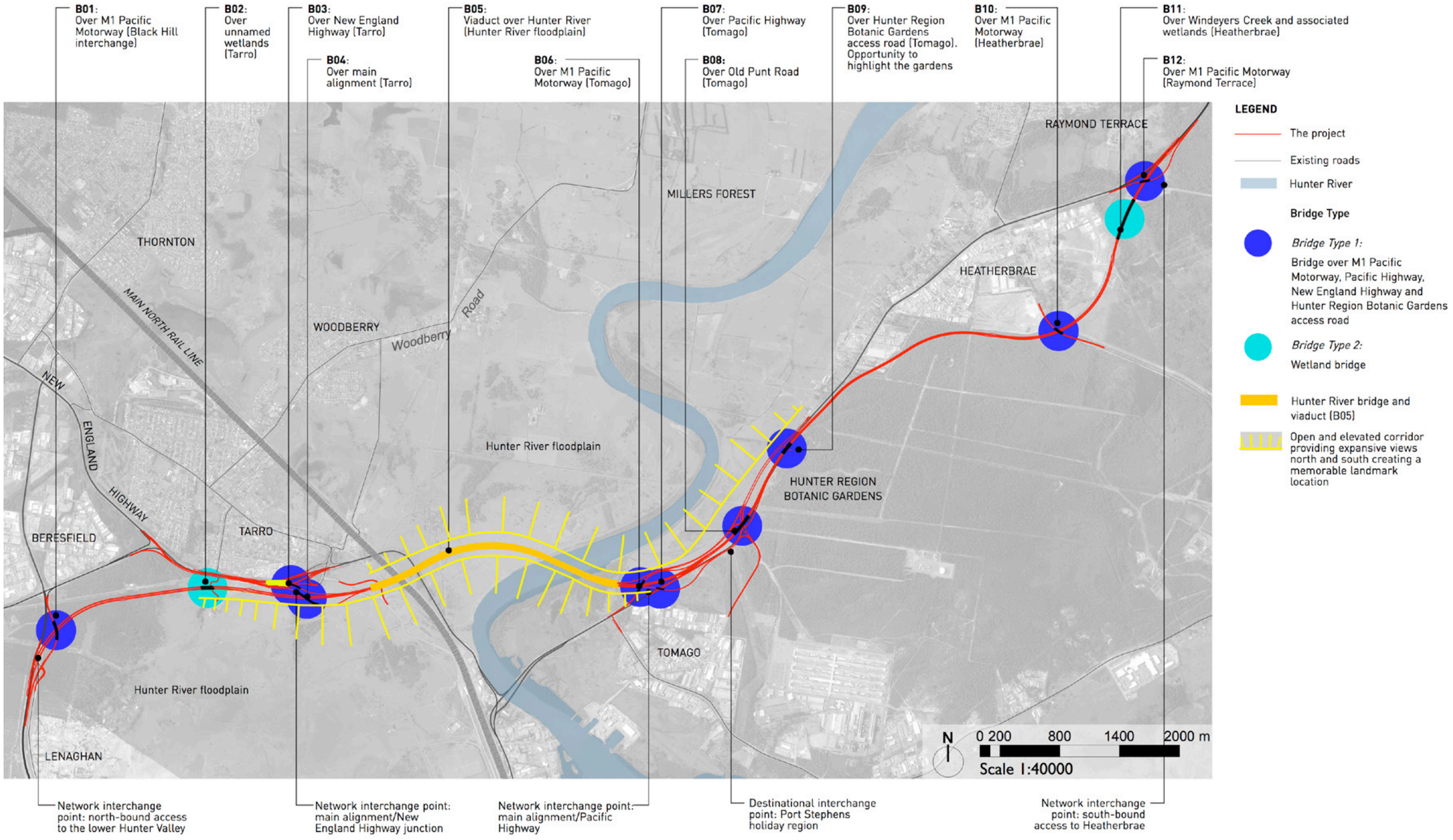

Figure 5–5 Urban design strategy: place-making

6 URBAN DESIGN CONCEPT

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6.

Urban design concept

6.1 Overview

The urban design concept addresses how the project fits into the surrounding area, how it supports local connections and how it contributes to communities and their natural setting. The urban design concept has been developed based on the urban design strategy outlined in **Chapter 5**. It describes and illustrates the relationship between the various project elements and the study area's built, natural and community context.

The urban design concept is described in several sections:

- **Bridges** (**Section 6.2**)
  This section describes the project's bridges
- **Retaining walls** (**Section 6.3**)
  Retaining walls including walls associated with bridges
- **Noise barriers** (**Section 6.4**)
  Noise barriers include noise walls and other types of barriers
- **Earthwork formations** (**Section 6.5**)
  Earthwork formations include the cuttings and embankments associated with fitting the project into its surroundings
- **Drainage and stormwater** (**Section 6.6**)
  Hydrological features include project stormwater management and drainage infrastructure
- **Roadside furniture** (**Section 6.7**)
  Roadside furniture for the project includes safety barriers, signage and messaging systems, lighting, fencing and other ancillary structures
- **Pedestrians, cyclists and public transport** (**Section 6.8**)
  Project infrastructure to support active and public transport in the area
- **Property access** (**Section 6.9**)
  Adjustments to existing access arrangements
- **Landscape design** (**Section 6.10**)
  This section outlines the landscape design approach adopted for the project
- **Crime Prevention Through Environmental Design** (**Section 6.11**)
  This section describes how CPTED principles have been integrated into the project.

A description of the design elements is followed by urban design drawings in **Section 6.12**, illustrating the project in its entirety.

6.2 Bridges

There are 12 new bridges (including three twin bridges) for the project. **Table 6–1** summarises information for bridges. More detailed information on the structural design of bridges is provided in Chapter 5 of the EIS. The urban design approach to bridges is described in **Section 6.2.1**. Bridges are illustrated in **Section 6.12.3**.

Table 6–1 Summary of bridge and key features

Note: All bridge features and dimensions are indicative and may change

ID	Name	Location	Structure	Key features
B01	Bridge over M1 Pacific Motorway	Black Hill interchange	• Super-T girders • Reinforced concrete portal frame pier • Northern abutment: spill-through • Southern abutment: reinforced soil retaining wall.	• About 72m, with two equal spans • Two traffic lanes. Potential for future third travel lane • Shoulders on both sides • Safety screens.
B02	Bridge over unnamed wetlands	Tarro	• Super-T girders • Circular concrete piers • Trapezoidal headstocks • Spill-through abutments.	• Twin bridges, about 104m in length • Four approximately equal spans • Two traffic lanes per bridge • Shoulders on both sides of each bridge.
B03	Bridge over New England Highway	Tarro interchange	• Bulb T girders • Reinforced concrete portal frame pier • Northern abutment: spill-through abutment including a reinforced soil wall to tie in with ramp retaining walls (refer **Section 6.3**) • Southern abutment: spill-through.	• About 101m, with four spans of varying lengths • One traffic lane with shoulders on both sides • Safety screens.
B04	Bridge over main alignment	Tarro interchange	• Bulb T girders • Reinforced concrete portal frame pier • Spill-through abutments.	• About 117m, with four spans • Single traffic lane, with shoulders on both sides • Safety screens.
B05	Viaduct over Hunter River	Hunter River and Hunter River floodplain, Tarro/Tomago	Three different sections: 1. Southern approach which crosses the Main North Rail Line, the New England Highway and the floodplain 2. Hunter River crossing 3. Northern approach.	Features common to all sections: • About 2,550m total length • Two traffic lanes in each direction • Shoulders on both sides that providing additional width for safety in case of breakdowns.
	Viaduct over Hunter River, Section 1 and Section 3	Approach spans (B05 viaduct)	• Super-T girders • Trapezoidal headstocks supported on blade columns • Reinforced concrete walled pier and integrated deflection walls next to the Main North Rail Line • Staggered piers under high voltage power lines.	• Varying span length • Safety screen where required • Near the northern abutment the bridge accommodates the northbound exit and southbound entry ramps.
	Viaduct over Hunter River, Section 2	Hunter River crossing (B05 bridge)	• Precast segmental balanced cantilever box girder spans • Circular piers with widened column capital • Blade piers near edge of the river to transition to approach spans.	• About 309m, with varying span lengths • Navigation clearance: 32m wide by 10m high.
B06	Bridge over M1 Pacific Motorway	Tomago interchange	• Bulb T girders • Reinforced concrete portal frame pier • Spill-through abutments.	• About 82m, with three spans of varying lengths • Two traffic lanes • Shoulders on both sides • Safety screens.

ID	Name	Location	Structure	Key features
B07	Bridge over Pacific Highway	Tomago interchange	• Bulb T girders • Reinforced concrete portal frame pier • Spill-through abutments.	• About 70m, with three spans of varying lengths • Single traffic lane with shoulders on both sides • Safety screens.
B08	Twin bridges over Old Punt Road	Tomago interchange	• Post tensioned voided concrete slab • Reinforced concrete portal frame pier • Spill-through abutments.	• Twin bridges, about 110m in length • Three spans of varying lengths • Two traffic lanes in each direction • Shoulders on both sides • Safety screens.
B09	Bridge over Hunter Region Botanic Gardens access road	Tomago	• 1,215mm deep Super-T girders • Spill-through abutments.	• About 28m in length, consisting of a single span • Single bridge for both travel lanes • Two traffic lanes in each direction • Shoulders on both sides • Safety screens.
B10	Bridge over M1 Pacific Motorway	Masonite Road, Heatherbrae	• Super-T girders • Reinforced concrete portal frame pier on driven steel piles • Spill-through abutments.	• About 68m in length, with two spans • One traffic lane in each direction • Shoulders and safety screens on both sides • Shared path on one side.
B11	Bridge over Windeyers Creek and associated wetlands	Heatherbrae	• Super-T girders • Circular piers • Spill-through abutments.	• Length: about 330m, with multiple spans • Two traffic lanes in each direction • Shoulders on both sides.
B12	Bridge over M1 Pacific Motorway	Raymond Terrace interchange	• Bulb T girders • Reinforced concrete portal frame pier • Spill-through abutments.	• Length: about 76m • Single travel lane • Two equal spans • Shoulders on both sides • Safety screens.

6.2.1 Bridge urban design approach

The urban design approach for bridges is to:

- Design bridges to be simple, contemporary and refined, avoiding unnecessary complexity and clutter to complement the landscape setting
- Maximise consistency of design for bridges of similar type regarding their substructure (including piers and abutments) and superstructure (including girders, bridge deck, headstocks, parapets, screens and railings) to ensure visual cohesion of the project
- Design bridges to reflect their prominence within the road network hierarchy
- Consider the overall composition of major structural elements where they occur in groups or clusters, for example around interchanges.

Two bridge types have been identified for the project and give rise to specific design treatments. The bridge types are (**Figure 6–1**):

1. Type 1: Bridges over roads
2. Type 2: Bridges over floodplains and wetlands including the viaduct.

Bridge types and the proposed design treatments are further described in the following sections and would be refined during detailed design.

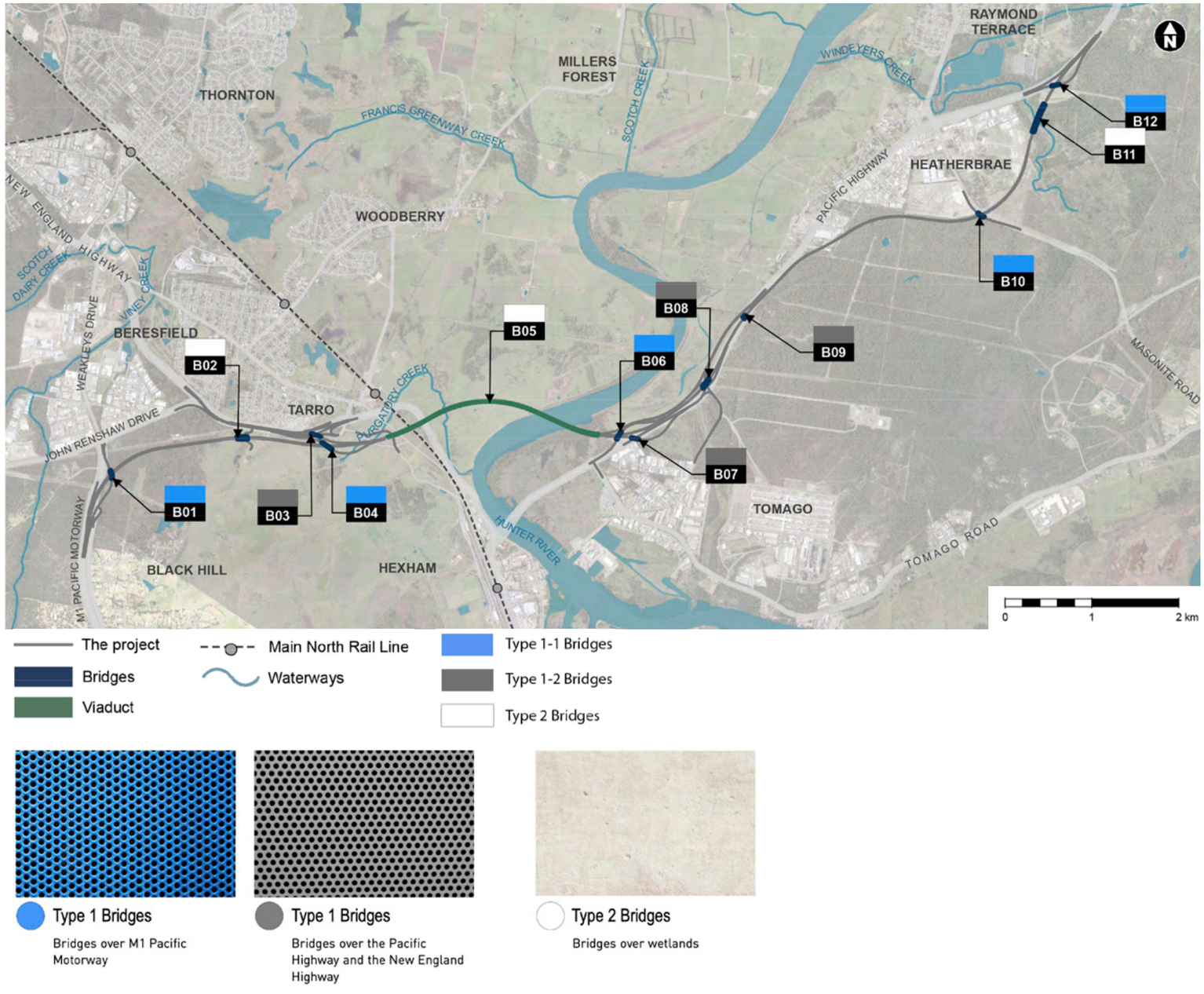


Figure 6–1 Project bridges

Type 1 bridges

The proposed M1 Pacific Motorway extension to Raymond Terrace is primarily a direct connection across the Hunter River between existing sections of motorway. It is also the primary junction between the M1 Pacific Motorway and the New England Highway at Tarro and the Pacific Highway at Tomago.

The merging of these major roads is associated with several bridges which facilitate movement between the respective road corridors as entry and exit ramps and sometimes the corridors themselves bridge over each other. Bridges therefore represent an opportunity to reinforce the motorists' location within the road network. Accordingly, these bridges have been identified as "type 1" bridges.

Project bridges over roads have a high visibility as they typically occur over the main entry/exit points of the M1 Pacific Motorway. They require a considered design approach that can signal landmarks for orientation and wayfinding for the motorist.

A distinctive design treatment is proposed for Type 1 bridges to provide for orientation and wayfinding for motorists travelling on any of these major roads. The treatment differentiates two sub-categories (**Figure 6–2**):

- Bridges over the M1 Pacific Motorway
- Bridges over the other roads including the New England Highway, Pacific Highway and local roads.

The proposed design treatment would unify the overbridges associated with each sub-category into a cohesive set of structures. This would create a distinctive identity for this section of the M1 Pacific Motorway, highlighting and reinforcing the strategic location of the project within the National Land Transport Network – also refer **Section 4.8**.

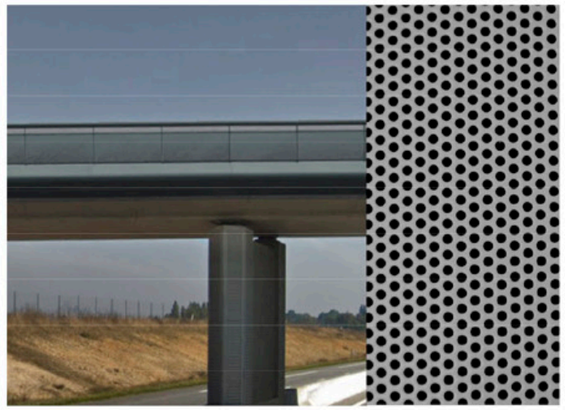
The design of Type 1 bridges is illustrated on **Figure 6–2 a**nd includes:

1. Perforated metallic cladding along bridge parapets that is integrated with the bridge safety screen. The design of the safety screen would reinforce the horizontal form of the bridges and help reduce visual bulk. The colour of safety screens and cladding serves to differentiate the respective road corridors as follows:
   - Bridges over the M1 Pacific Motorway would respond to the waterways and floodplains of the study area by integrating elements of blue
   - Bridges over the Pacific Highway and the New England Highway would be characterised by neutral tone that contrasts with bridges over the M1 Pacific Motorway.
2. The remaining visible elements of the superstructure and substructure would remain standard concrete colouring and exhibit subtle design detailing. Examples might include chamfered corners or tapered piers and headstocks with a smooth plain concrete finish
3. Safety screen posts would match the parapet cladding colour. Safety screen mesh would be of a type and colour that would maximise transparency
4. The spill-through bridge abutments would be a simple concrete paved finish in a dark grey colour to provide a restrained finish that visually recedes relative to the adjoining landscape.

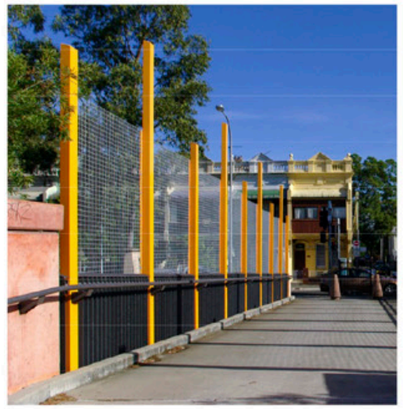
Type 1 Bridges

- Bridges over M1 Pacific Motorway
- Bridges over the New England Highway & Pacific Highway

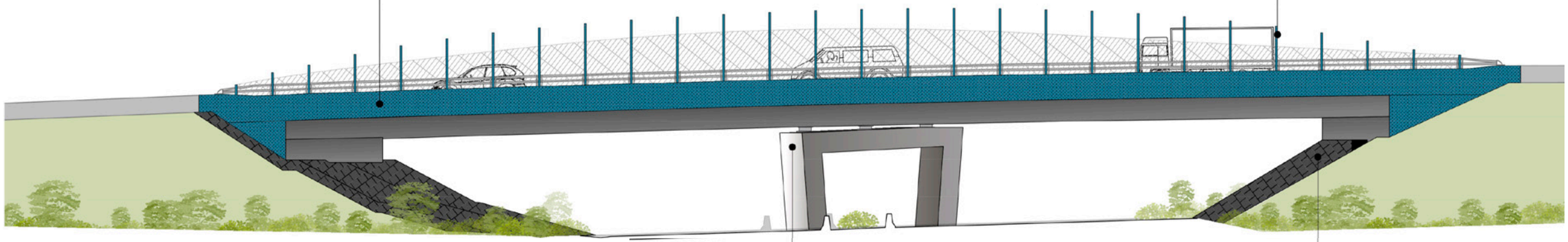
Blue coloured perforated metallic cladding integrated with the safety screen and extending over the bridge parapet of bridges over the M1 Pacific Motorway



Neutral tone perforated metallic cladding integrated with the safety screen and extending over the bridge parapet of bridges over the Pacific Highway, New England Highway and local roads



- Coloured safety screen posts to match metalic cladding
- Dark mesh to reduce visibility of screens



Typical elevation of Type 1 bridge over M1 Pacific Motorway showing proposed urban design outcomes. For specific bridge elevations refer Section 6.12.3

Plain concrete piers with subtle detailing (eg. chamfered or tapered edges)

Bold and simple surface patterning abutments in a dark grey colour

Figure 6–2 Urban design concept for Type 1 bridges

Type 2 bridges

Type 2 bridges include two sub-categories:

- The 2.6 kilometre long viaduct (B05) over the Hunter River and its floodplain would be a major new element in the landscape. Due to the inherently commanding nature of the structure, a simple and restrained character and form would be appropriate, allowing the height and form of the bridge to be the major feature, as it undulates over the floodplain
- The two wetland bridges (B02 and B11) are of low visibility and require minimal design treatments.

For the viaduct (B05) over the Hunter River and its floodplain simple and refined structural design would be key to the creation of a new landmark that responds to the cultural and community context as well as the functional requirements.

The design criteria for the two wetland bridges are illustrated in (**Figure 6–3**):

1. Design bridges to be efficient and functional structures that exhibit simplicity of form and character. Standard details for the parapets and bridge rail barriers would maximise views for motorists to surrounding areas
2. Standard bridge detailing would be appropriate for the superstructure and substructure in order to maximise ease of construction and maintenance
3. The spill-through bridge abutment would be a simple rip-rap finish to meet scour protection requirements.

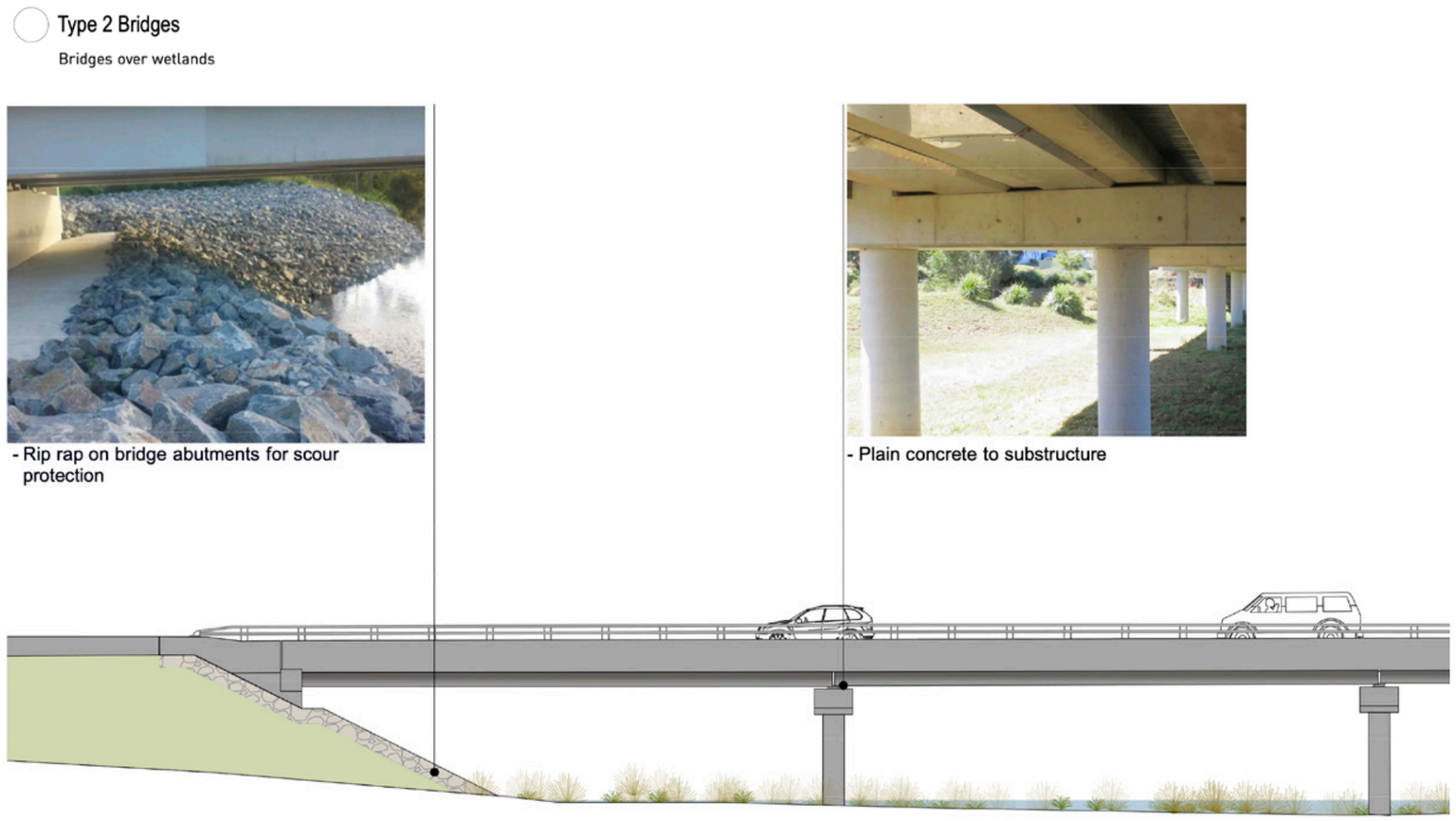


Figure 6–3 Urban design concept for Type 2 bridges

6.3 Retaining walls

6.3.1 Urban design approach

The project design has sought to:

- Avoid the use of retaining walls where possible
- Mitigate the height of retaining walls through the use of vegetation.

Retaining walls along the project are generally limited to locations at interchanges, on the approaches to bridges. Three retaining wall structures would be required for the project. They are summarised in **Table 6–2**.

Consistent with the open character of the landscape, the design has sought to maximise visually open arrangements under bridges. This involved a preference for spill-through abutments over retaining walls, as spill-through abutments enable views into the surrounding landscape. Retaining walls on the project are used to:

- Shorten bridge spans relative to spill-through abutments
- Help overcome the level changes between different travel lanes or ramps where space constraints preclude the use of sloped embankments
- Contain approach batter slopes from extending out onto the roadway.

In these instances, retaining walls reduce the overall footprint of the project.

Table 6–2 Retaining wall summary

ID	Location	Maximum height (m)	Length (m)
RW1	Reinforced soil wall bridge abutment at bridge B01 (**Section 6.12.4**)	5.5	60
RW2	Concrete retaining wall along northbound entry at Tarro interchange (**Section 6.12.4**)	4.5	200 (both sides)
RW3	Reinforced soil wall bridge abutment at bridge B03 (**Section 6.12.4**)	9	27

6.3.2 Wall finishes

Retaining walls associated with bridges would be reinforced soil walls constructed of precast concrete panels. The exception is RW02 which would be a plain, off white cast in situ wall. Walls would be treated to ensure their surface restricts glare. In areas at risk from vandalism an anti-graffiti sealer would be applied to walls to ensure walls are easily cleaned in the event of a graffiti attack.

The majority of retaining walls are well set back from traffic lanes. This allows the use of vegetation to soften the wall façade and maintain a green outlook that corresponds to the project's setting as shown on **Figure 6–34**.

6.4 Noise barriers

Noise treatments for the project are detailed in the Noise and Vibration Working Paper (Appendix H of the EIS). Three noise barriers have been identified as shown on **Figure 6–4**, and include:

- NB01, an existing retained noise barrier about 265 metres in length. A short section of NB01 near Lenaghans Drive would require a minor alignment adjustment to accommodate the south-bound entry to the existing M1 Pacific Motorway
- NB02, an existing noise barrier to about 1105 metres in length that would be repaired in place. It would be complemented with new sections near Pasadena Crescent Reserve and between Christie Road and Quarter Sessions Road
- NB03, a new noise barrier about 741 metres in length.

Generally, noise barriers for the project would be provided in locations where there are either existing noise barriers present or on alignments that closely follow existing road corridors. This would avoid tree and vegetation removal, minimising changes to the existing environment and associated landscape character and visual impacts.

Further assessment would be carried out during detailed design to confirm the location and height of the noise barriers and refine the design. Consistent with Transport's Noise wall design guideline (TfNSW, 2016b), the urban design principles for noise walls are:

- Use finishes and materials that are sympathetic to the immediate setting as well as the local environment, reduce the perceived scale of noise walls and contribute to the amenity and visual quality of the area
- Integrate noise walls with the design of the project including road furniture and landscape elements to ensure a considered composition of all elements
- Where it is safe and feasible provide space for screening vegetation on both sides of noise barriers, in order to maintain the predominantly green landscape outlook, and to soften the perceived scale of walls
- Consider whether noise walls offer suitable opportunities for integration of interpretive elements or public art.

Figure 6–4 Noise barriers along the project. Sheet 1 of 2

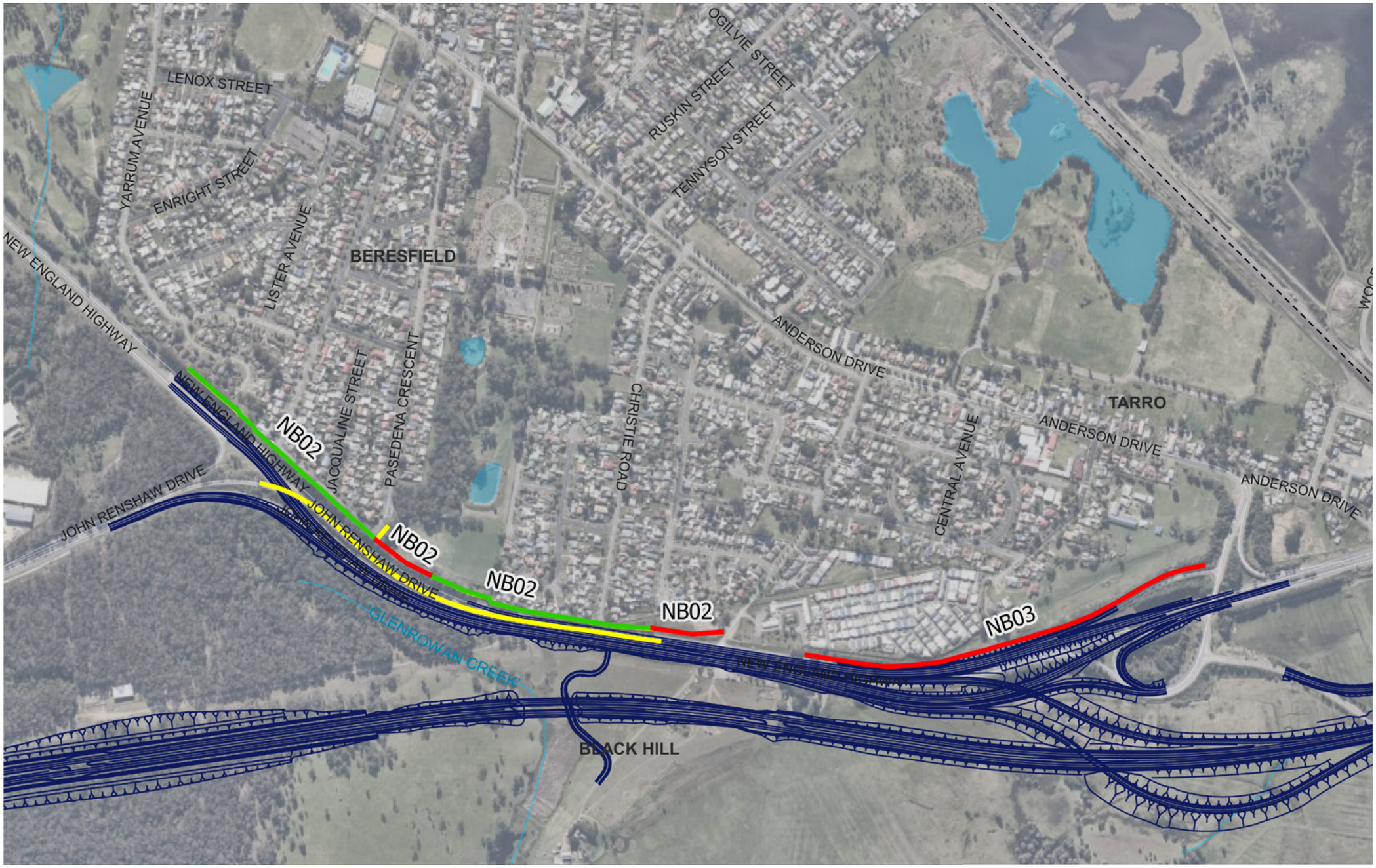


Figure 6–4 Noise barriers along the project. Sheet 2 of 2

6.5 Earthwork formations

A number of cuttings and embankments would be required along the main alignment due to the undulating topography. Large cuttings and embankments would not be required along local roads, with the exception of Masonite Road which requires large embankments to bridge over the main alignment. The location and dimension of cuttings and embankments would be confirmed during detailed design.

All slopes would be revegetated to integrate the project with the surrounding landscape (**Section 6.10**). Slope stabilisation would be consistent with the Transport's Guideline for Batter Surface Stabilisation using vegetation (TfNSW, 2015).

6.5.1 Cuttings

Generally, cuttings would slope at a rate of one metre of vertical rise for every two metres of horizontal run. The exception to this is the cutting at Black Hill which would have slope at a rate of one metre of vertical rise for every 2.5 metres of horizontal run (**Figure 6–15**). Benches would be provided where required for slope stability and maintenance access. Cuttings are subject to change following geotechnical analysis.

Vegetation is the preferred treatment for cuttings, with the cut formations adopted for the project providing a slope that could be successfully vegetated. Rounding of the top edges of the batters would be applied to transition from batter slopes to natural ground. Together with vegetation, this would help to integrate the formation with the surrounding landscape.

Subject to geotechnical and soil conditions as well as utility constraints, vegetation of cut batters with vegetation incorporating trees would be the preferred outcome for the project in order to maximise integration with surrounding bushland. Geotechnical information obtained to date indicates that canopy trees would be suitable for use on cut embankments. This would be confirmed during detailed design.

Where cut batters are in hard rock or where it is not reasonable and feasible to revegetate cut batters, they would be left as natural stone where stable. Any slope stabilisation treatments would be in accordance with Transport guidelines.

Shotcrete

Generally, the project would seek to avoid the use of shotcrete in cuttings. Shotcrete would only be used in locations where unstable geology unsuitable for vegetation is uncovered during detailed design investigations and/or site excavation and in accordance with Transport's Shotcrete design guideline (TfNSW, 2016a).

6.5.2 Embankments

Embankments are potentially highly visible, unnatural formations. To minimise the visual effect of embankments, the project has adopted the following strategies:

1. Development of a project alignment that generally follows the edge of the floodplain where embankments are able to be integrated with the rising topography. The backdrop of elevated townships and vegetated areas helps absorb the project into the landscape when seen from a distance across the open floodplain landscape
2. Vegetating embankments to soften their appearance and to reflect and integrate with the surrounding landscape. The integration of topsoil into the design of batters would be critical to ensure long-term success of vegetation. The preferred installation technique for vegetation would be confirmed during detailed design, consistent with Transport's Guideline for Batter Surface Stabilisation using vegetation (TfNSW, 2015)
3. Installation of trees at the bottom of embankments, where feasible
4. Flattening out the toes of steep embankments would be flattened out to achieve better integration with the surrounding landform
5. Flattening of batters where space permits.

Further detail on earthworks is provided in Chapter 5 of the EIS. A representative range of embankments along the project is illustrated in the cross sections in **Section 6.12.2**.

6.6 Drainage and stormwater

Much of the project would be located in a flood-prone area (**Figure 4–2**). One of the project's objectives is to improve route reliability, reducing the need for periodic road closures due to flooding. The project would provide a minimum flood immunity to the 1 in 20 average recurrence interval event. At the same time, the design of the project would generally allow the natural flow regimes to be maintained.

Due to the location of the project near environmentally sensitive areas including waterways and catchment management areas (**Section 4.3**), the project has been designed to avoid direct discharge into sensitive areas.

The following sections provide an overview of key drainage design elements. Further detail on the project's drainage design is provided in Chapter 5 of the EIS.

6.6.1 Water quality

Water quality management infrastructure for the project would include water quality controls such as basins, vegetated swales and spill containment bunds at drainage outlets. Thirty-nine permanent operational water quality basins would be required for the project, with the design seeking to convert construction basins to operational (where possible) to avoid extensive impacts from basin construction.

The design has sought to maximise the use of vegetated swales on the approach to water quality basins. This would constitute green infrastructure that assists in visually integrating swales with the landscape setting as well as treat water quality, helping to reduce basin size.

6.6.2 Creek adjustments

The design for the project sought to minimise adjustments to natural creeks and waterways. However, two waterways would need to be adjusted:

- Unnamed tributary of Viney Creek: About 150 metres of an intermittent drainage line associated with Viney Creek would need to be adjusted to accommodate the M1 Pacific Motorway entry ramp from the Weakleys Drive and John Renshaw Drive intersection. The adjusted tributary would consist of a grass lined channel (**Figure 6–5**)
- Purgatory Creek: About 320 metres of Purgatory Creek would be adjusted to the south to accommodate the Tarro interchange. The adjusted creek would consist of a ten metre wide grass lined channel. As far as practicable, creek adjustments would be designed in a way that mimics natural flow conditions (which are ephemeral) (**Figure 6–7**).

The adjusted creeks would be rehabilitated with vegetation following construction of the project (refer to the urban design plans in **Section 6.12.1**). The potential hydrological and ecological impacts of creek adjustments are discussed in the BAR (Appendix I of the EIS) and the Hydrology and Flooding Working Paper (Appendix J of the EIS).

6.7 Roadside furniture

The project would require a range of roadside furniture to support safety in operation. Roadside furniture would be typical of motorway environments and would be placed in accordance with respective standards and guidelines. Roadside furniture would include:

- Safety barriers, designed to suite the different conditions along the project
- Safety screens (refer **Section 6.12.3** for drawings illustrating bridges and safety screens)
- Furniture associated with bus stop relocation (refer plans in **Section 6.12.1**)
- Systems for monitoring and managing traffic would include closed circuit television and variable message signs
- Signage to enforce road rules and regulations, provide information on direction of travel, posted speed limit and parking restrictions and provide information on services at Beresfield and Heatherbrae including the Hunter Region Botanic Gardens
- Emergency and traffic management facilities including emergency cross-over, U-turn and stopping bays, emergency phones, median gates and bollards
- Headlight glare attenuation measures where required (refer **Figure 6–11**)
- Fencing to restrict access to the motorway and other operational areas
- Fauna crossing structures along the main alignment including canopy bridges, glider poles, under bridge crossings and fauna fencing. Refer to the BAR (Appendix I of the EIS) for more detailed information on fauna crossings
- Lighting would generally not be required along the project but would be provided at interchanges and associated ramps in accordance with the Australian Standards (AS/NZS1158.1.1:2005 Lighting for Roads and Public Spaces and AS/NZ4282-1997 Control of the Obtrusive Effects of Outdoor Lighting).

6.8 Pedestrians, cyclists and public transport

The project would provide a shared path about 600 metres in length along the eastbound lane of Masonite Road between the proposed overpass and the Tomago Road and Pacific Highway intersection at Tomago. A second section of shared path is provided along the Hunter Region Botanic Gardens access road under bridge B09 (**Figure 6–11**), providing access between the bus stop located on the eastern side of the Pacific Highway and the Hunter Region Botanic Gardens.

In addition, the project would provide consistent widened shoulders for on-road cyclist use, resulting in a more direct and continuous route for cyclists from the current end of the M1 Pacific Motorway at Black Hill and the existing Pacific Highway north of Heatherbrae (refer to the urban design plans in **Section 6.12.1**).

The project provides connectivity to the Aurizon access road at Tarro, which would enable connection to the possible future Tarro to Shortland off-road cycle route planned by the City of Newcastle (**Figure 6–7**).

6.9 Property access and residual land

Much of the project is located near to existing road corridors, helping to minimise fragmentation and severance of larger rural property holdings. Following construction, land not required for the ongoing operation of the project would be reinstated to its original use or as agreed with affected property owners or disposed of in accordance with Transport guidelines for the disposal of surplus residual property (TfNSW 2020c). Access to any residual property parcels would be maintained via existing local roads or new service roads constructed as part of the project.

The project would require a new access road into the Hunter Region Botanic Gardens, as well as realignment of two existing access roads:

- Property access south of the New England Highway at Tarro would be cut off by the project. This private property access would be realigned to the west of the existing access and pass under the twin bridges over the wetland (B02) (**Figure 6–6**)
- The Aurizon access road off Anderson Drive and would be cut off by the project. A permanent diversion would be provided, with the diversion passing under the viaduct (B05) then tying into the existing access road south of the main alignment embankment (**Figure 6–7**). This road would also serve as the new route for the Tarro to Shortland cycle route proposed by City of Newcastle.

Transport would continue to consult with property owners through the detailed design and consider possible options for total acquisition and/or disposal of residual land, in accordance with Transport guidelines for the disposal of surplus residual property (TfNSW 2020c).

Land subject to temporary use will be rehabilitated as soon as practicable to an appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses. This will be carried out in consultation with the relevant council and/or the land owner. For more detail on residual land refer to the Land Use and Property Working Paper (Appendix N of the EIS).

6.10 Landscape design

The landscape design for the project provides specific direction for landscape work associated with the project.

6.10.1 Landscape design approach

The role of the project landscape design is to:

- Provide vegetative cover
- Stabilise the embankments and other areas disturbed by project construction to prevent erosion
- Complement adjoining cultural and natural landscapes, thereby helping to integrate the project with the local area and mitigating the landscape character and visual impacts associated with the project
- Restore native plant communities to maximise integration with existing PCTs (**Section 4.4**), thereby helping to reduce and mitigate project impacts on flora and fauna and contributing to the biodiversity goals for the Hunter Region (**Section 2.1.1** and **Section 4.4.3**).

6.10.2 Landscape design principles

The landscape design is based on the following principles:

- Retain existing vegetation where possible
- Vegetate all areas affected by the project and construction work. Areas within the construction footprint and outside of the operational footprint would generally be reinstated to their existing condition and would involve appropriate weed management as outlined in the BAR (Appendix I of the EIS)
- Re-establish native PCTs where they would be disturbed in order to restore ecological and habitat values and help biodiversity protection and recovery, where feasible
- Provide special treatments of distinct and/or larger plant stock in key locations such as urban interfaces and visitor destinations (i.e. Tarro and the Hunter Region Botanic Gardens) to create visual landmarks or highlights. The type and extent of special treatments would be resolved during detailed design
- Provide trees in verges and medians where it is safe and feasible to do so, based on clear zone and sight line requirements
- Where it is safe to do so, use vegetation to visually separate travel lanes and road corridors in order to:
  - Reduce the visual and landscape character impacts of multiple parallel travel lanes
  - Maintain a green outlook consistent with the regional setting and floodplain location.
- Where appropriate and feasible, use vegetation to screen the project from sensitive receivers nearby
- Place vegetation and in particular trees having regard to the presence of existing utility services assets and in accordance with the requirements of the respective asset owner such as water, stormwater, gas, power and communications services
- Use predominantly large-scale revegetation techniques such as seeding applications or bushland restoration. Planting or over-planting may be appropriate in select or highlight areas where an immediate established landscape effect is desired. This would be resolved during the detailed design
- Maximise the use of locally sourced plant material for all native vegetation including locally collected seed and plants grown from locally collected seed.

6.10.3 Vegetation species

The project would generally use plant species for the landscape design that build on the native PCTs of the area (**Section 4.4**). These native species may be supplemented where appropriate by commercially available species known to perform well under motorway conditions.

In selected areas including at the interfaces with urban areas and the Hunter Region Botanic Gardens (**Figure 6–6** and **Figure 6–11**), distinct species may be appropriate to highlight these areas.

Plant species for use along the project would be finalised during detailed design with project stakeholders.

Plant species selection would need to consider:

- Safety, including sight lines and sight stopping distance requirements and the need for frangible vegetation within clear zones
- The need for passive surveillance, consistent with CPTED principles (**Section 6.11**)
- Commercial availability
- Availability of seed stock and/or strategies to ensure availability that may need to include seed collection
- Ongoing maintenance requirements
- Performance record under motorway conditions to ensure viable, durable and robust species are chosen
- Exclusion of invasive species near bushland areas including species identified as noxious or local weeds
- Exclusion of species known to present a high fire risk
- Establishment requirements.

6.11 Crime Prevention Through Environmental Design

The project, through its urban design principles and objectives (**Section 5.3**), has made a commitment to the provision of safe connections for all users through the integration of CPTED principles (**Section 2.2.4**). The following section outlines how the CPTED principles have been applied on the project to minimise the opportunity for crime by using design and place management principles.

Surveillance

Good surveillance means that people can see what others are doing. People feel safe in public areas when they can easily see and interact with others. Would-be offenders are often deterred from committing crime in areas with high levels of surveillance. The project achieves deterrence by:

- Clear sightlines between public and private places. Due to the nature of the project, there are limited private places. However, the design has ensured that all publicly accessible areas of the project such as shared paths, cycleways and shoulders are connected by clear sightlines from travelling lanes on the project or local roads, ensuring passive surveillance by motorists
- Vegetation that does not provide potential offenders with a place to hide or entrap victims by maximising sightlines and passive surveillance (**Section 6.10.2** and **Section 6.10.3**).

The project would not provide any public places where people would be expected to gather. There is therefore no need for the project to provide public space for good surveillance at night.

Access control

Physical and symbolic barriers minimise opportunities for crime and increase the effort required to commit crime by channelling or restricting the movement of people. By making it clear where people are permitted to go or not go, it becomes difficult for potential offenders to reach and victimise people and their property. Illegible boundary markers and confusing spatial definition make it easy for criminals to make excuses for being in restricted areas. However, care needs to be taken to ensure that the barriers are not tall or hostile, creating the effect of a compound.

The project achieves effective access control through the use of fencing to create physical barriers that restrict access to:

- Private property, clearly delineating boundaries between public and private space
- Operational areas (**Section 6.7**)
- High-risk areas including areas with limited passive surveillance.

Physical barriers are reinforced by signage provided as required in accordance with the relevant Transport guidelines and design standards to reinforce access control messages.

Territorial reinforcement

Community ownership of public space sends positive signals. If people feel that they have some ownership of public space, they are more likely to gather and to enjoy that space. There are limited opportunities for the project to encourage a sense of community ownership, which is typically fostered by the creation of attractive spaces for people to gather and through a sense of responsibility for the condition of public places. However, community ownership also recognises that people often feel comfortable in places which feel owned and cared for.

The project achieves territorial enforcement and community ownership through the application of the urban design objectives and principles (**Section 5.3**), to ensure the project constitutes an interesting and enjoyable motorway that integrates with surrounding communities. Project elements have been designed to allow for safe and cost-effective maintenance. This will ensure that the project maintains a well-cared for appearance, consistent with this principle.

Space management

Linked to the principle of territorial reinforcement, space management ensures that space is appropriately utilised and well cared for. Space management strategies include site cleanliness, rapid repair of vandalism and graffiti, the replacement of burned out lighting and the removal or refurbishment of decayed physical elements. As outlined above, the project has been designed to facilitate ease of space management. Maintenance of the project would be carried out in accordance with work health and safety requirements and relevant Transport guidelines and specifications.

Further consideration and review would be carried out during the detailed design to ensure the continued integration of CPTED principles (**Chapter 11**).

6.12 Concept design drawings

The urban design concept drawings illustrate the project in its entirety. They include the following:

Concept design plans

Concept design plans at 1:5,000 scale for the entire project (**Section 6.12.1**)

1. Urban design concept plan - sheet 1 (Black Hill)
2. Urban design concept plan - sheet 2 (Black Hill, Beresfield, Tarro)
3. Urban design concept plan - sheet 3 (Tarro, Tomago)
4. Urban design concept plan - sheet 4 (Hexham, Tomago)
5. Urban design concept plan - sheet 5 (Tomago near Tomago Road)
6. Urban design concept plan - sheet 6 (Tomago near Old Punt Road)
7. Urban design concept plan - sheet 7 (Heatherbrae near Hunter Region Botanic Gardens)
8. Urban design concept plan - sheet 8 (Heatherbrae south of Masonite Road)
9. Urban design concept plan - sheet 9 (Heatherbrae north of Masonite Road)
10. Urban design concept plan - sheet 10 (Raymond Terrace).

Cross sections

Cross sections in **Section 6.12.2**, illustrate the project's third dimension at select locations as shown on the urban design plans in **Section 6.12.1**, in order to show the range of outcomes along the project, including at:

1. Section 1: Black Hill Cut
2. Section 2: Tarro
3. Section 3: Tomago interchange
4. Section 4: Along Old Punt Road
5. Section 5: Heatherbrae interchange
6. Section 6: Masonite Road
7. Section 7: Raymond Terrace interchange.

Bridge drawings

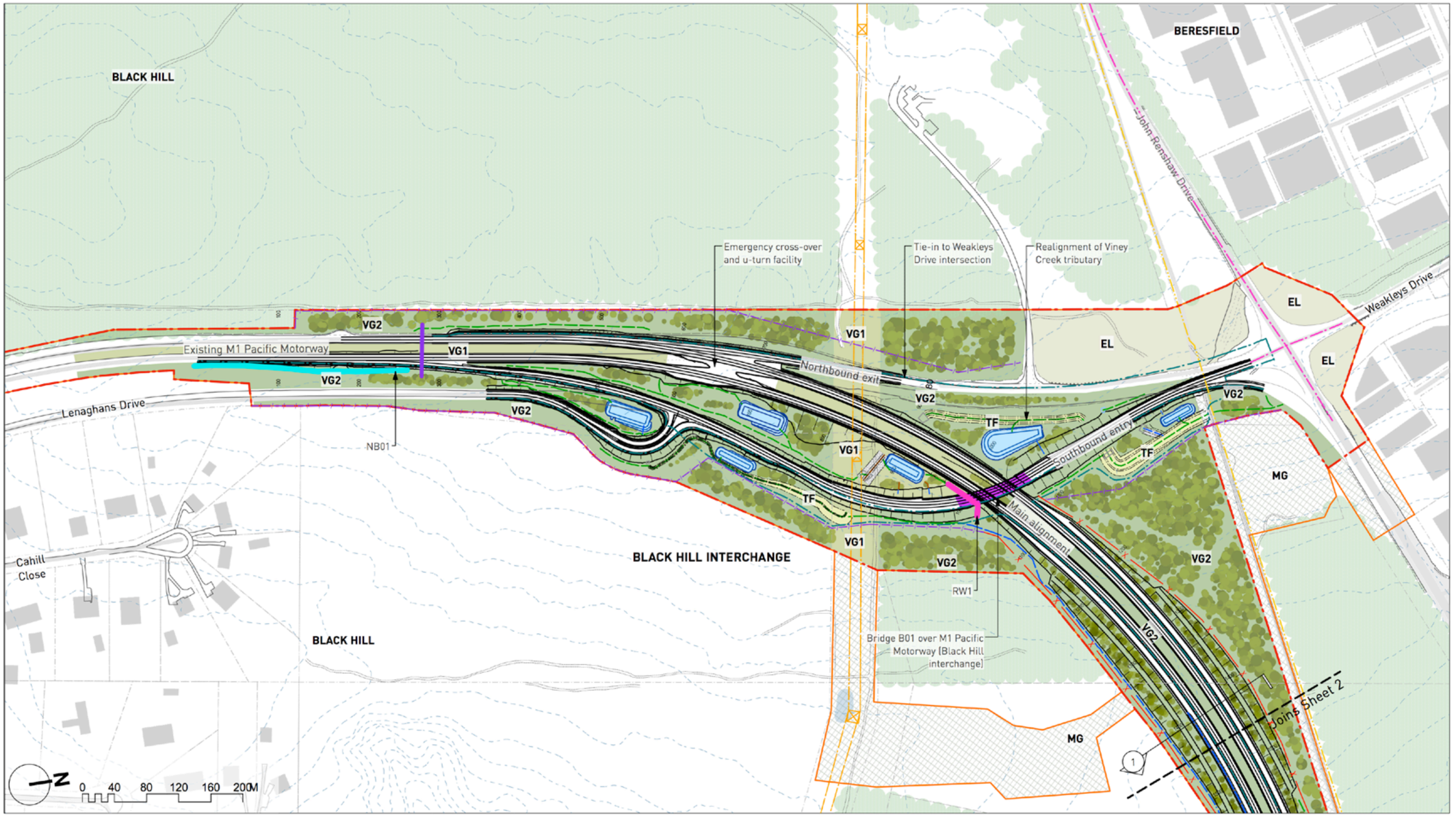
Bridge drawings in **Section 6.12.3** comprise elevations and sections for all project bridges, consistent with the bridge design approach (**Section 6.2**):

1. Bridge B01 over M1 Pacific Motorway (Black Hill)
2. Bridge B02 over unnamed wetlands (Tarro)
3. Bridge B03 over New England Highway (Tarro)
4. Bridge B04 over main alignment (Tarro)
5. Bridge B05: Viaduct over Hunter River (Hunter River floodplain)
6. Bridge B06 over M1 Pacific Motorway (Tomago)
7. Bridge B07 over Pacific Highway (Tomago)
8. Bridge B08: Twin bridges over Old Punt Road (Tomago)
9. Bridge 09 over Hunter Region Botanic Gardens access road (Tomago)
10. Bridge B10 over M1 Pacific Motorway (Heatherbrae)
11. Bridge B11 over Windeyers Creek and associated wetlands (Heatherbrae)
12. Bridge B12 over M1 Pacific Motorway (Raymond Terrace).

Retaining wall drawings

Retaining wall drawings in **Section 6.12.4** comprise of cross sections for retaining walls at the Tarro interchange.

6.12.1 Concept design plans



LEGEND

Project elements

- Construction boundary
- Operational boundary
- Project carriageways
- New bridge
- Retaining wall
- Noise barrier
- Road barriers
- Bicycle access
- Proposed bicycle access by Council
- Boundary fence
- Fauna fence
- Fauna rope crossing
- Concrete lined channel
- Grass lined channel
- Rock lined channel
- Permanent drainage basin
- Cuttings and embankments
- Key views from the project

Project landscape elements

- Indicative tree cover
- EL Existing landscaping retained
- VG1 Groundcover
- VG2 Groundcovers and frangible shrubs
- VG3 Wetland and riparian vegetation
- TF Turf
- MG Make good existing ground surface

Existing built and natural elements

- Cadastral boundaries
- Existing buildings
- Removed buildings
- Non-Aboriginal heritage item
- Existing road network
- High voltage power lines and stanchions
- Main North Rail Line
- Existing adjoining bushland
- Existing water bodies
- Contours - 2m interval
- Significant tree

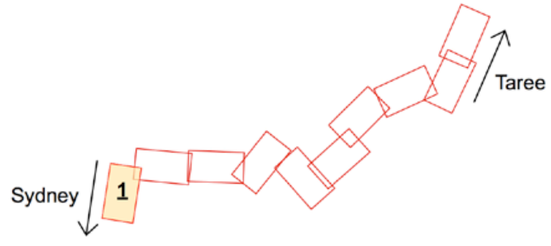
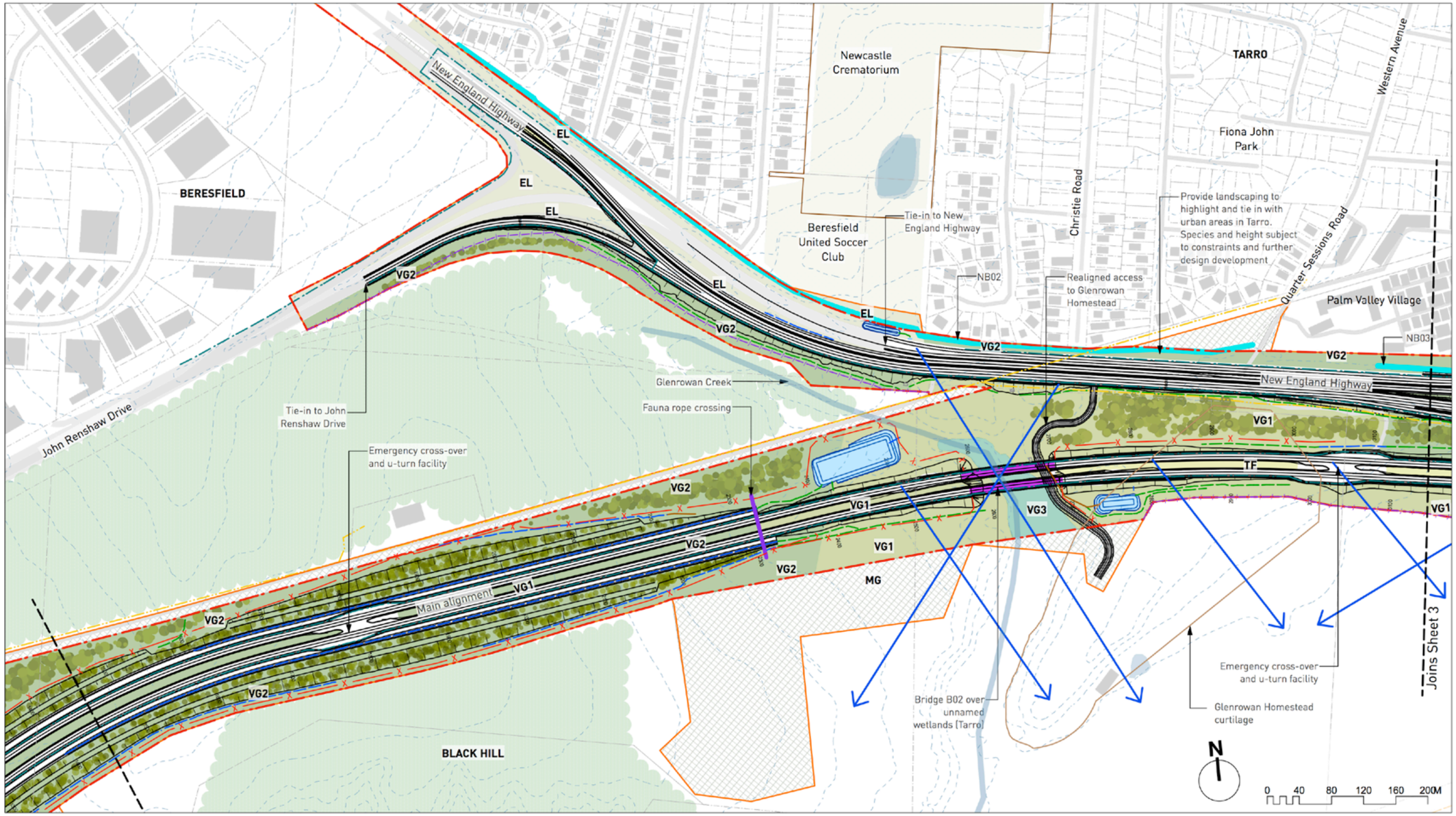


Figure 6–5 Urban design concept plan – sheet 1 (Black Hill)



LEGEND

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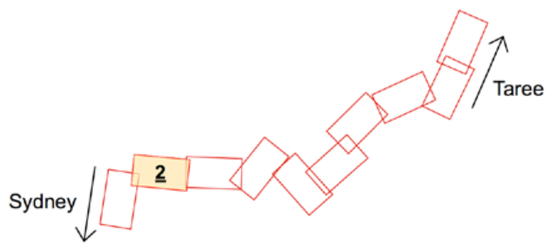
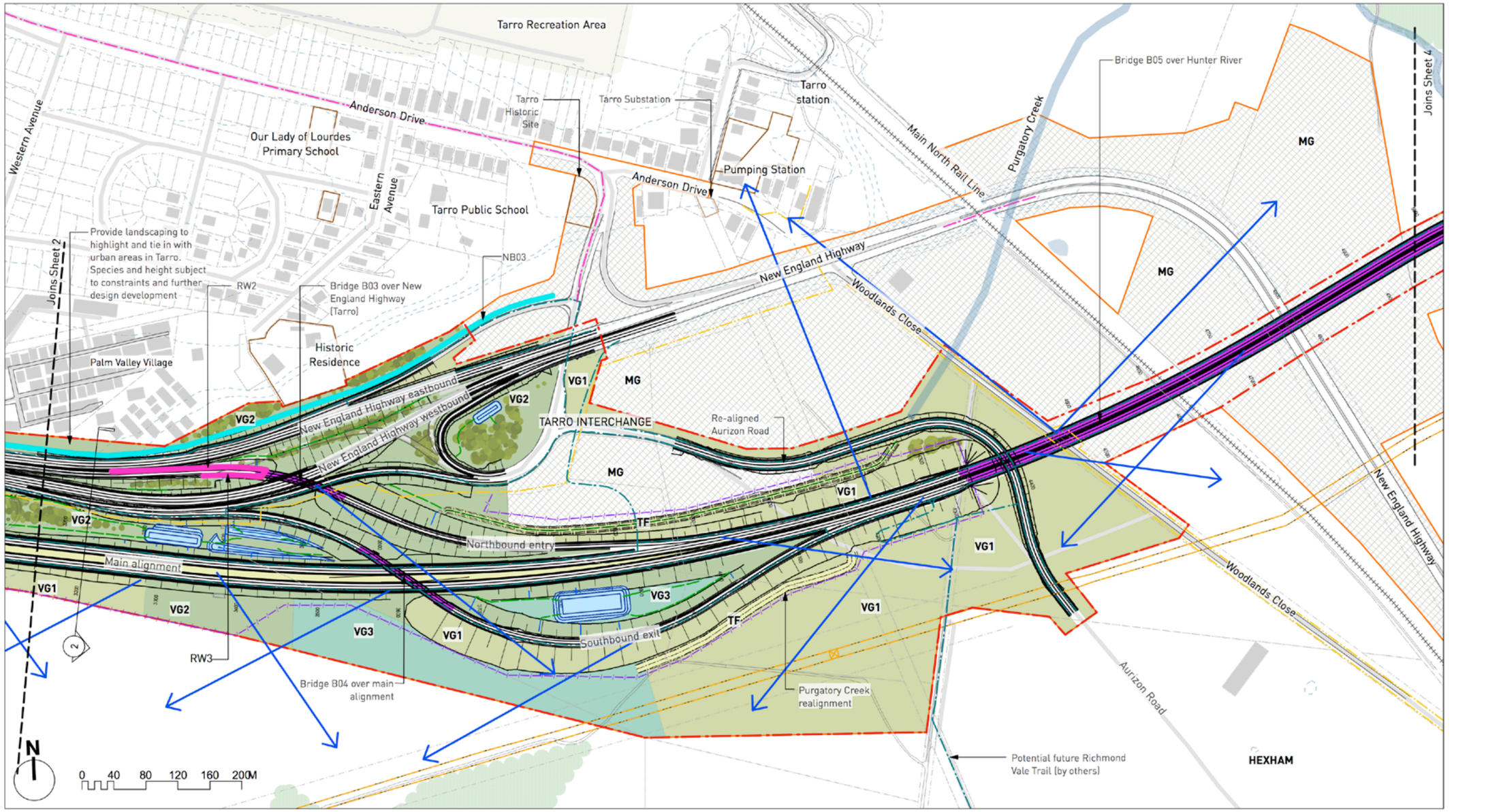


Figure 6–6 Urban design concept plan – sheet 2 (Black Hill, Beresfield, Tarro)



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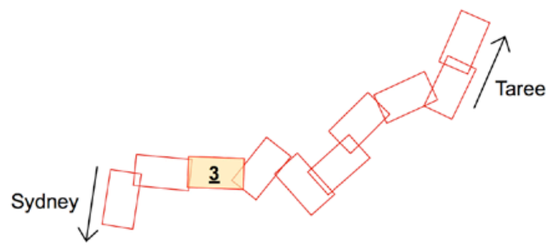
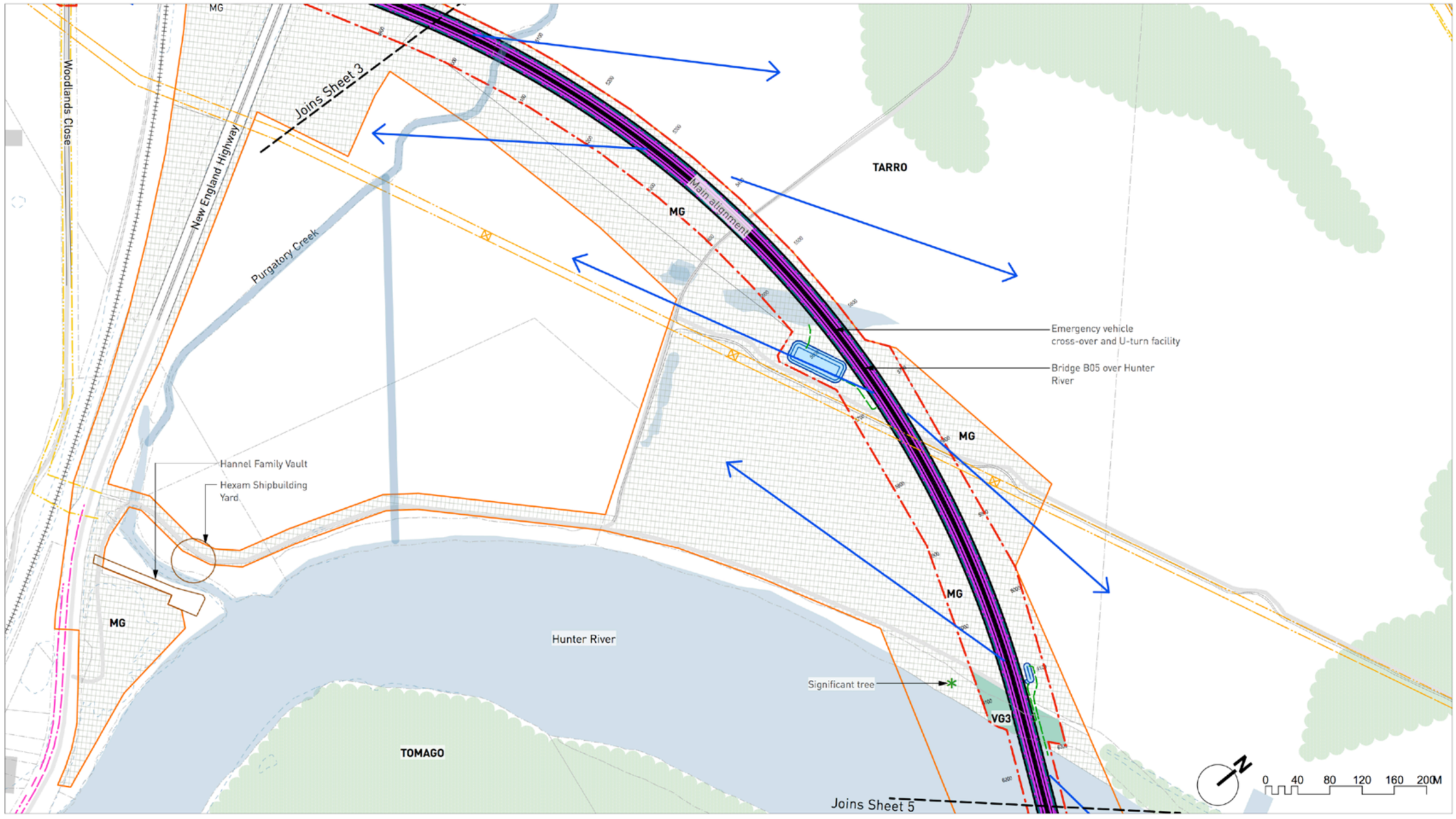


Figure 6–7 Urban design concept plan – sheet 3 (Tarro, Tomago)



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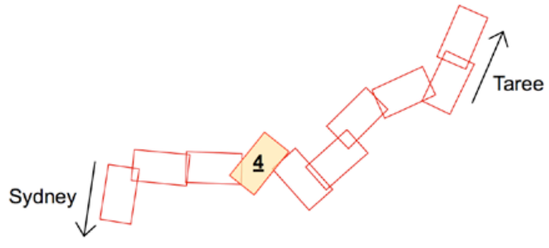
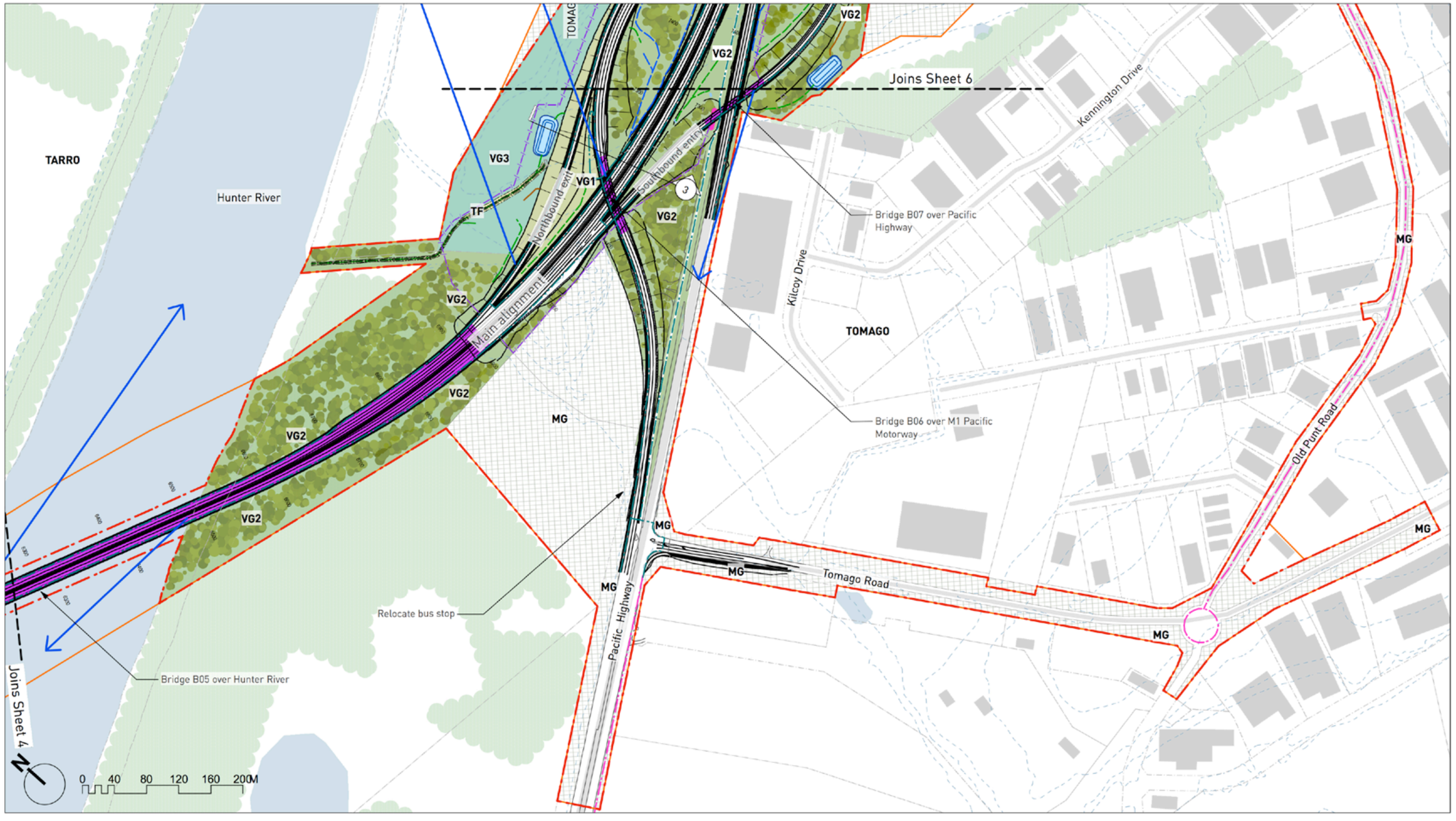


Figure 6–8 Urban design concept plan – sheet 4 (Hunter River floodplain)



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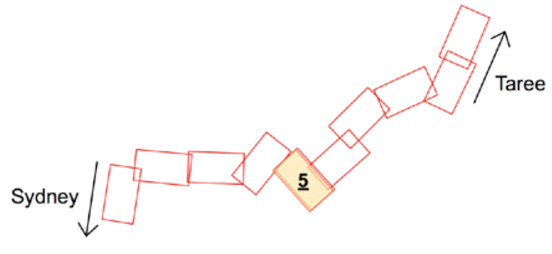
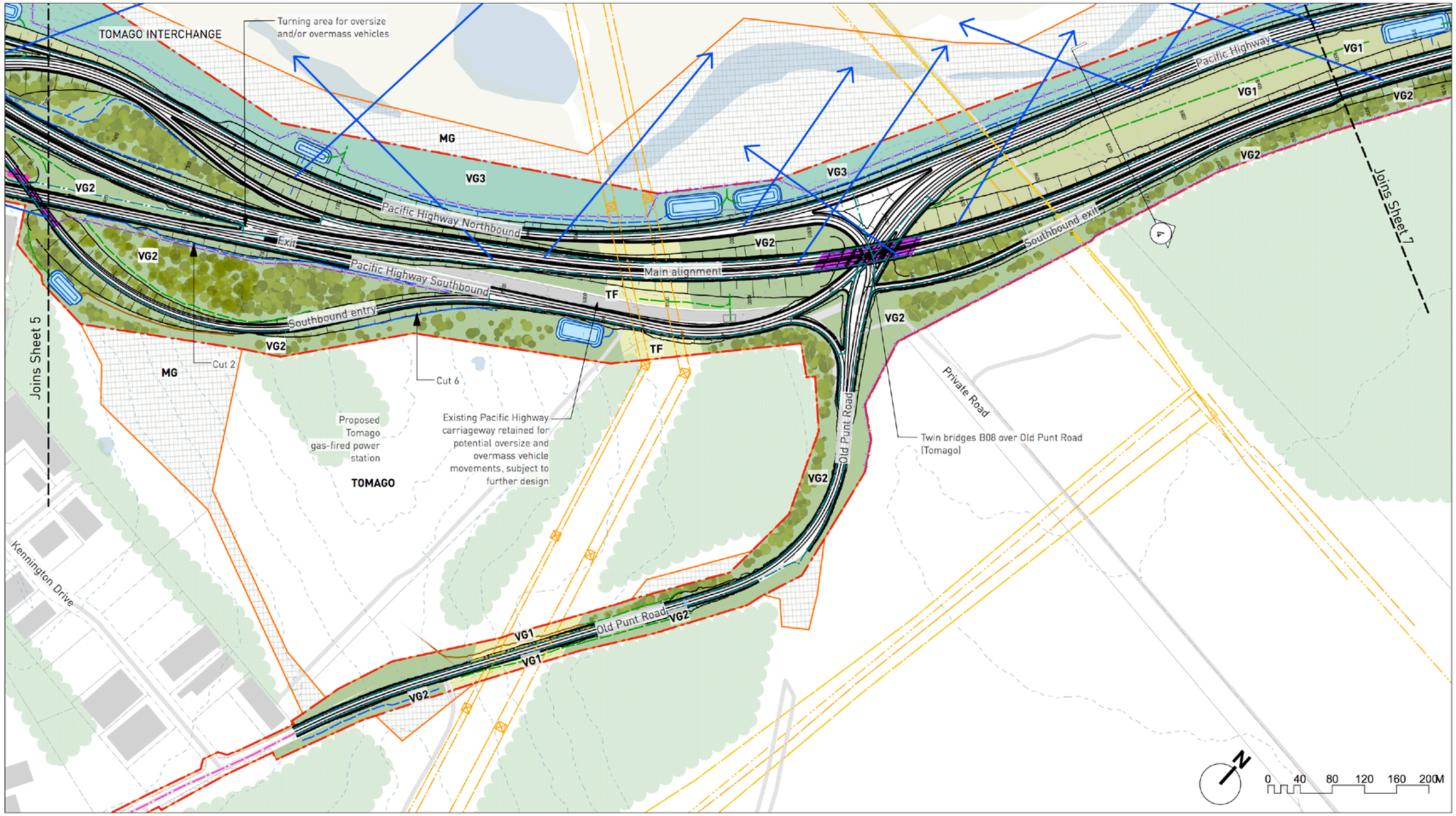


Figure 6–9 Urban design concept plan – sheet 5 (Tomago near Tomago Road)



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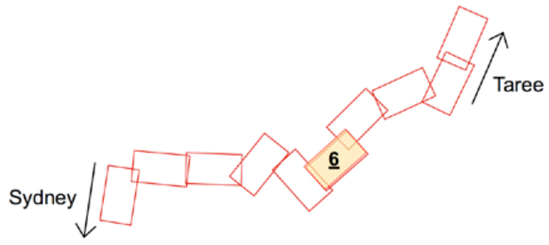
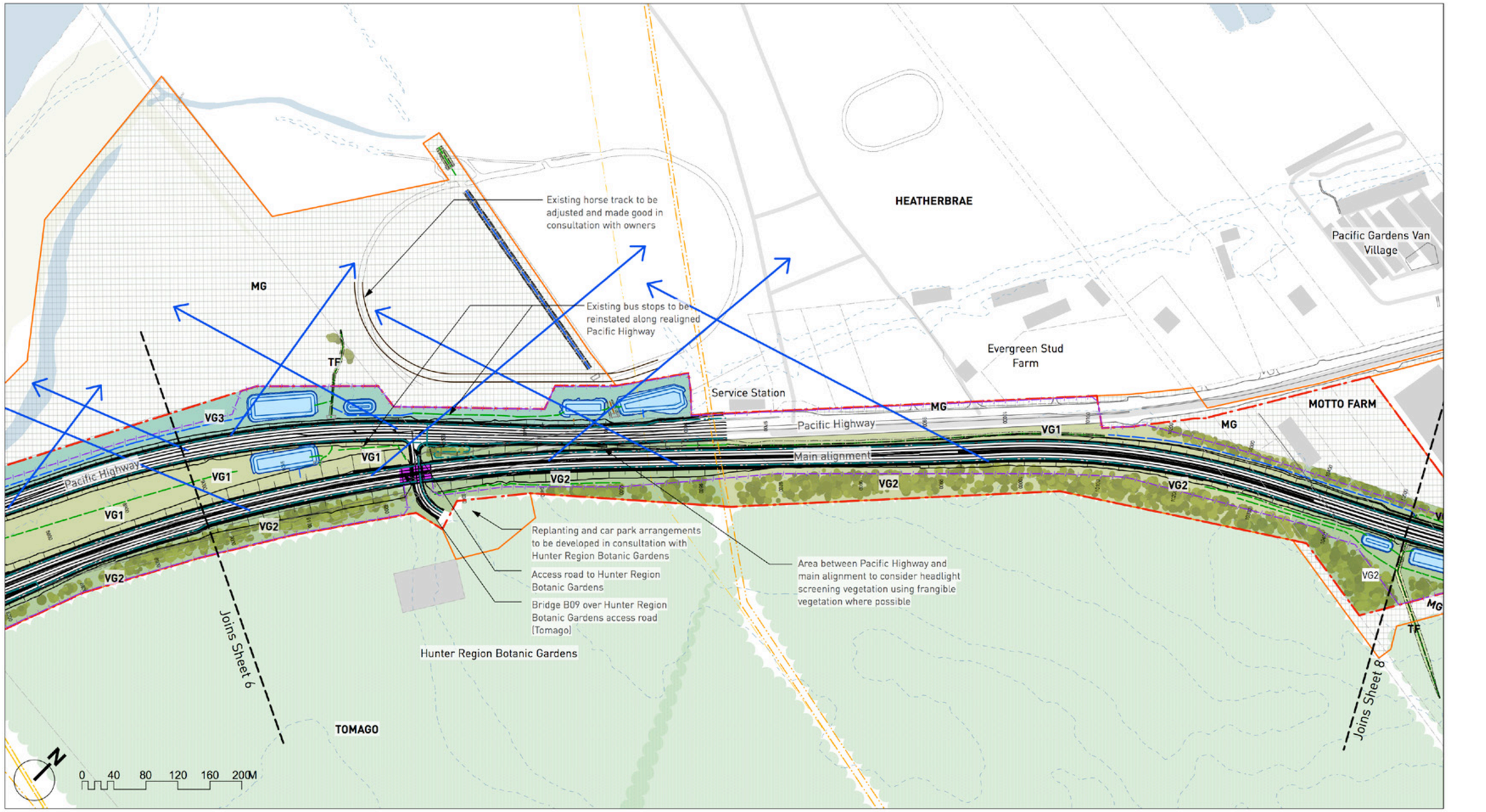


Figure 6–10 Urban design concept plan – sheet 6 (Tomago near Old Punt Road)



LEGEND

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- Contours - 2m interval
- Significant tree

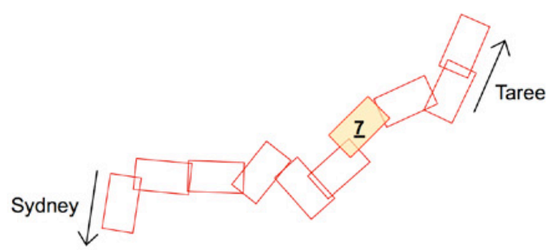
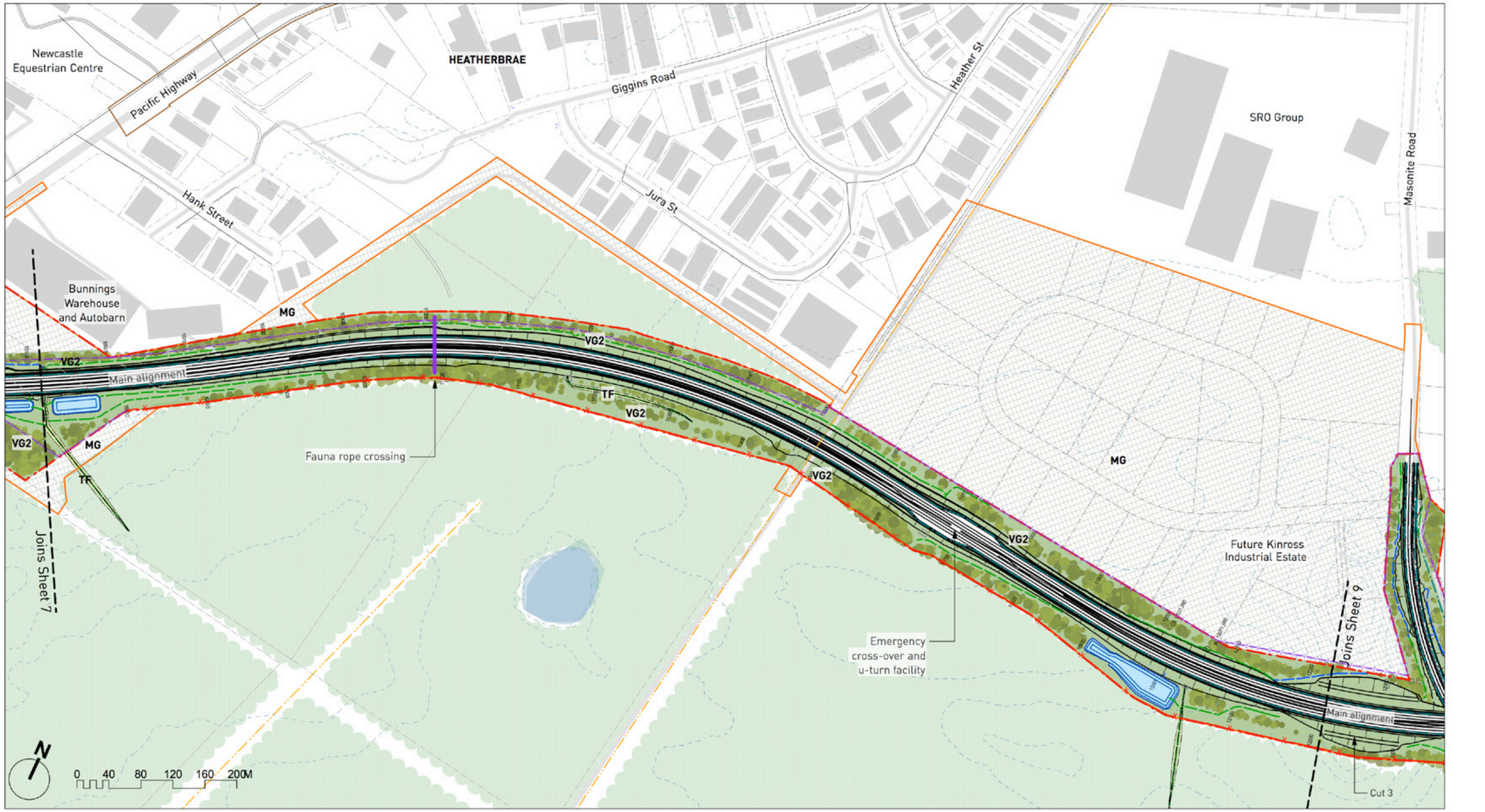


Figure 6–11 Urban design concept plan – sheet 7 (Heatherbrae near Hunter Region Botanic Gardens)



LEGEND

Project elements

- Construction boundary
- Operational boundary
- Project carriageways
- New bridge
- Retaining wall
- Noise barrier
- Road barriers
- Bicycle access
- Proposed bicycle access by Council
- Boundary fence
- Fauna fence
- Fauna rope crossing
- Concrete lined channel
- Grass lined channel
- Rock lined channel
- Permanent drainage basin
- Cuttings and embankments
- Key views from the project

Project landscape elements

- Indicative tree cover
- EL Existing landscaping retained
- VG1 Groundcover
- VG2 Groundcovers and frangible shrubs
- VG3 Wetland and riparian vegetation
- TF Turf
- MG Make good existing ground surface

Existing built and natural elements

- Cadastral boundaries
- Existing buildings
- Removed buildings
- Non-Aboriginal heritage item
- Existing road network
- High voltage power lines and stanchions
- Main North Rail Line
- Existing adjoining bushland
- Existing water bodies
- Contours - 2m interval
- Significant tree

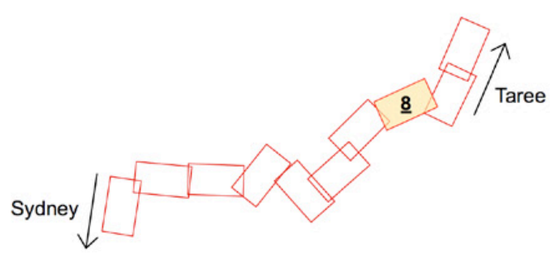
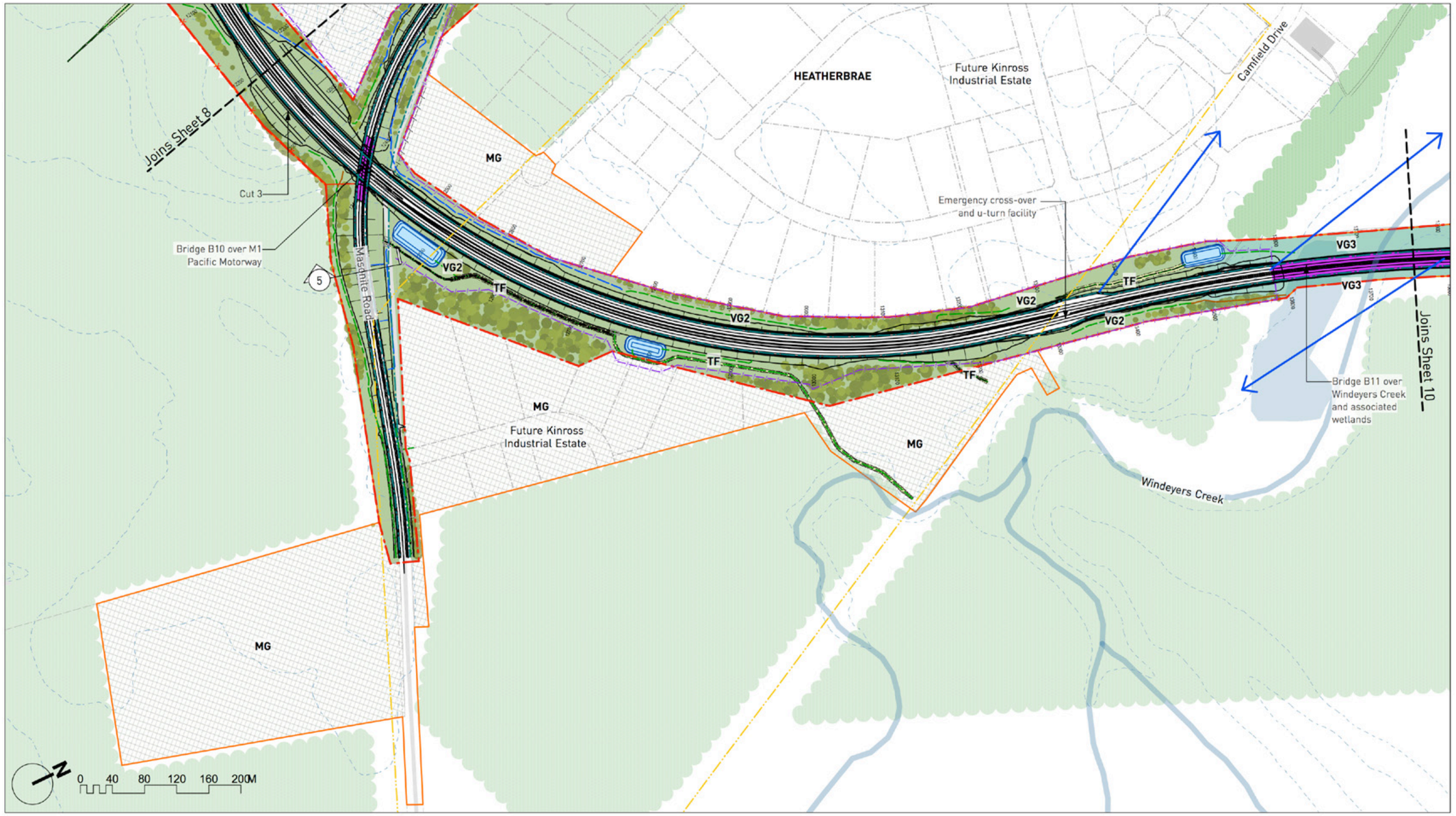


Figure 6–12 Urban design concept plan – sheet 8 (Heatherbrae south of Masonite Road)



LEGEND

Project elements

- Construction boundary
- Operational boundary
- Project carriageways
- New bridge
- Retaining wall
- Noise barrier
- Road barriers
- Bicycle access
- Proposed bicycle access by Council
- Boundary fence
- Fauna fence
- Fauna rope crossing
- Concrete lined channel
- Grass lined channel
- Rock lined channel
- Permanent drainage basin
- Cuttings and embankments
- Key views from the project

Project landscape elements

- Indicative tree cover
- EL Existing landscaping retained
- VG1 Groundcover
- VG2 Groundcovers and frangible shrubs
- VG3 Wetland and riparian vegetation
- TF Turf
- MG Make good existing ground surface

Existing built and natural elements

- Cadastral boundaries
- Existing buildings
- Removed buildings
- Non-Aboriginal heritage item
- Existing road network
- High voltage power lines and stanchions
- Main North Rail Line
- Existing adjoining bushland
- Existing water bodies
- Contours - 2m interval
- Significant tree

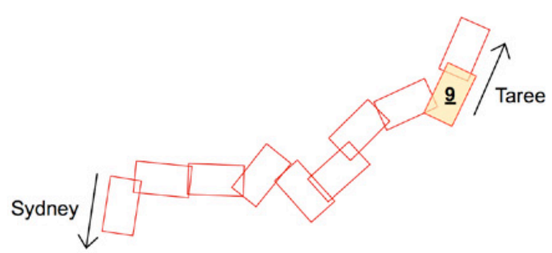
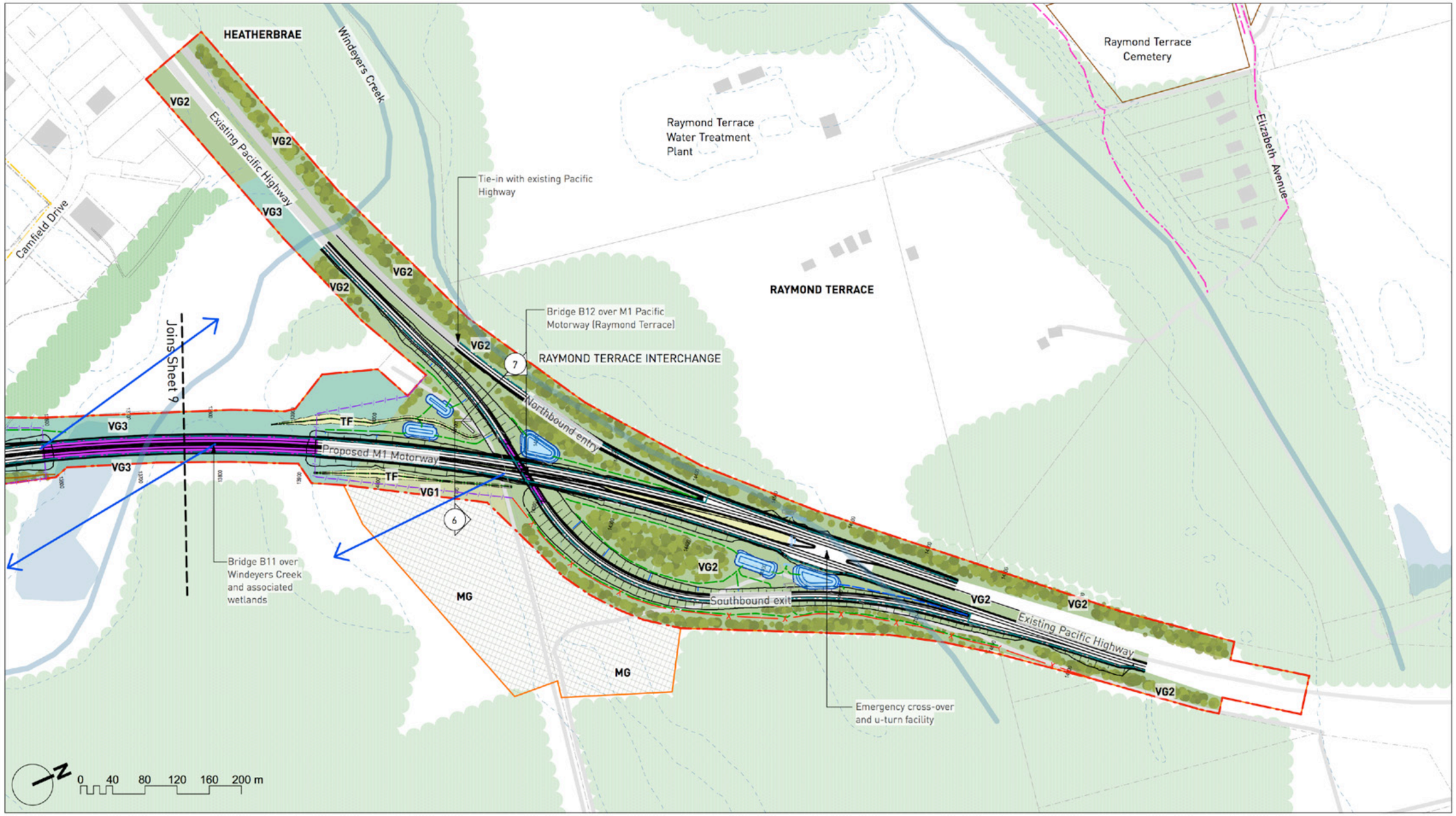


Figure 6–13 Urban design concept plan – sheet 9 (Heatherbrae north of Masonite Road)



LEGEND

Project elements

- Construction boundary
- Operational boundary
- Project carriageways
- New bridge
- Retaining wall
- Noise barrier
- Road barriers
- Bicycle access
- Proposed bicycle access by Council
- Boundary fence
- Fauna fence
- Fauna rope crossing
- Concrete lined channel
- Grass lined channel
- Rock lined channel
- Permanent drainage basin
- Cuttings and embankments
- Key views from the project

Project landscape elements

- Indicative tree cover
- EL Existing landscaping retained
- VG1 Groundcover
- VG2 Groundcovers and frangible shrubs
- VG3 Wetland and riparian vegetation
- TF Turf
- MG Make good existing ground surface

Existing built and natural elements

- Cadastral boundaries
- Existing buildings
- Removed buildings
- Non-Aboriginal heritage item
- Existing road network
- High voltage power lines and stanchions
- Main North Rail Line
- Existing adjoining bushland
- Existing water bodies
- Contours - 2m interval
- Significant tree

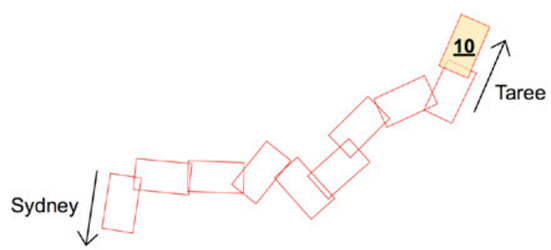
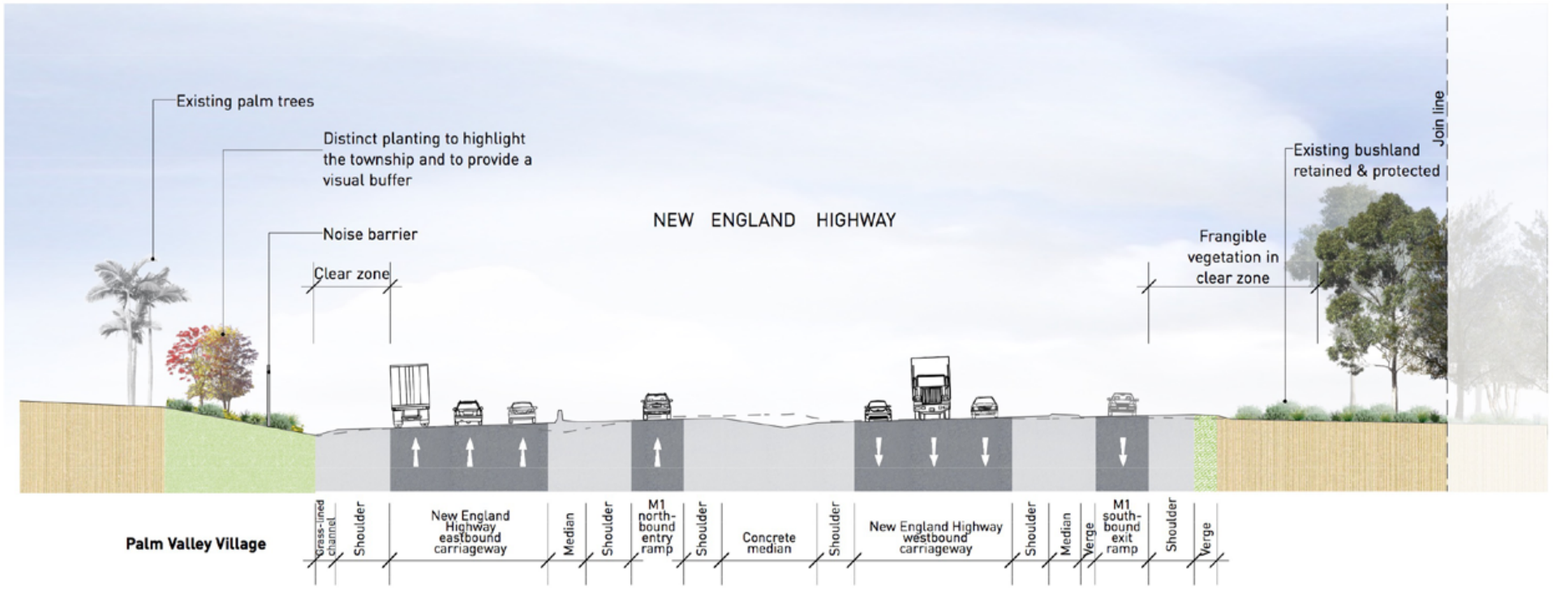


Figure 6–14 Urban design concept plan – sheet 10 (Raymond Terrace)

6.12.2 Cross sections

Figure 6–15 Section 1: Black Hill Cut



2 SECTION AT TARRO
SCALE @ A3: 1:400

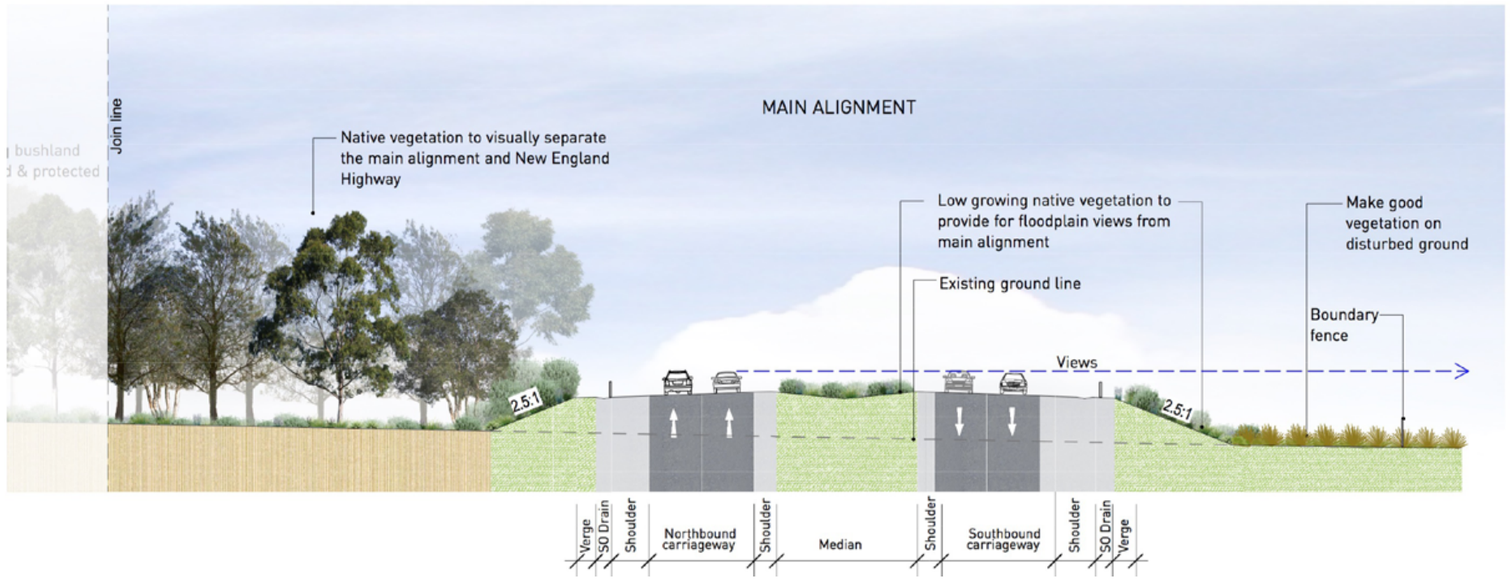


Figure 6–16 Section 2: Tarro

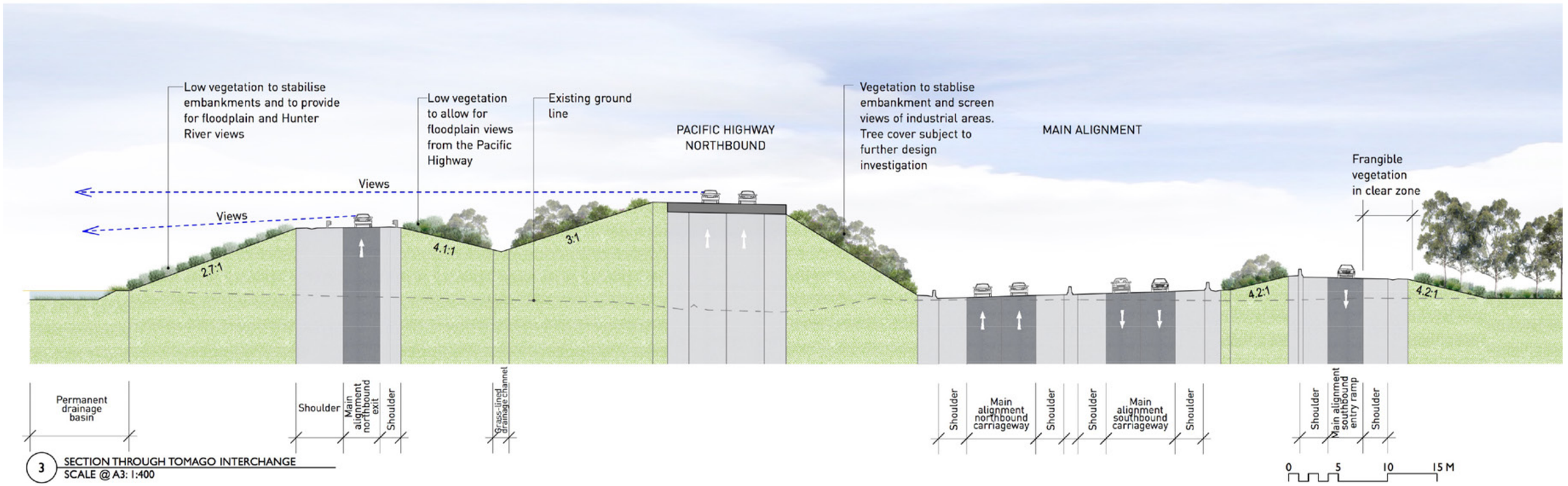


Figure 6–17 Section 3: Tomago interchange

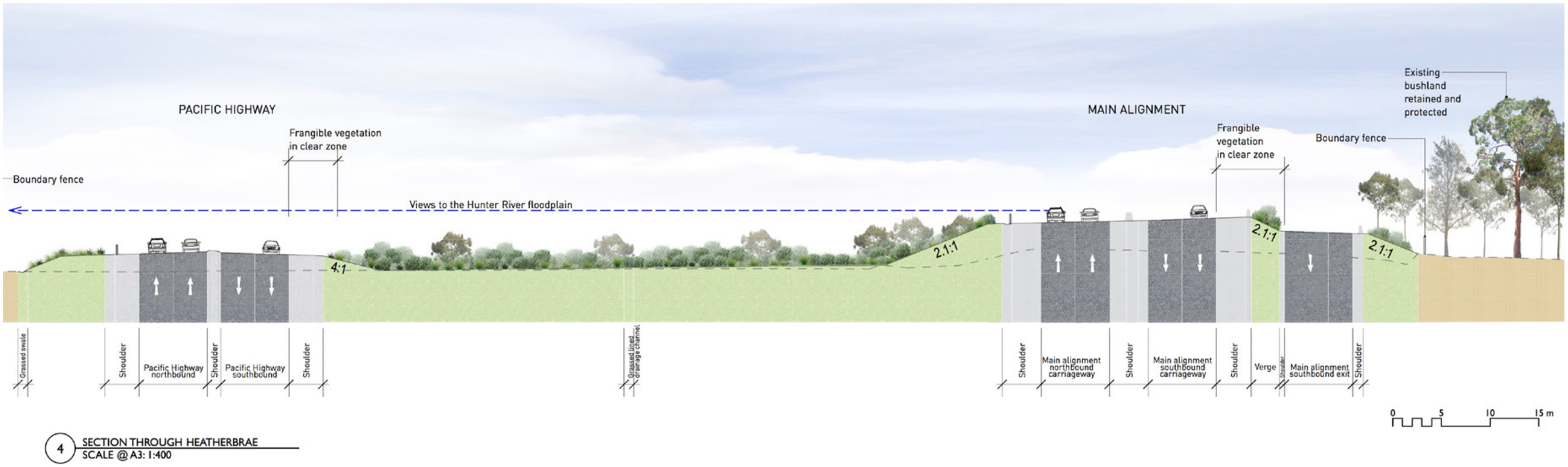
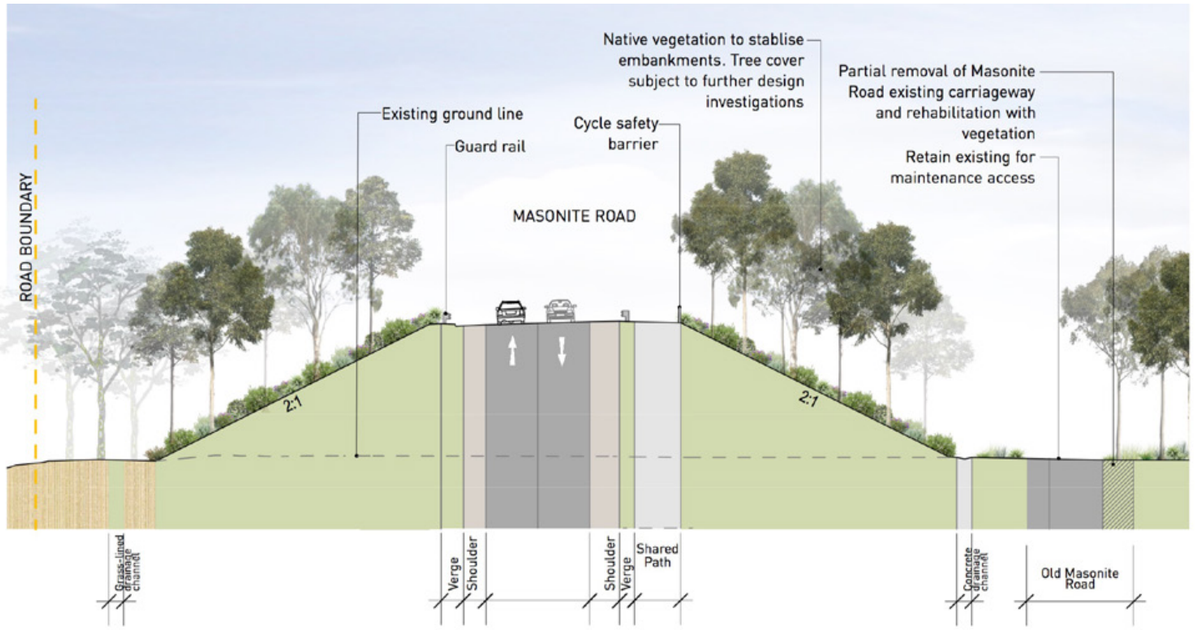
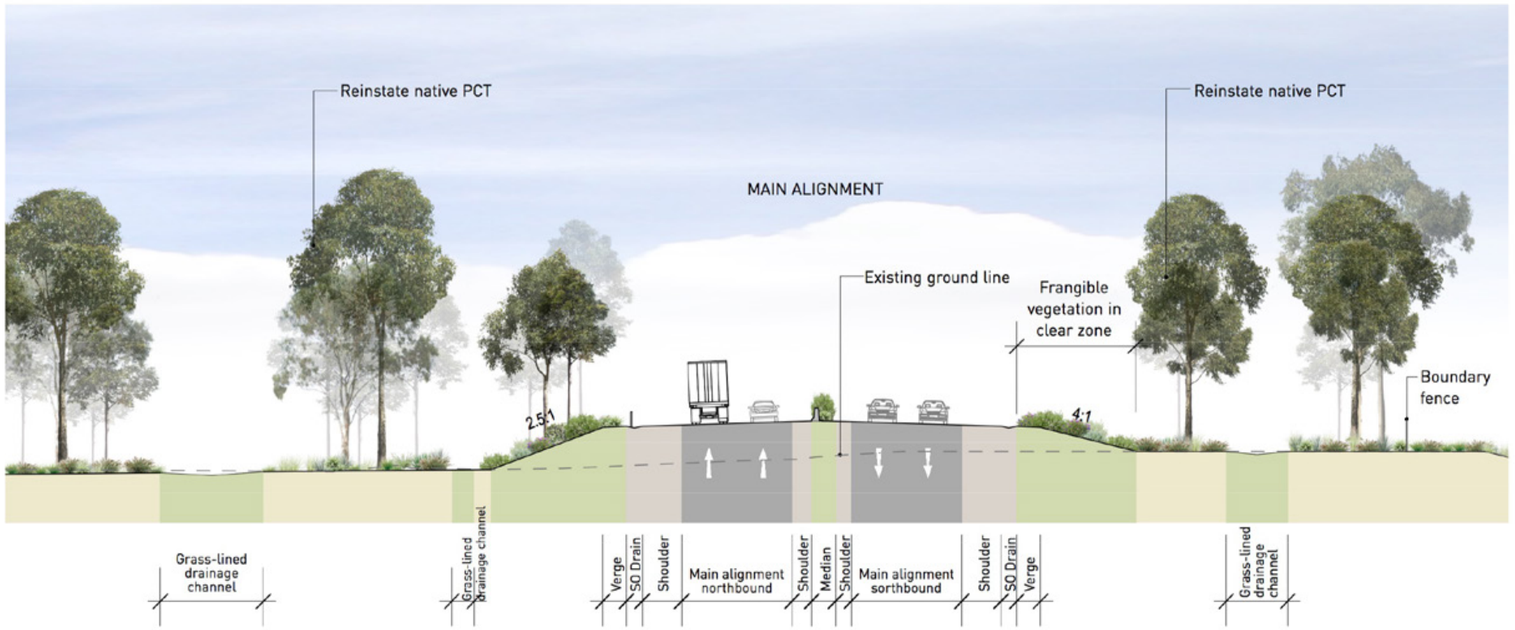


Figure 6–18 Section 4: Heatherbrae interchange



5 SECTION THROUGH MASONITE ROAD
SCALE @ A3: 1:400

Figure 6–19 Section 5: Masonite Road



6 SECTION THROUGH RAYMOND TERRACE INTERCHANGE
SCALE @ A3: 1:400

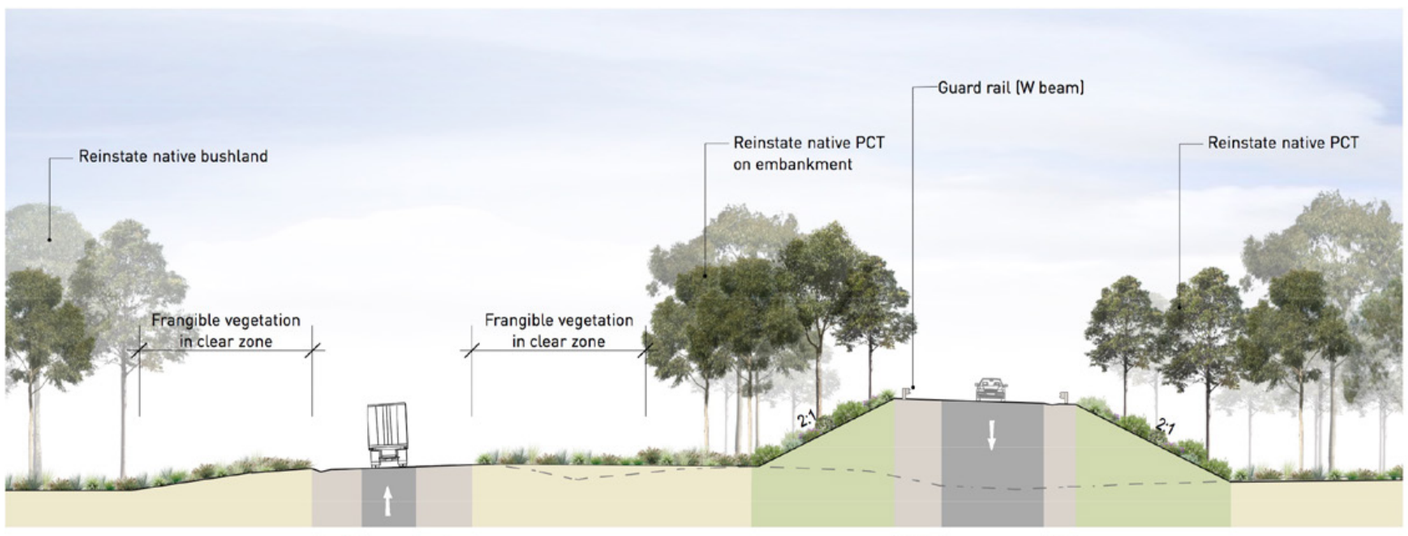
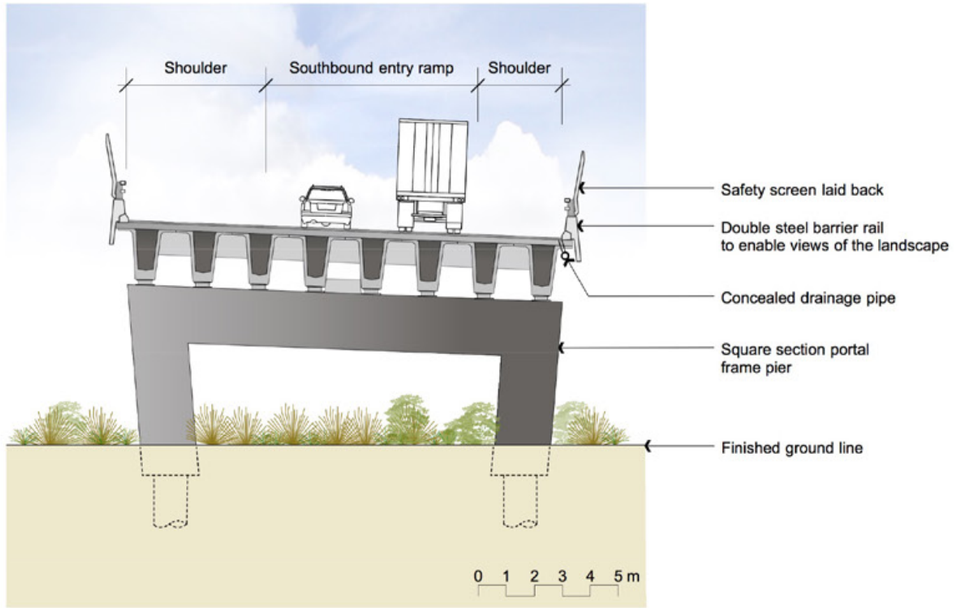
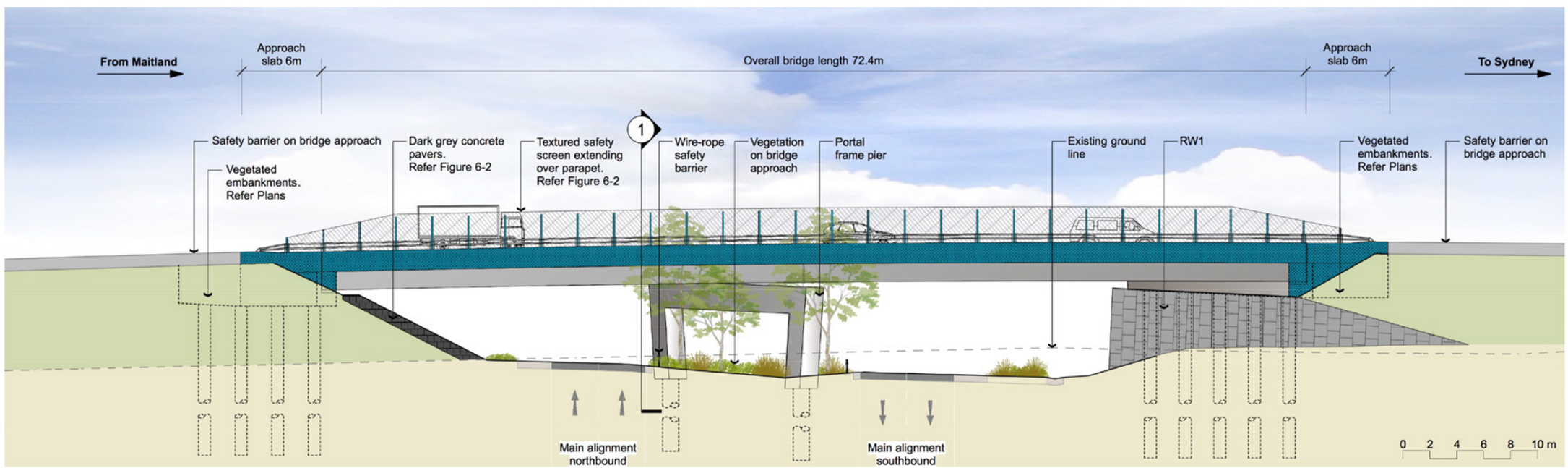


Figure 6–20 Section 6: Raymond Terrace interchange

6.12.3 Bridge drawings

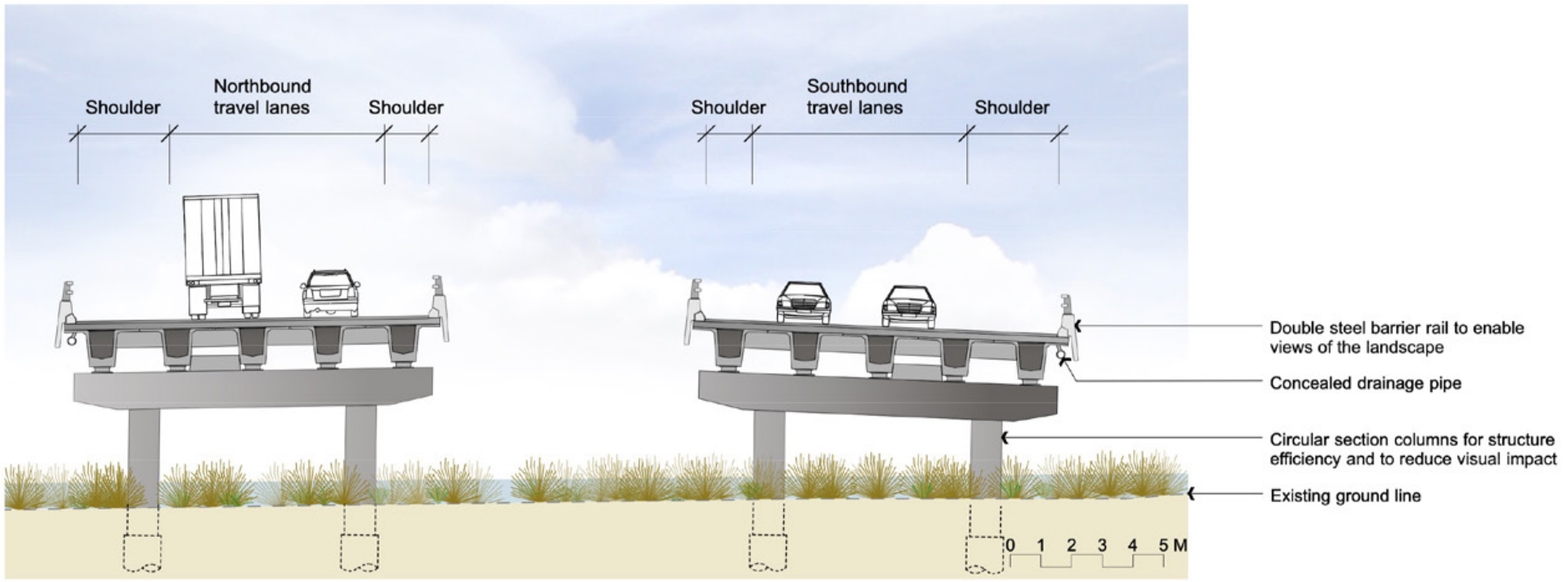


1 BRIDGE B01 OVER M1 PACIFIC MOTORWAY (BLACK HILL INTERCHANGE) - SECTION
SCALE @ A3: 1:200

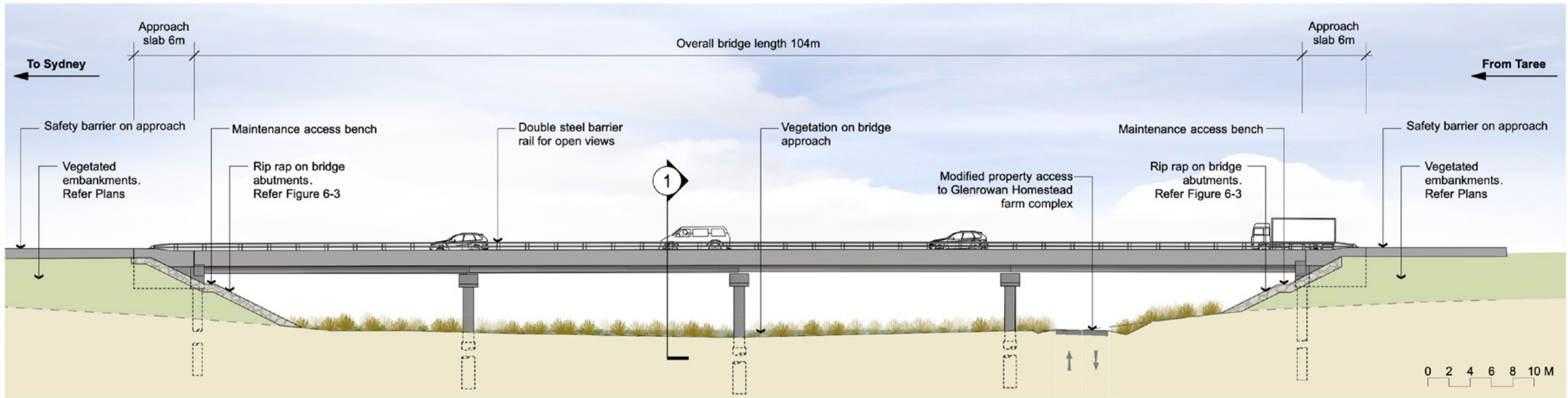


2 BRIDGE B01 OVER M1 PACIFIC MOTORWAY (BLACK HILL INTERCHANGE) - ELEVATION
SCALE @ A3: 1:300

Figure 6–21 Bridge B01 over M1 Pacific Motorway (Black Hill interchange)

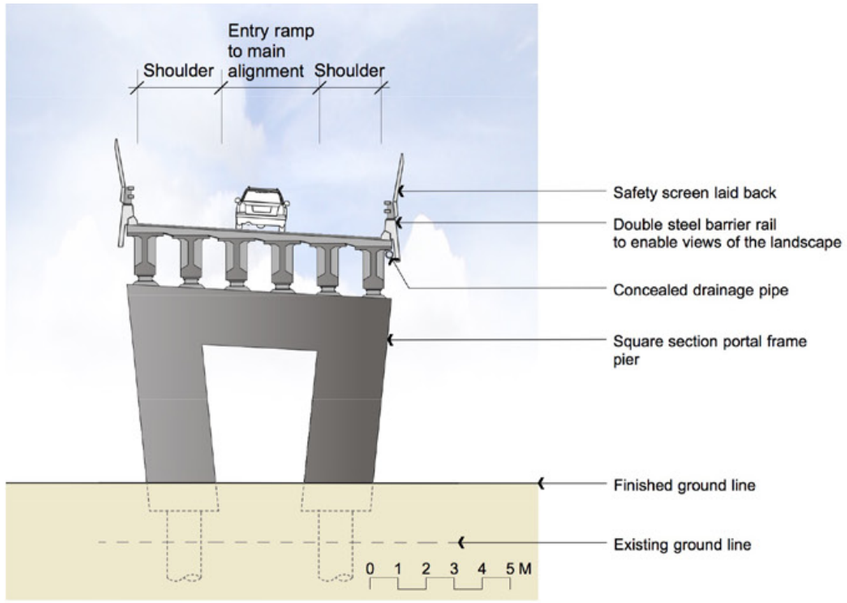


1 BRIDGE B02 OVER UNNAMED WETLANDS (TARRO) - SECTION
SCALE @ A3: 1:200

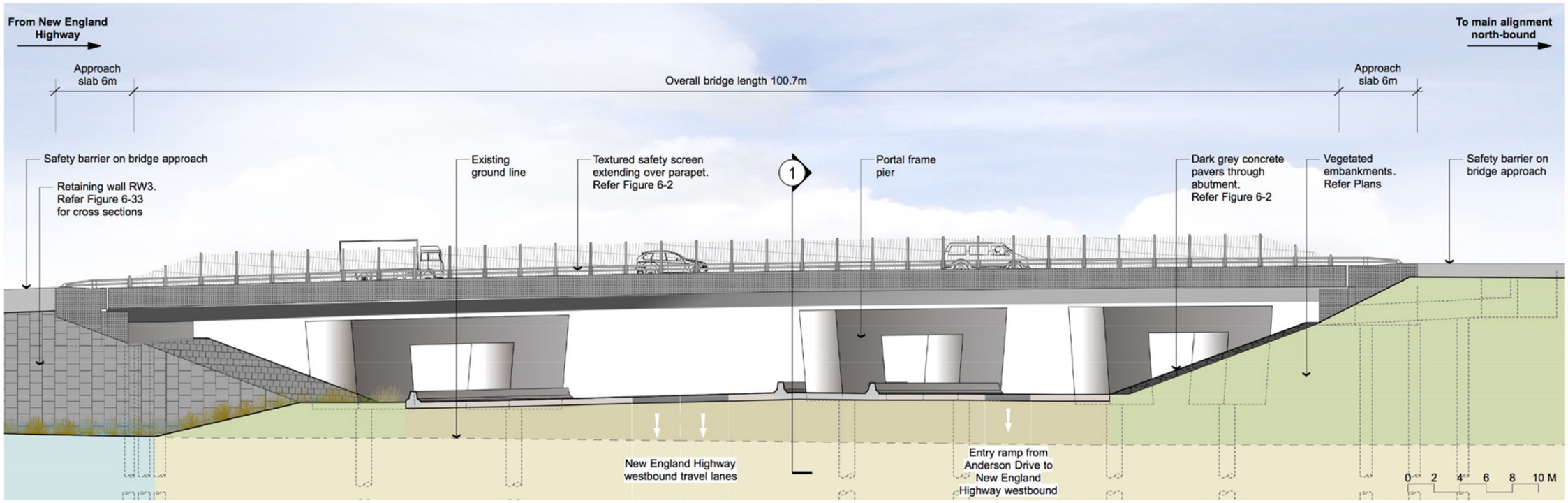


2 BRIDGE B02 OVER UNNAMED WETLANDS (TARRO) - ELEVATION
SCALE @ A3: 1:400

Figure 6–22 Bridge B02 over unnamed wetlands (Tarro)

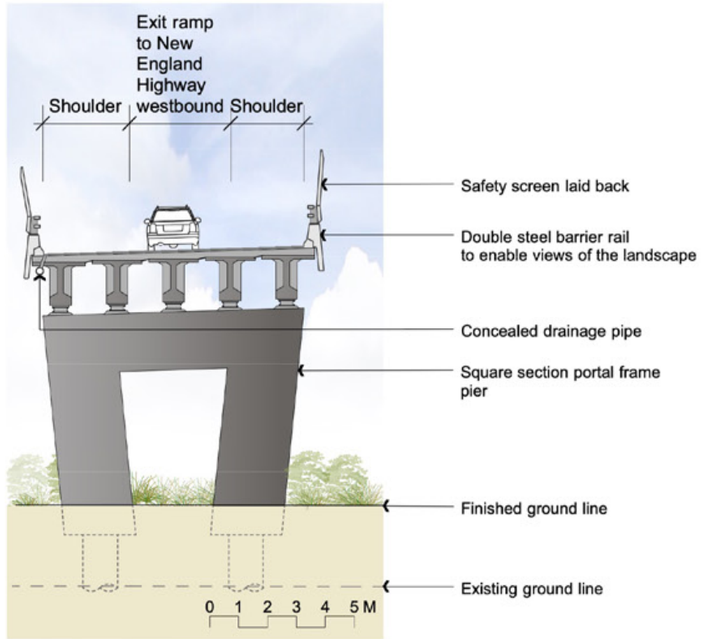


1 BRIDGE B03 OVER NEW ENGLAND HIGHWAY (TARRO) - SECTION
SCALE @ A3: 1:200

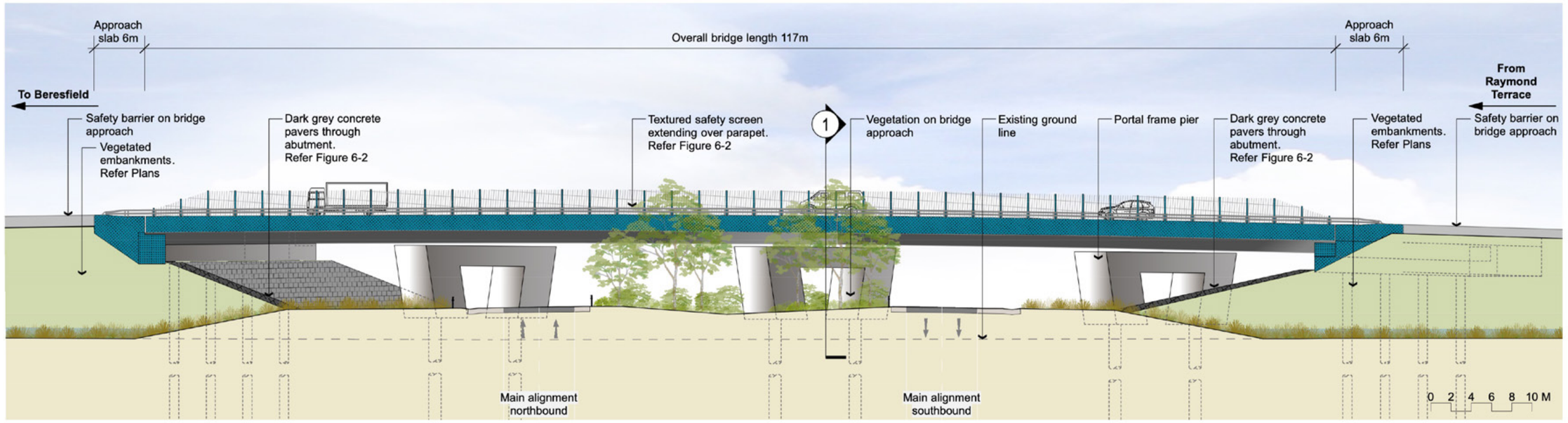


2 BRIDGE B03 OVER NEW ENGLAND HIGHWAY (TARRO) - ELEVATION
SCALE @ A3: 1:300

Figure 6–23 Bridge B03 over New England Highway (Tarro)

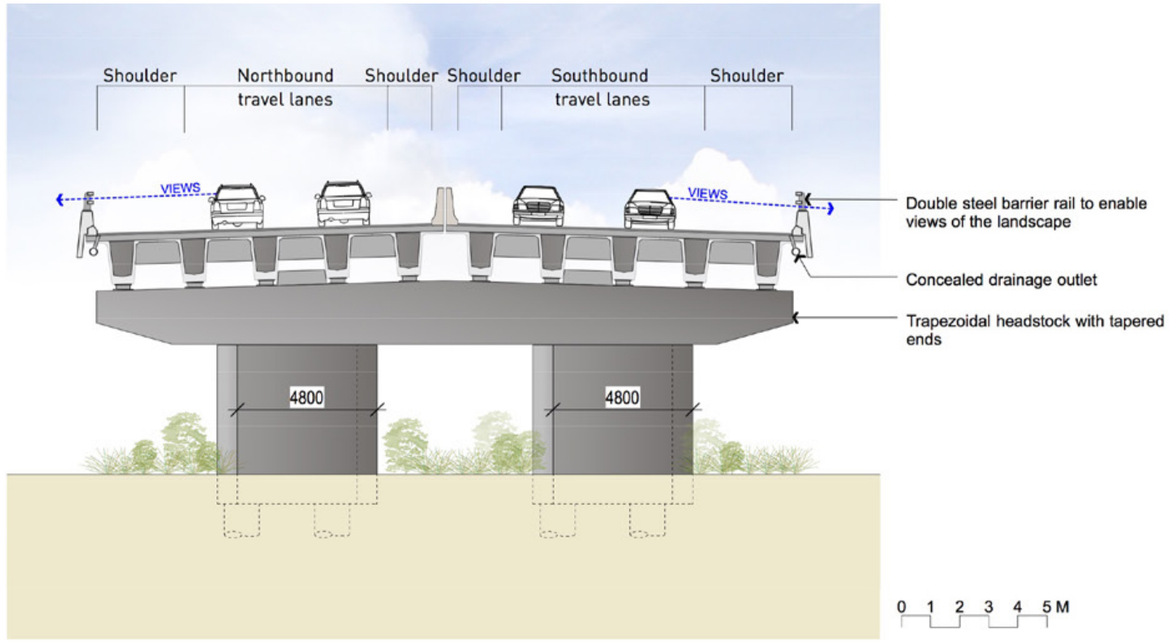


1 BRIDGE B04 OVER MAIN ALIGNMENT (TARRO) - SECTION
SCALE @ A3: 1:200

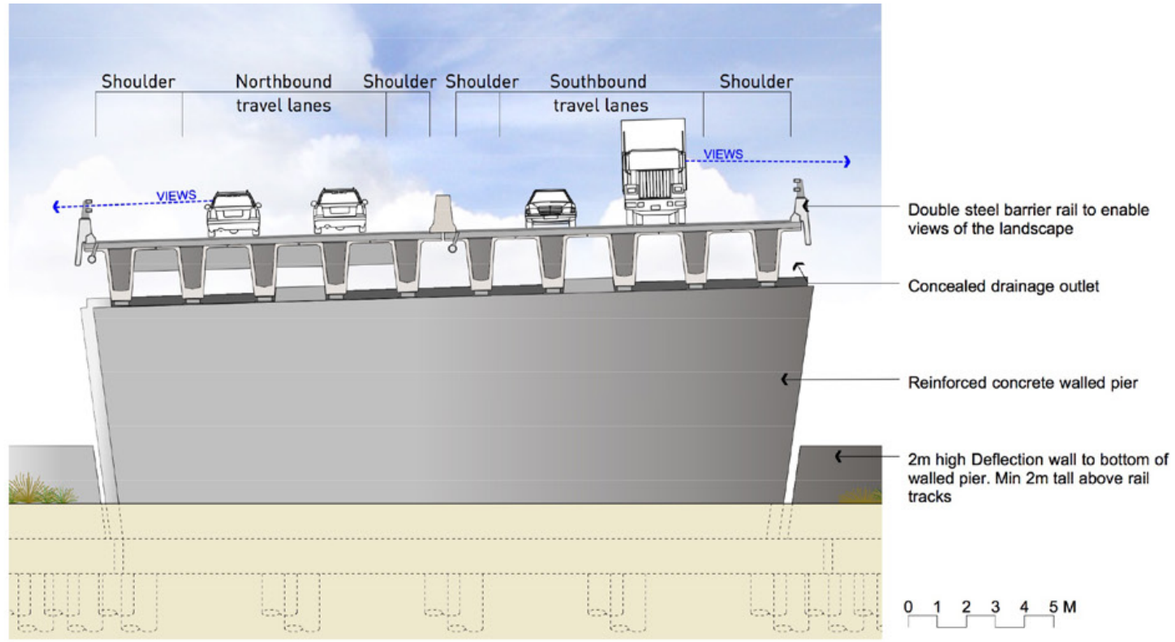


2 BRIDGE B04 OVER MAIN ALIGNMENT (TARRO) - ELEVATION
SCALE @ A3: 1:400

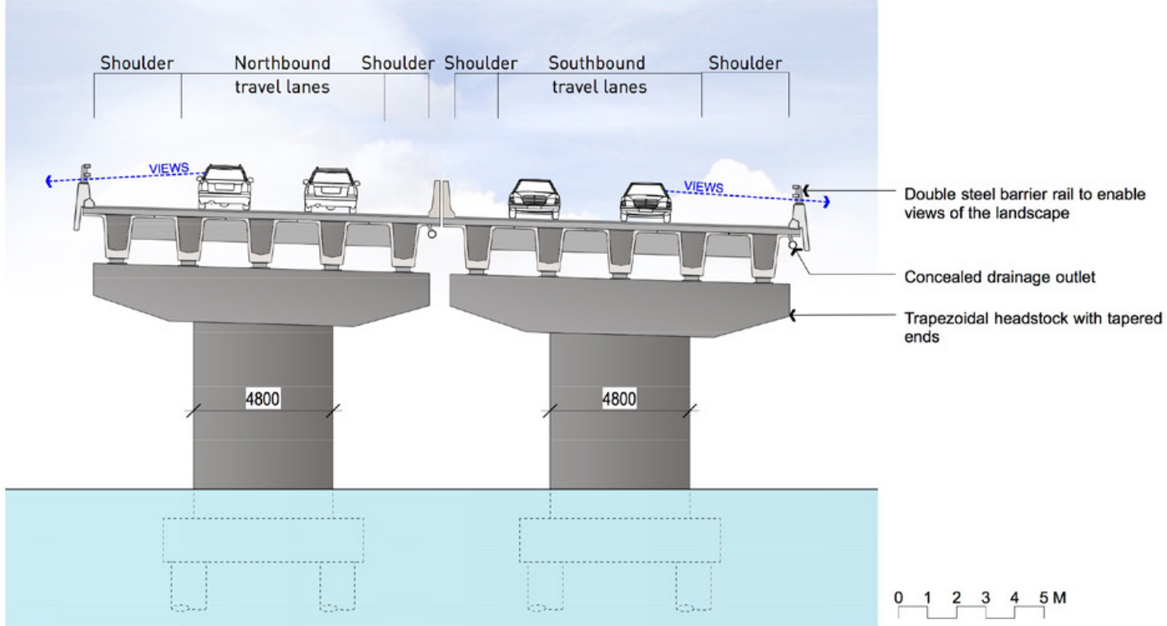
Figure 6–24 Bridge B04 over main alignment (Tarro)



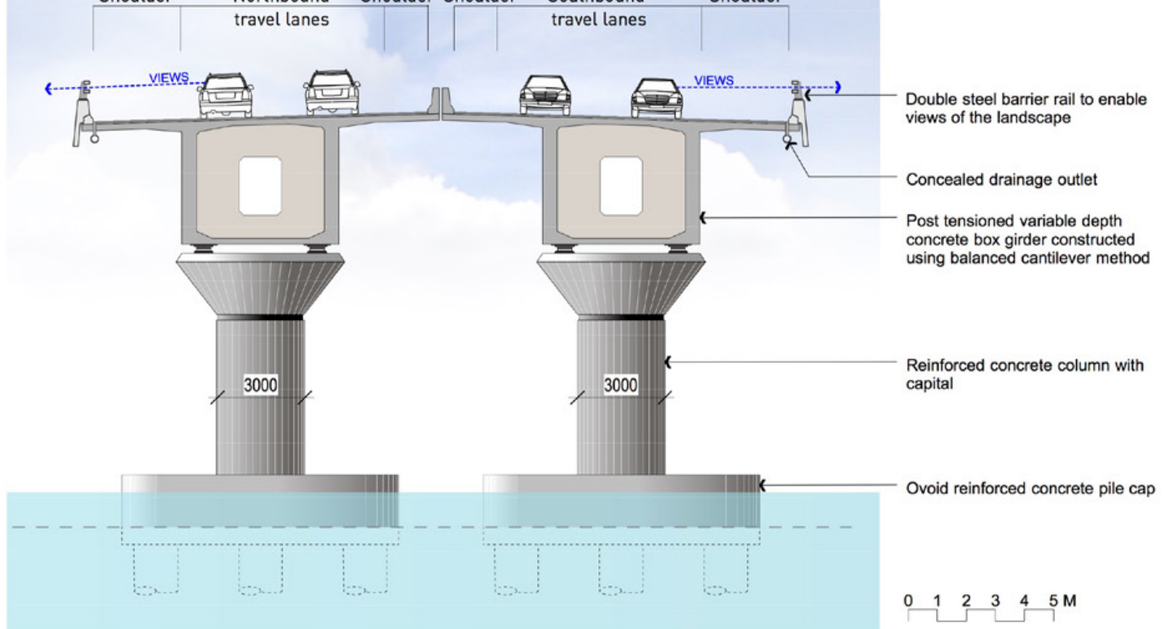
1 BRIDGE 05 PIER TYPE 1 - FLOODPLAIN PIER - SECTION
SCALE @ A3: 1:200



2 BRIDGE 05 PIER TYPE 2 - PIER ALONG MAIN NORTH RAIL LINE - SECTION
SCALE @ A3: 1:200

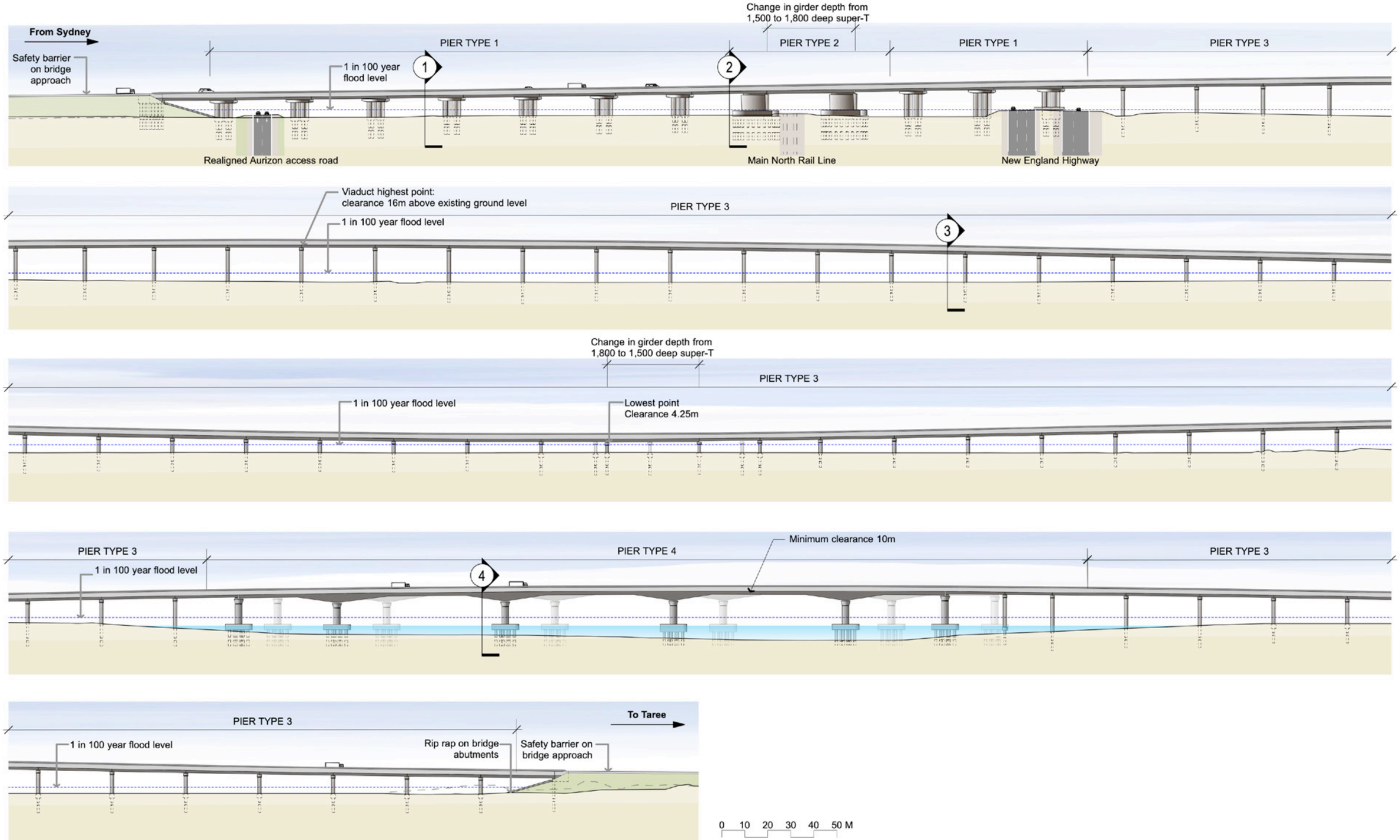


3 BRIDGE 05 PIER TYPE 3 - TRANSITION PIER - SECTION
SCALE @ A3: 1:200



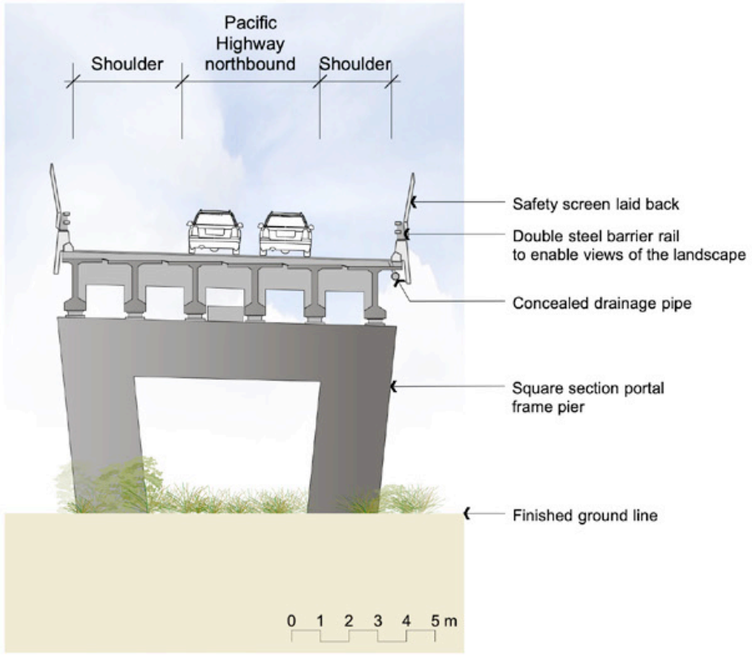
4 BRIDGE 05 PIER TYPE 4 - HUNTER RIVER PIER - SECTION
SCALE @ A3: 1:200

Figure 6–25 Bridge B05 viaduct over Hunter River (Hunter River floodplain): cross sections

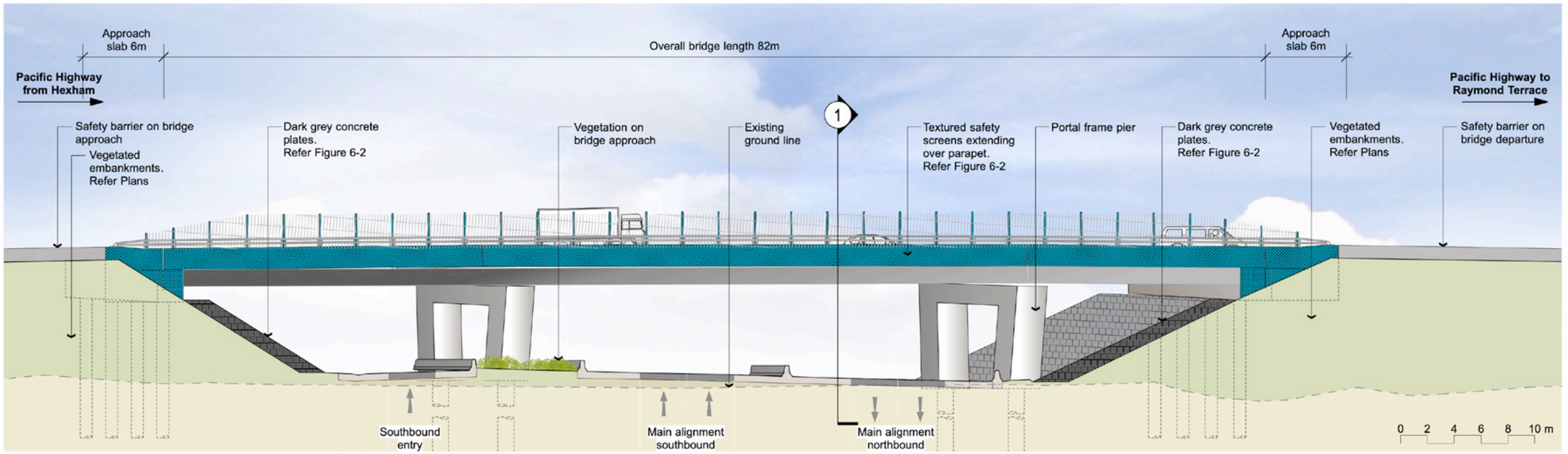


1 BRIDGE B05 VIADUCT OVER HUNTER RIVER (HUNTER RIVER FLOODPLAIN) - ELEVATION
SCALE @ A3: 1:1,500

Figure 6–26 Bridge B05 viaduct over Hunter River (Hunter River floodplain): elevation

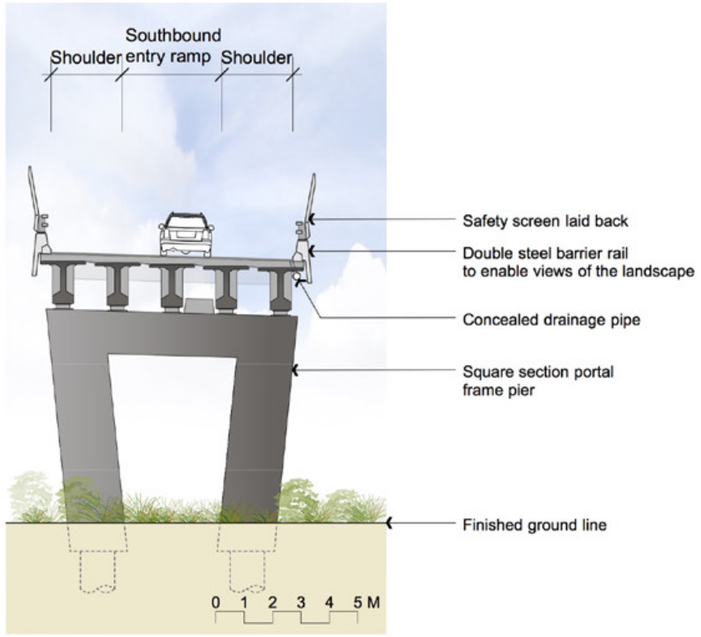


1 BRIDGE B06 OVER M1 PACIFIC MOTORWAY (TOMAGO) - SECTION
SCALE @ A3: 1:200

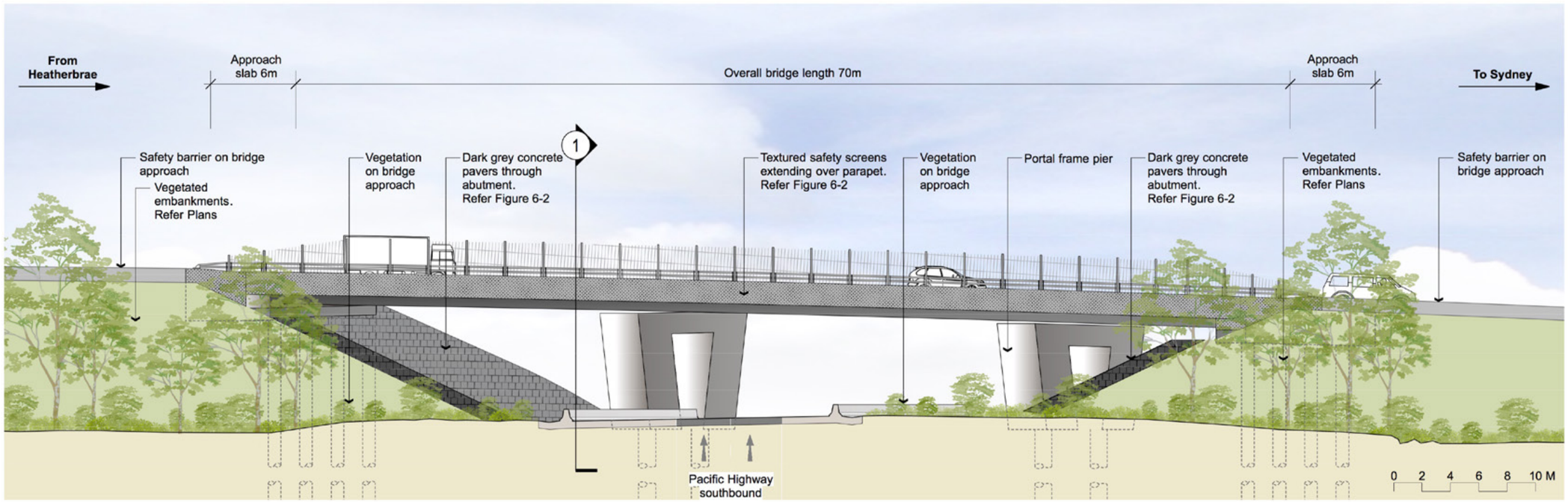


2 BRIDGE B06 OVER M1 PACIFIC MOTORWAY (TOMAGO) - ELEVATION
SCALE @ A3: 1:300

Figure 6–27 Bridge B06 over M1 Pacific Motorway (Tomago)

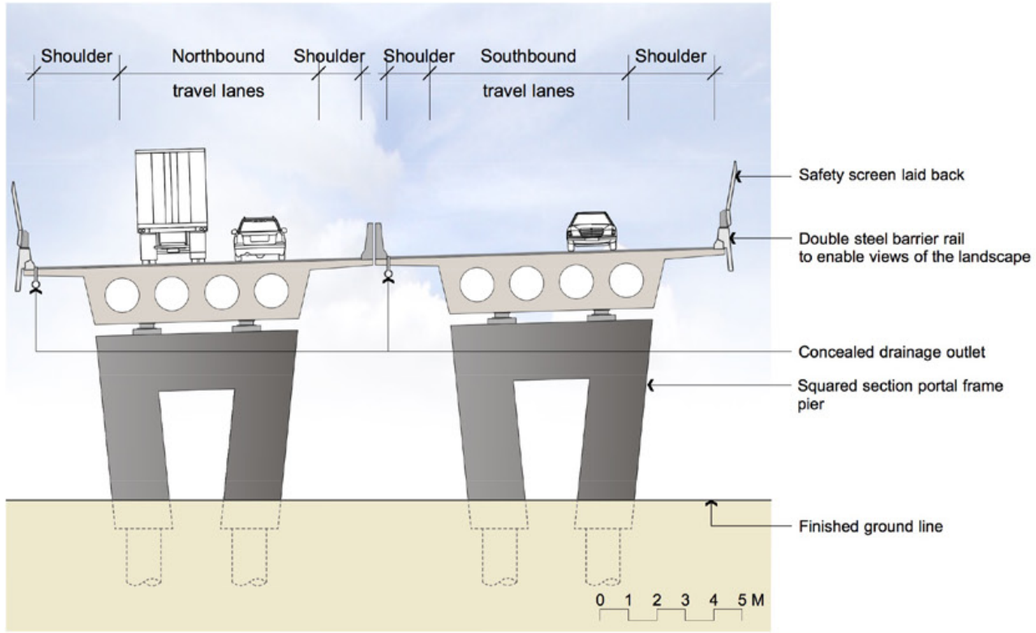


1 BRIDGE 7: SOUTH-BOUND ENTRY OVER PACIFIC HIGHWAY - SECTION
SCALE @ A3: 1:200

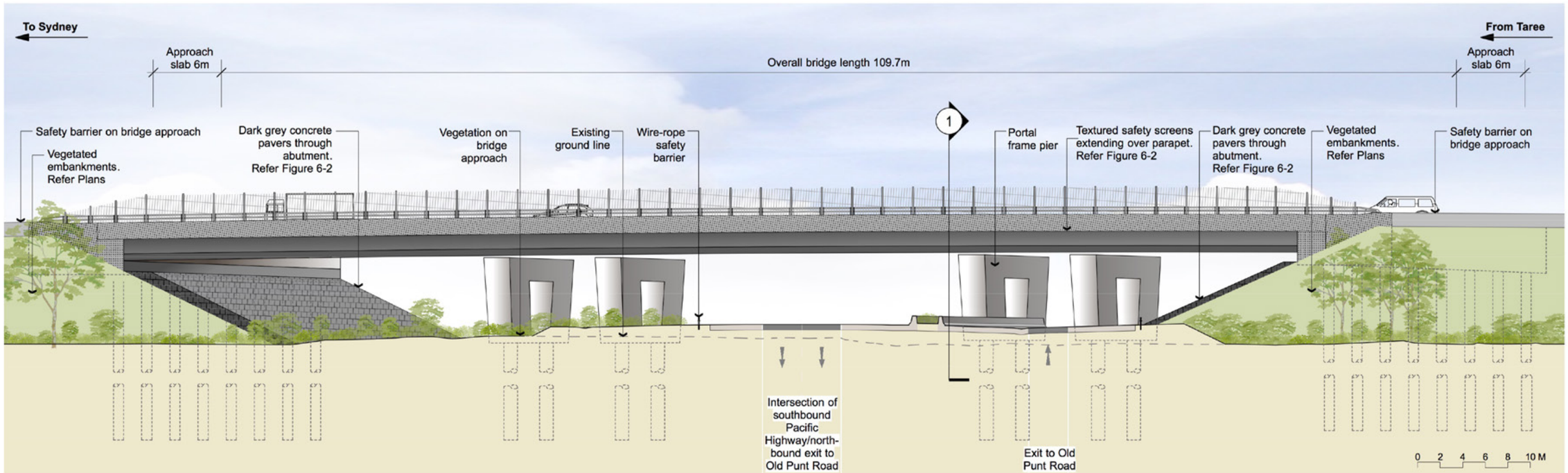


2 BRIDGE 7: SOUTH-BOUND ENTRY OVER PACIFIC HIGHWAY - ELEVATION
SCALE @ A3: 1:300

Figure 6–28 Bridge B07 over Pacific Highway (Tomago)

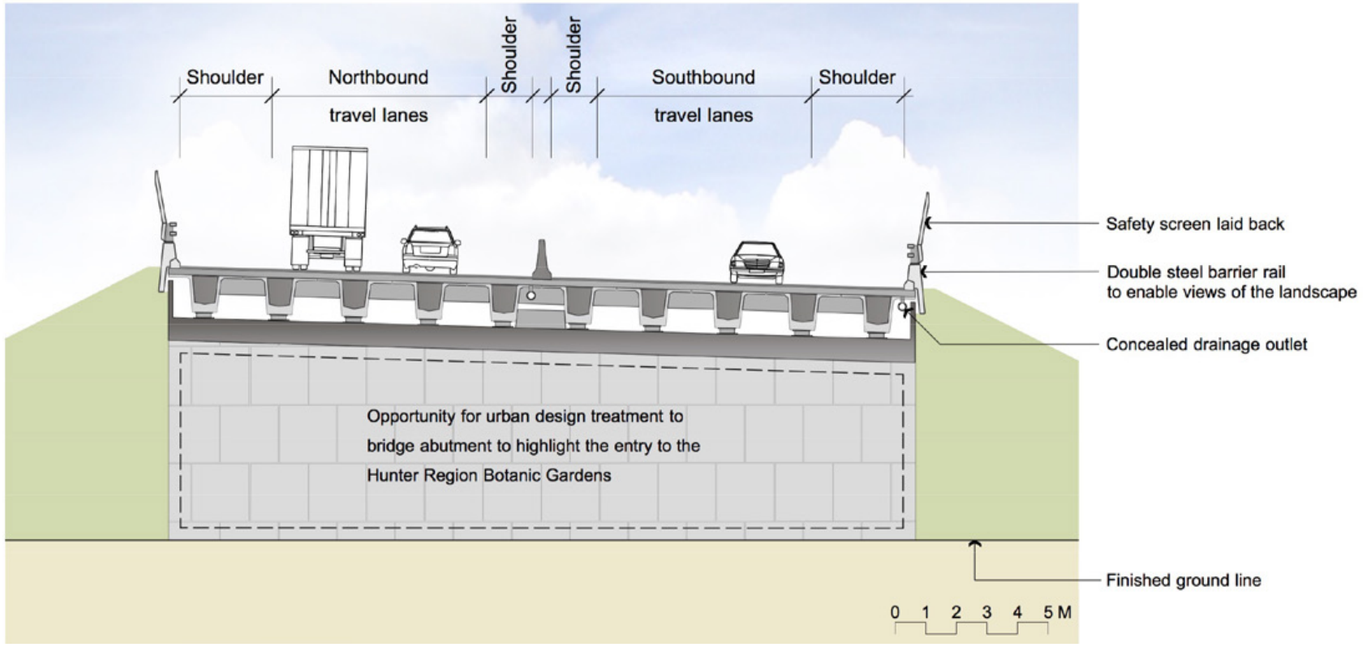


1 TWIN BRIDGES B08 OVER OLD PUNT ROAD (TOMAGO) - SECTION
SCALE @ A3: 1:200

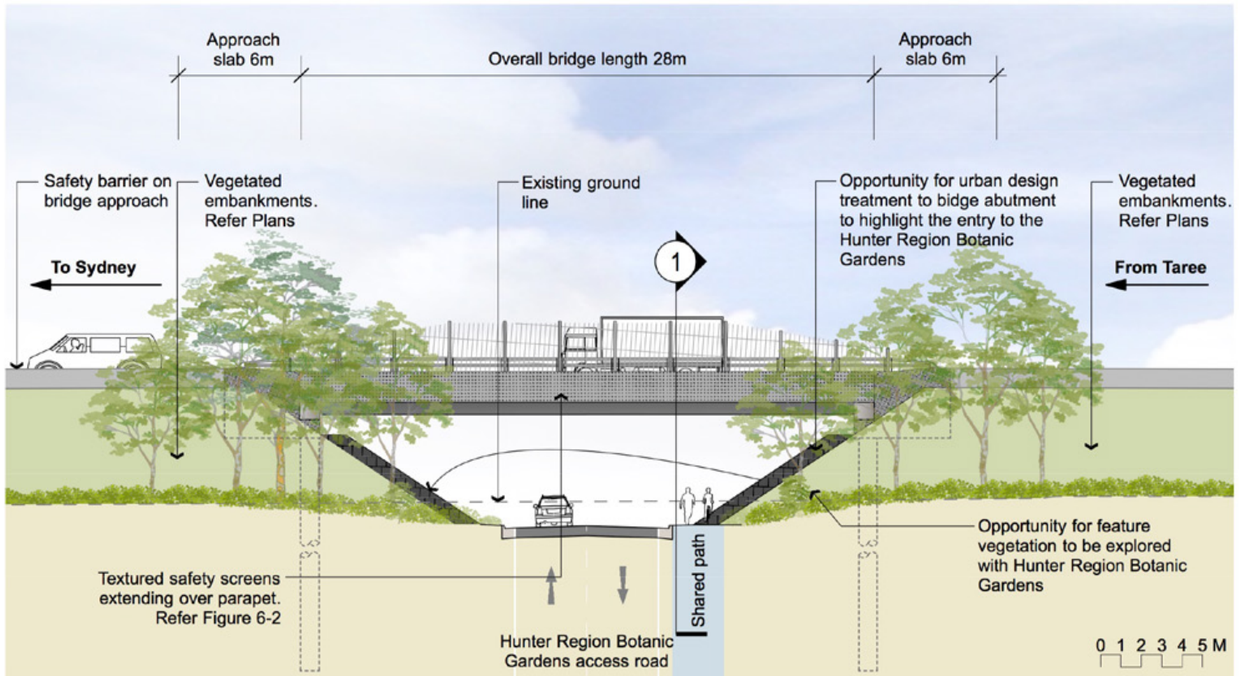


2 TWIN BRIDGES B08 OVER OLD PUNT ROAD (TOMAGO) - ELEVATION
SCALE @ A3: 1:350

Figure 6–29 Twin bridges B08 over Old Punt Road (Tomago)

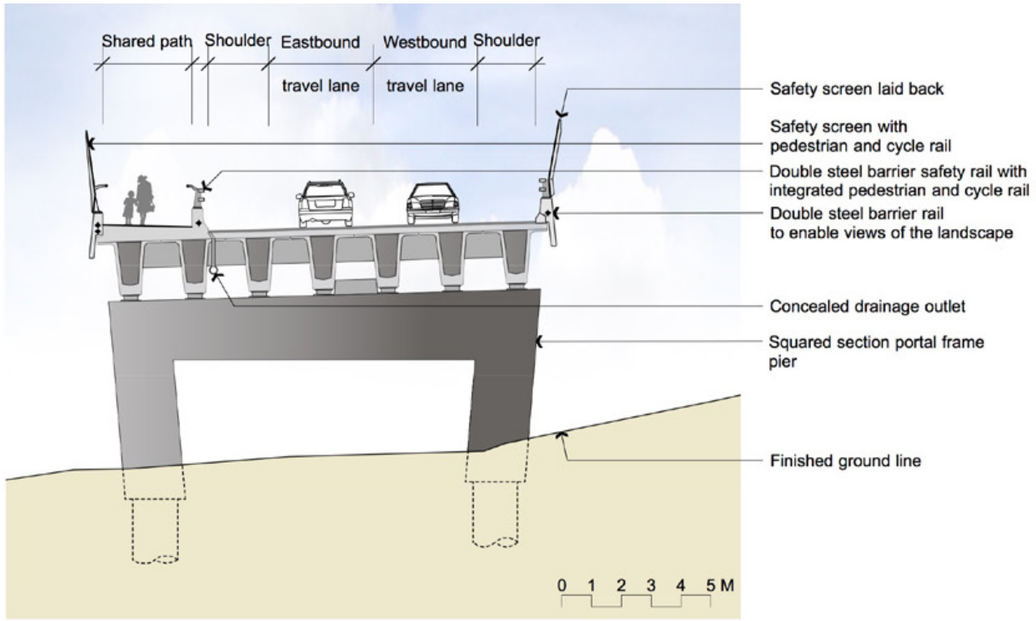


1 BRIDGE B09 OVER HUNTER REGION BOTANIC GARDENS ACCESS ROAD (TOMAGO) - SECTION
SCALE @ A3: 1:200



2 BRIDGE B09 OVER HUNTER REGION BOTANIC GARDENS ACCESS ROAD (TOMAGO) - ELEVATION
SCALE @ A3: 1:300

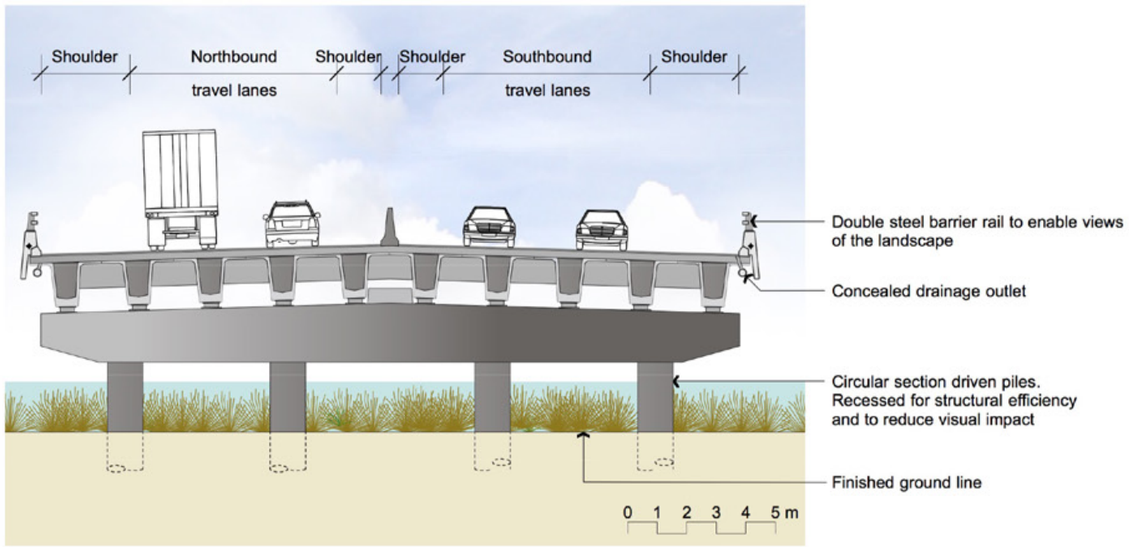
Figure 6–30 Bridge B09 over Hunter Region Botanic Gardens access road (Tomago)



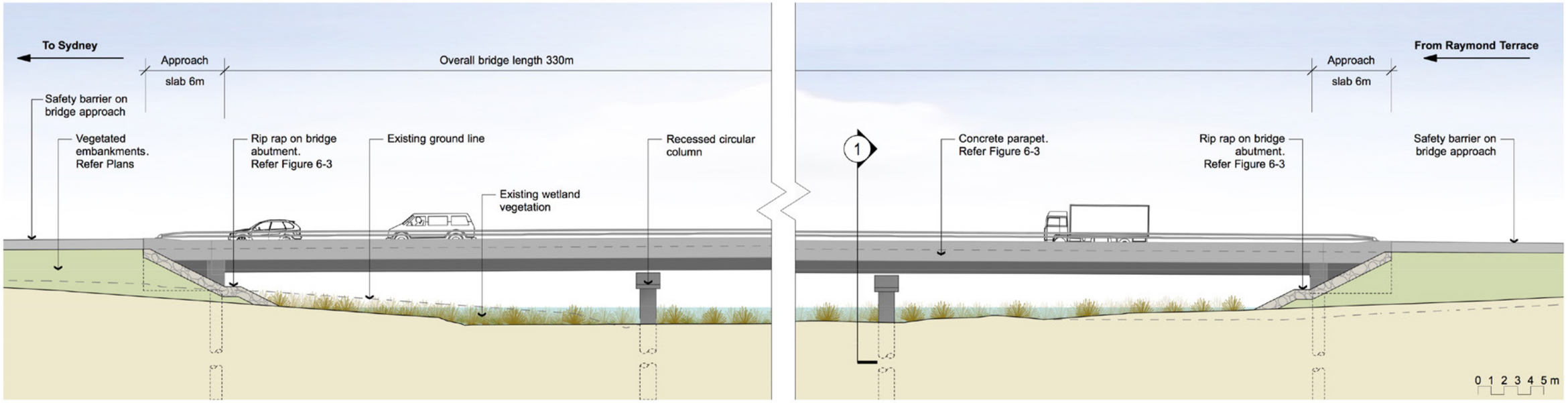
1 BRIDGE B10 OVER M1 PACIFIC MOTORWAY (HEATHERBRAE) - SECTION
SCALE @ A3: 1:200

2 BRIDGE B10 OVER M1 PACIFIC MOTORWAY (HEATHERBRAE) - ELEVATION
SCALE @ A3: 1:300

Figure 6–31 Bridge B10 over M1 Pacific Motorway (Heatherbrae)

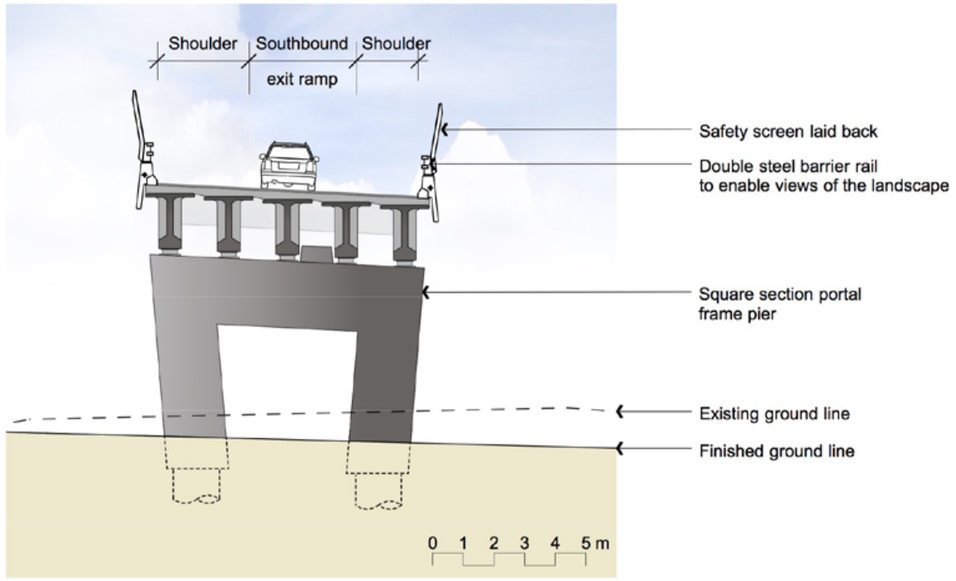


1 BRIDGE B11 OVER WINDEYERS CREEK AND ASSOCIATED WETLANDS (HEATHERBRAE) - SECTION
SCALE @ A3: 1:200

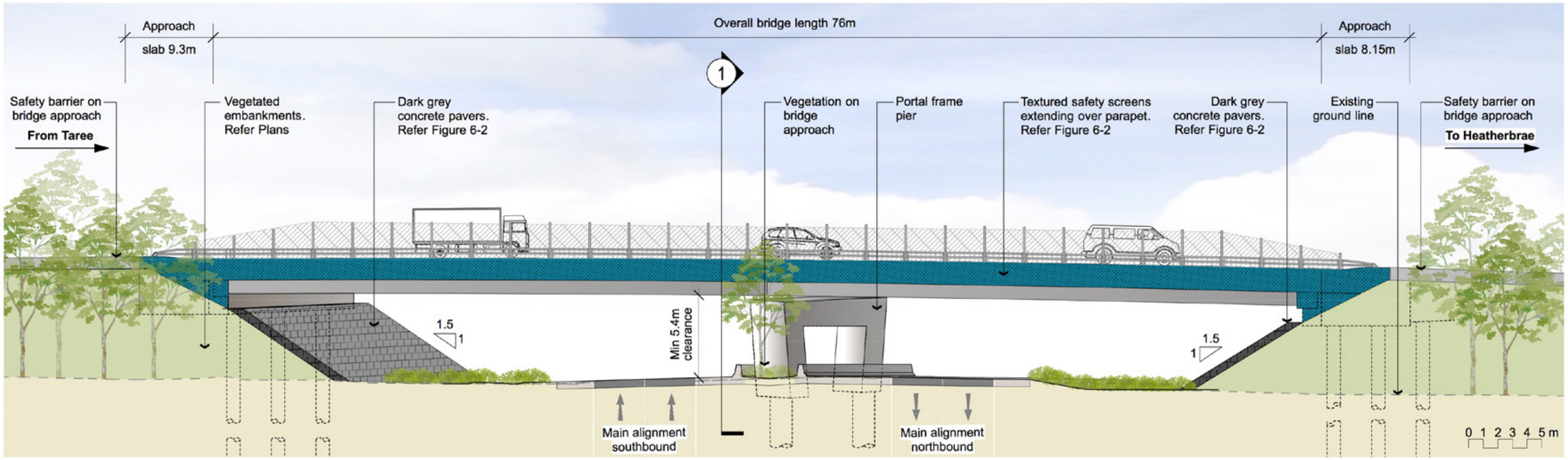


2 BRIDGE B11 OVER WINDEYERS CREEK AND ASSOCIATED WETLANDS (HEATHERBRAE) - ELEVATION
SCALE @ A3: 1:300

Figure 6–32 Bridge B11 over Windeyers Creek and associated wetlands (Heatherbrae)



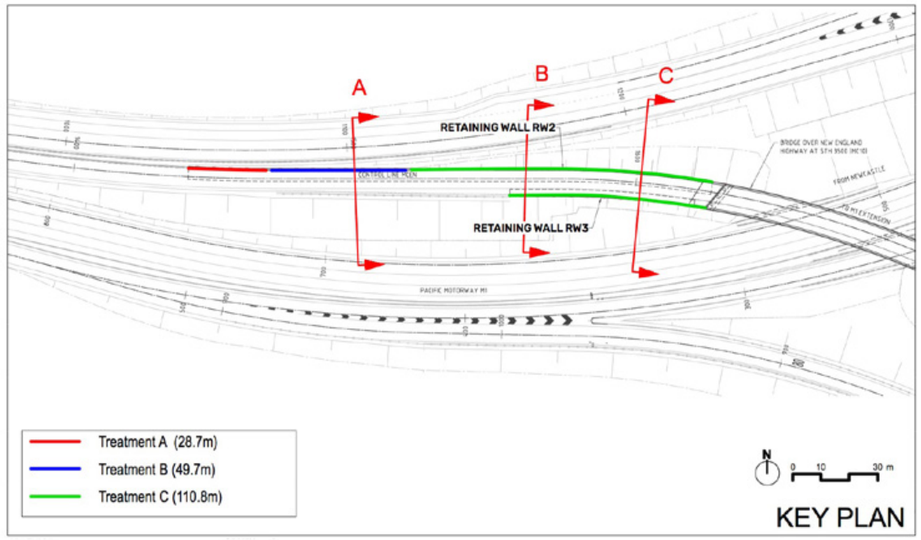
1 BRIDGE B12 OVER M1 PACIFIC MOTORWAY (RAYMOND TERRACE) - SECTION
SCALE @ A3: 1:200

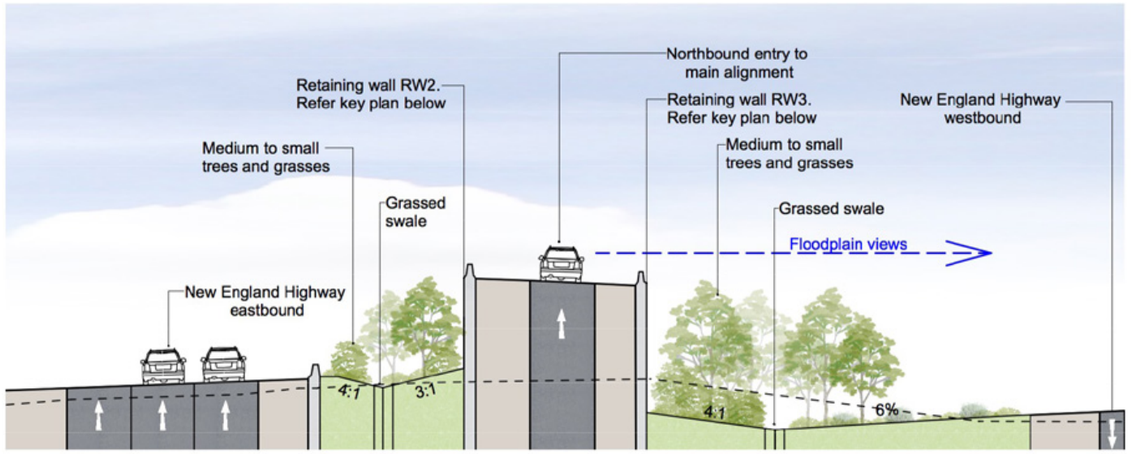


2 BRIDGE B12 OVER M1 PACIFIC MOTORWAY (RAYMOND TERRACE) - ELEVATION
SCALE @ A3: 1:300

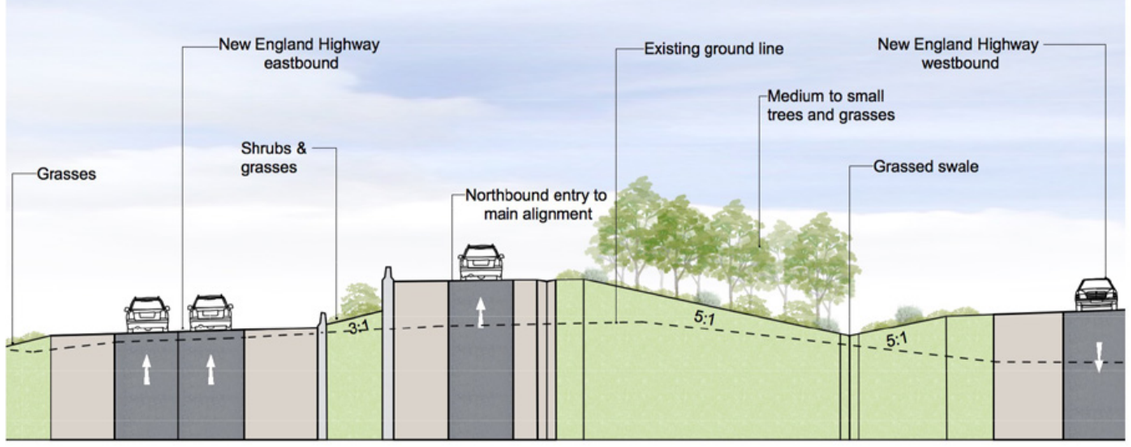
Figure 6–33 Bridge B12 over M1 Pacific Motorway (Raymond Terrace)

6.12.4 Retaining wall drawings

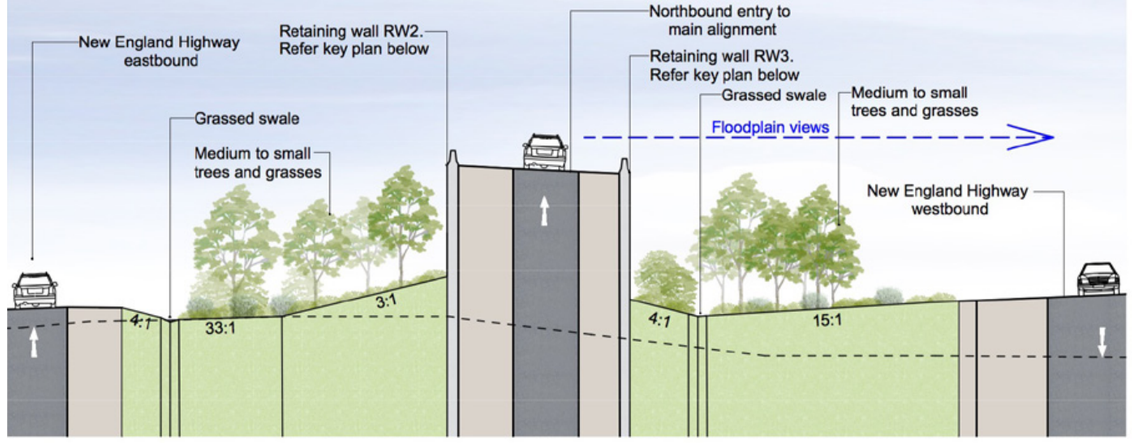




SECTION B



SECTION A



SECTION C

Figure 6–34 Retaining wall cross sections, Tarro interchange

7 LANDSCAPE CHARACTER IMPACT ASSESSMENT

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7.

Landscape character impact assessment

7.1 Landscape character zones

Based on the contextual analysis and ground-truthing, seven LCZs were identified within the study area. They are described in **Table 7–1** and shown on **Figure 7–1**.

Table 7–1 Landscape character zones within the study area

Landscape character zone	Description
LCZ 1: Black Hill	The Black Hill landscape is characterised by dense native woodlands incised by clearings for the existing M1 Pacific Motorway, John Renshaw Drive and utility easements. The area is situated on elevated land next to the Hunter River floodplain and Hexham Swamp and includes rural residential properties in Black Hill. The topography is gently undulating.
LCZ 2: Hunter River Floodplain	The Hunter River Floodplain landscape is characterised by the low-lying and flat topography of the floodplain and its predominant grazing land use. There are also large areas of wetlands and natural swamps including Hexham Swamp. Intermittent stands and clumps of swamp and floodplain forests as well as stands of mangroves along the Hunter River provide a contrast with the low-growing vegetation cover associated with grazing and swampy and wetland areas.
LCZ 3: Beresfield – Tarro – Woodberry	The Beresfield – Tarro – Woodberry landscape is characterised by predominantly low-density residential areas located on gently undulating land on higher ground overlooking the floodplain. Each suburb has a small centre and incorporated public open space and recreation areas. A light industrial area/employment area is located in Beresfield north of and next to John Renshaw Drive.
LCZ 4: Tomago	The Tomago landscape is distinct from other urban areas surrounding the project, functioning primarily as an employment area with a diversity of industrial uses, the largest of which is aluminium smelting at Tomago. Pockets of native open forests and woodland remain including along the road system and the edges of major power easements.
LCZ 5: Tomago Sandbeds	The Tomago Sandbeds landscape is characterised by dense native woodland cover divided into large blocks by power easements and associated access and management tracks. The western edge encompasses elevated land along the edge of and overlooking the Hunter River floodplain including the existing Pacific Highway alignment.
LCZ 6: Heatherbrae	The Heatherbrae landscape is characterised by the small urban centre of Heatherbrae, situated above the edge of the Hunter River floodplain and laid out along the existing Pacific Highway. The area functions as a local residential, service and employment centre.
LCZ 7: Windeyers Creek	The Windeyers Creek landscape separates the urban area of Heatherbrae from the urban area of Raymond Terrace. The landscape character constitutes a highly modified landscape along Windeyers Creek and the Grahamstown Drain and incorporates associated wetlands and tributaries. It is characterised by a mix of native vegetation, wetlands, pastures and pine plantations. It also has important water management functions that include the Raymond Terrace water treatment works.

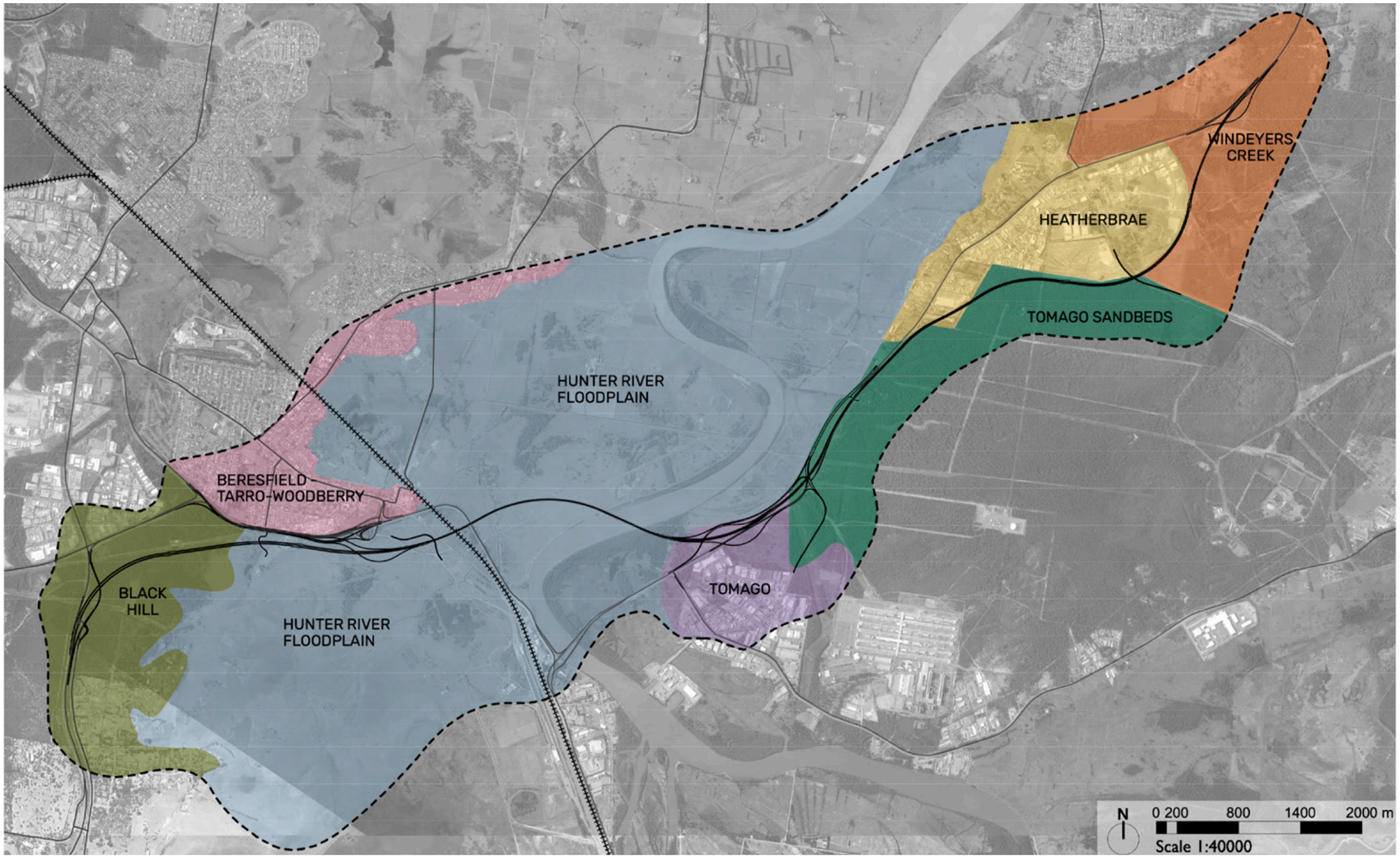

Figure 7–1 Landscape character zones within the study area

7.2 Construction impacts

Before construction starts detailed planning would be carried out to consider construction methods and scheduling, and how to manage community and environmental issues. These issues generally include noise, access, amenity and general disruption and compliance with work, health and safety requirements.

Construction methods and management measures to minimise environmental impacts would be detailed in the Construction Environmental Management Plan (CEMP), which would be prepared by the construction contractor. The construction contractor would manage construction impacts in accordance with the following general principle:

- Consider and manage the effect on urban amenity, including impacts on residential receivers and road users in terms of amenity, noise, access and general disruption
- Manage impacts on existing infrastructure including local roads, utilities and services
- Recognise the increased safety risk when carrying out modifications to existing infrastructure and that night work or traffic switches may be required.

The project construction footprint is the area required to construct the project. The construction footprint is generally broader than the operational footprint. A construction footprint for the project has been provided in Chapter 5 of the EIS. It seeks to minimise environmental impacts while providing sufficient room to allow the project to be constructed in a safe manner.

Irrespective of detailed construction planning, landscape character impacts experienced during construction for a project of this nature would result from the permanent operational project elements as they are being constructed and from temporary sources of change to the landscape character. Typically, temporary sources of change would include:

- Construction footprint establishment including vegetation removal, fencing and hoarding
- Ancillary facilities establishment and operation including vegetation removal, fencing and hoarding
- Construction activities including the operation of plant and equipment
- Construction-related traffic movements including workforce movements
- Traffic management including temporary traffic changes and management measures
- Lighting during construction (**Section 7.2.2**).

Chapter 5 of the EIS provides further detail on construction of the project.

7.2.1 Landscape character impacts

Construction activities would take place in all LCZs and result in temporary landscape character impacts. Impacts would vary across the project's construction footprint depending on the construction activities being carried out at the time. Some LCZs would also be impacted by work in adjoining LCZs where activities occur close to LCZ interfaces.

LCZs that have a high sensitivity to change, would experience greater landscape character impacts during construction. The landscape character impacts of the project during construction are expected to be:

- High for the Hunter River Floodplain LCZ
- High-moderate for Tomago Sandbeds LCZ
- Moderate for the Black Hill, Beresfield-Tarro-Woodberry, Heatherbrae and Windeyers Creek LCZs
- Moderate-low for the Tomago LCZ.

Overall, impacts during construction are temporary in nature and would be managed where possible through appropriate siting of infrastructure, materials and finishes of sheds and hoardings, and management of increased traffic in the study area.

7.2.2 Lighting during construction

Some night time construction would be required as detailed in Chapter 5 of the EIS and may impact sensitive receivers and fauna in close proximity.

In order to prevent adverse impacts on the health and well-being of sensitive receivers in close proximity, all night work and lighting would be managed in accordance with statutory requirements and guidelines to ensure that there would be no unacceptable lighting impacts. Lighting procedures and management measures would be documented in the CEMP and carried out accordingly. This may include consideration of lighting levels, projection angles, direction and length of frequency of exposure.

Light pollution has the potential to impact nocturnal fauna by interrupting their life cycle or making species more vulnerable to predation. However, fauna within the study area would already be accustomed to light pollution from the existing lighting on the New England Highway and Pacific Highway. The increased artificial lighting associated with the project would be unlikely to have a significant effect. An assessment of light impacts on fauna is provided in the BAR (Appendix I of the EIS).

7.3 Operational impacts in LCZ 1 - Black Hill

The existing landscape character of Black Hill is discussed in **Table 7–2**, together with a description of changes in the LCZ as a result of the project. The landscape character of Black Hill is illustrated on **Figure 7–2**.

7.3.1 Project elements

The major project elements in LCZ 1 include:

- The Black Hill interchange including lighting
- A major cutting (Cut C01) through the ridge line at Black Hill, between the existing M1 Pacific Motorway and the Hunter River floodplain
- Replacement of a small section of existing noise barrier with a new noise barrier (NB01) of the same height
- Road drainage and water quality control measures
- Roadside furniture and elements such as safety barriers, fences and signs.

Figure 7–2 Landscape character images Black Hill

7.3.2 Landscape character assessment

Table 7–2 Black Hill existing landscape character and likely changes

Character attribute	Existing landscape character	Landscape character changes
Landform	• Undulating landform rising from the Hunter River floodplain to a ridge along the M1 Pacific Motorway.	Cut C01 would alter the landform. Revegetation would help integrate the cutting with the natural landform over time.
Vegetation cover	• Extensive bushland vegetation in the north, bisected by a number of utility easements • Grazing in the south.	• Clearing for the project would alter bushland cover in the northern LCZ • Localised vegetation removal may be required for the replacement noise barrier NB01 • Revegetation of native plant community types within the operational footprint would minimise this change.
Built form	• Rural residential dwellings in the south-east • High voltage power lines.	• New road infrastructure in previously undeveloped areas • NB01 would replace an existing noise barrier of the same height in a similar location and would not result in any changes to the built form in this zone.
Heritage	• No non-Aboriginal heritage items • Several Aboriginal heritage items.	Aboriginal heritage would be salvaged from the construction footprint as part of Aboriginal heritage management measures (refer to the ACHAR in Appendix L of the EIS). Removal would not affect the overall landscape character.
Spatial quality	• Enclosed in bushland areas • In rural residential and grazing areas dwellings and remnant and planted vegetation provide spatial definition • Views are limited to short-distance views along road and utility corridors.	Localised change to the spatial quality where the project would bisect bushland in the northern part of the LCZ and open up new view corridors.
Public domain	• There are no public domain areas within this LCZ • There is no public open space.	The project would not impact any public domain areas.
Key activity areas	There are two activity areas within 500m of the project: • The Beresfield light industrial area north of John Renshaw Drive • The Hunter Valley Equestrian Centre on the western side of the M1 Pacific Motorway.	The project would not change the use of existing activity areas.
Connectivity and access	• Main routes for vehicular access and connectivity include the M1 Pacific Motorway, John Renshaw Drive, Weakleys Drive, New England Highway and Lenaghans Drive • No public transport • Limited provision for cycling, generally on-road • No dedicated pedestrian paths.	• Improved regional and national transport connectivity • Reduced traffic along the New England Highway and John Renshaw Drive constituting a beneficial change • Improved cycle connectivity through a more direct and continuous route for cyclists from the Black Hill interchange to the existing Pacific Motorway north of Heatherbrae • All existing access is retained with some modifications.

7.3.3 Landscape character impact assessment summary

Sensitivity

Due to the undulating topography and extensive tree cover, changes within this LCZ would not be widely visible beyond the project's operational footprint. However, bushland in the LCZ is important as a visual backdrop to the open floodplain. Accommodating change of the order brought about by the project would not be possible without altering the spatial qualities and landform of the LCZ.

The sensitivity of the Black Hill LCZ to change is considered to be **moderate**.

Magnitude

The project would increase the amount of the road-related infrastructure in this LCZ. It would require clearing of remnant bushland vegetation and result in changes to the natural landform to accommodate the project's geometric requirements, including the large Black Hill cut (C01). The changes would affect the spatial character of this LCZ.

Beneficial outcomes from the project would be a reduction in traffic volumes on John Renshaw Drive and the New England Highway, reducing congestion and improving connectivity. The provision of a more direct cycle route along the project also delivers further connectivity improvements.

Overall, the assessment indicates the magnitude of impact of the project in this zone would be **moderate**.

Conclusion

The assessment indicates the landscape character impact on this zone is likely to be **moderate**.

Summary - LCZ 1	Rating
Sensitivity	Moderate
Magnitude	Moderate
Landscape character impact	**Moderate**

7.4 Operational impacts in LCZ 2 – Hunter River Floodplain

The existing landscape character of the Hunter River Floodplain is discussed in **Table 7–3**, together with a description of changes in the LCZ as a result of the project. The landscape character of the Hunter River Floodplain is illustrated on **Figure 7–3**.

7.4.1 Project elements

The major project elements in LCZ 2 include:

- Modifications to the existing Tarro interchange including lighting
- Bridges including the viaduct (B05) over the Hunter River floodplain and bridge B02 over wetlands at Tarro
- Adjustments to existing roads and property access
- Road drainage and water quality control measures
- Adjustment of Purgatory Creek
- Roadside furniture and elements such as safety barriers, fences and signs.

Figure 7–3 Landscape character images of Hunter River floodplain

7.4.2 Landscape character assessment

Table 7–3 Hunter River Floodplain existing landscape character and likely changes

Character attribute	Existing landscape character	Landscape character changes
Landform	• The flat low-lying Hunter River floodplain and associated wetlands define the landscape.	The project would not alter the landform.
Vegetation cover	• Predominantly low growing vegetation • Dispersed floodplain forest remnants in small clumps and larger stands.	• Much of the project would be elevated above existing, minimising vegetation clearing • Cleared vegetation would comprise predominantly low-growing pasture vegetation, as well as a small section of mangroves along the Hunter River. Reinstatement of vegetation through project landscape work would minimise this change.
Built form	• No urban centres • Small number of rural properties • High voltage transmission lines.	• New road infrastructure through the previously undeveloped floodplain • The viaduct (B05) would create a landmark crossing of the Hunter River • By introducing an additional road corridor, the project would alter the direct physical and visual relationship between Tarro and the floodplain.
Heritage	• Several items of non-Aboriginal heritage, most of which are well beyond the project's operational footprint • Several Aboriginal heritage items.	• The project would bisect the curtilage of the heritage-listed Glenrowan Homestead and require the demolition of the weatherboard cottage. The introduction of a motorway corridor would alter the integrity of the building complex within the landscape setting, vistas to the north and the visual amenity of the setting • Impacts on heritage values, management and mitigation are fully described in the Non-Aboriginal Heritage Working Paper (Appendix Q of the EIS) • Aboriginal heritage would be salvaged from the construction footprint as part of Aboriginal heritage management measures (refer to the ACHAR in Appendix L of the EIS). Removal would not affect the overall landscape character.
Spatial quality	• Open and expansive landscape framed by low hills in adjoining LCZs.	• Earthworks formation would result in changes to the open landscape and spatial qualities at the interface with LCZ 3 • The size and spacing of piers supporting the viaduct (B05) would interfere with the open spatial character of the floodplain • The Hunter River bridge (B05) would alter the open spatial character as experienced by water-based viewers along a short section of the Hunter River • Project bridges would provide new opportunities to experience the open landscape.
Public domain	• Limited to an undeveloped open space west of the Hunter River High School in Heatherbrae, located about 850m north of the project.	The project would not result in any changes to public domain areas.
Key activity areas	• Hexham industrial area provides a range of employment opportunities • Water-based activities associated with the Hunter River.	The project would not result in any changes to activity areas.
Connectivity and access	• Main routes for vehicular access and connectivity include the New England Highway and Maitland Road • The Main North Rail Line is an important freight and commuter rail • Limited provision for cycling, generally on-road • Proposed Richmond Vale Rail Trail dedicated off-road cycle route – refer **Section 4.8.3** • No dedicated pedestrian paths.	• Improved regional and national transport connectivity • Reduced traffic along the New England Highway constitutes a beneficial change • Improved cycle connectivity through a more direct and continuous route for cyclists from the Black Hill interchange to the existing Pacific Motorway north of Heatherbrae • All existing access would be maintained, with some modifications.

7.4.3 Landscape character impact assessment summary

Sensitivity

The predominantly greenfield setting and the open landscape character with expansive views in all directions result in a low capacity to absorb change of the order associated with the project.

The sensitivity of the Hunter River Floodplain LCZ to change is considered to be **high**.

Magnitude

The project would increase the amount of the road-related infrastructure. Changes to the spatial qualities of the LCZ and its vegetation cover would be minor, with disturbed vegetation reinstated following project construction. The open spatial experience travelling along the New England Highway would be replaced with a similar experience along the main alignment.

The project would impact on the heritage values and significance of the Glenrowan Homestead through removal of the weatherboard cottage and bisection of the curtilage, affecting the integrity, vistas and landscape setting of the complex.

Beneficial outcomes from the project would be a new landmark crossing of the Hunter River, a reduction in traffic volumes on the New England Highway, reducing congestion and improving connectivity. The provision of a more direct cycle route along the project delivers further connectivity improvements.

Overall, the assessment indicates the magnitude of impact of the project in this zone would be **moderate**.

Conclusion

The assessment indicates the landscape character impact on this zone is likely to be **high to moderate**.

Summary - LCZ 2	Rating
Sensitivity	High
Magnitude	Moderate
Landscape character impact	**High to moderate**

7.5 Operational impacts in LCZ 3 – Beresfield-Tarro-Woodberry

The existing landscape character of Beresfield-Tarro-Woodberry is discussed in **Table 7–4**, together with a description of changes in the LCZ as a result of the project. The landscape character of Beresfield-Tarro-Woodberry is illustrated on **Figure 7–4**.

7.5.1 Project elements

The major project elements in LCZ 3 include:

- Widening the New England Highway generally between John Renshaw Drive and the existing Anderson Drive at Tarro interchange
- New and repaired existing noise barriers (NB02) along the New England Highway
- New noise barrier (NB03) along the New England Highway.

The project construction footprint would also extend into LCZ 3. This has been taken into consideration in the description of construction impacts in **Section 7.2**.

Figure 7–4 Landscape character images Beresfield-Tarro-Woodberry

7.5.2 Landscape character assessment

Table 7–4 Beresfield-Tarro-Woodberry existing landscape character

Character attribute	Existing landscape character	Landscape character changes
Landform	• Gently undulating landform, raised above the Hunter River floodplain	The project would not alter the landform.
Vegetation cover	• Predominantly urban areas • Vegetation is associated with private residential properties, open space areas and street trees and road corridors.	Minor changes to vegetation cover at the interface to LCZ 2 as a result of noise wall installation. Landscaping for the project would partly reduce this change over time.
Built form	• Predominantly low rise urban form with a range of uses • Existing noise walls along parts of the New England Highway.	The noise barrier NB03 near the Palm Valley Village would introduce new built form that would be consistent with the scale of existing built form. Similar, new and repaired existing noise barriers NB02 would be consistent with the scale of the built form in this zone.
Heritage	• Several items of non-Aboriginal heritage. The Tarro Historic Site is the only item within the project's construction footprint • The project would be visible from the Tarro Pumping Station and the residence at 29 Eastern Avenue, Tarro • There are no Aboriginal heritage items.	• Noise barrier NB03 installation and associated vegetation removal would change the character of the landscape setting for the heritage-listed residence at 29 Eastern Avenue by altering the spatial character and outlook. Screening vegetation provided as part of the project landscape design would re-establish a visual buffer towards the Tarro interchange over time but open vistas towards the floodplain would be interrupted by the noise barrier NB03 • The project would change the character of the setting of the Tarro Pumping Station. Visual impacts on the Tarro Pumping Station are addressed in **Section 8.3.6** • The Tarro Historic Site (**Figure 4–5**) is located within the construction footprint of the project. It is not anticipated that any construction activities would be carried out within the site • Heritage impacts, management and mitigation are fully described in the Non-Aboriginal Heritage Working Paper (Appendix Q of the EIS). They would not result in changes to the landscape character of this zone • Aboriginal heritage would be salvaged from the construction footprint as part of Aboriginal heritage management measures (refer to the ACHAR in Appendix L of the EIS). Removal would not affect the overall landscape character.
Spatial quality	• Enclosed in urban areas except for interfaces with LCZ 2 which enjoy expansive views over the floodplain.	• The project would result in a change to the spatial quality at the interface to LCZ 2 where new noise barrier segments of NB02 and new noise barrier NB03 would introduce a visual barrier between Tarro and the floodplain. The change would affect areas where no noise barriers currently exist and where there are relatively open views towards the floodplain landscape in LCZ 2. These areas are: – East of Quarter Sessions Road – Along the south-eastern boundary of Palm Valley Village – Along the rear of properties in southern Eastern Avenue. • There would be no change to the spatial quality to areas west of Christie Road due to the combination of existing noise wall NB02 existing enclosing vegetation.
Public domain	• Streets, footpaths, parks and public places in urban areas are generally located well outside project's operational footprint.	The project would not result in any changes to public domain areas.

Character attribute	Existing landscape character	Landscape character changes
Key activity areas	• Commercial areas, clubs, churches and other places of worship, cemeteries and rail stations, all of which are located well outside the project's operational footprint • Palm Valley Village immediately adjoins the project and comprises holiday accommodation as well as long-term accommodation • Tarro Railway Station is the main area of public activity from where the project would be visible. It is located about 400m north of the viaduct (B05).	• The project would not result in any changes to existing activity areas • Visual impacts on the Palm Valley Village and Tarro Railway Station are addressed in **Section 8.3.5** and **Section 8.3.7** respectively.
Connectivity and access	• Anderson Drive and Lawson Avenue are the main routes facilitating access within and between urban areas • Bus routes within urban areas do not interface with the project • No dedicated cycling infrastructure • Proposed Richmond Vale Rail Trail dedicated off-road cycle route – refer **Section 4.8.3** • Footpaths in urban areas outside the project operational footprint.	• Improved regional and national transport connectivity • Reduced traffic along the New England Highway constitutes a beneficial change • Improved cycle connectivity through a more direct and continuous route for cyclists from the Black Hill interchange to the existing Pacific Motorway north of Heatherbrae • No changes to existing access.

7.5.3 Landscape character impact assessment summary

Sensitivity

The primarily residential urban areas of Beresfield, Tarro and Woodberry would be highly sensitive to changes that alter the character, function and built form of the setting such as would be associated a new motorway. This sensitivity would be somewhat reduced by the proximity of the existing New England Highway in the adjoining LCZ 2.

The sensitivity of the Beresfield-Tarro-Woodberry LCZ to change is considered to be **moderate**.

Magnitude

The main project infrastructure introduced into the Beresfield-Tarro-Woodberry LCZ would be new noise barriers along the New England Highway. New noise barriers would result in the loss of the open interface to the Hunter River floodplain in LCZ 2, changing the spatial character at the edge of LCZ 3. This would affect a relatively small portion of the Beresfield-Tarro-Woodberry LCZ and would provide other amenity benefits such as a reduction in noise impacts on residential dwellings in close proximity to the New England Highway. Due to the alignment of the project within existing major road corridors located outside the Beresfield-Tarro-Woodberry LCZ, the existing character of sensitive residential areas would not be altered.

Overall, the assessment indicates the magnitude of the project would be **low**.

Conclusion

The assessment indicates the landscape character impact on this zone is likely to be **moderate to low**.

Summary - LCZ 3	Rating
Sensitivity	Moderate
Magnitude	Low
Landscape character impact	**Moderate to low**

7.6 Operational impacts in LCZ 4 – Tomago

The existing landscape character of Tomago is discussed in **Table 7–5**, together with a description of changes in the LCZ as a result of the project. The landscape character of Tomago is illustrated on **Figure 7–5**.

7.6.1 Project elements

The major project elements in LCZ 4 include:

- A new interchange at Tomago including lighting
- Modifications to Tomago Road including a right-turn lane from Tomago Road onto the Pacific Highway
- Road drainage and water quality control measures
- Roadside furniture and elements such as safety barriers, fences and signs.

Figure 7–5 Landscape character images Tomago

7.6.2 Landscape character assessment

Table 7–5 Tomago existing landscape character and likely changes

Character attribute	Existing landscape character	Landscape character changes
Landform	• Gently undulating landform, rising from the Hunter River floodplain towards the east	Embankments are associated with interchanges and are closely aligned with the natural landform. The project would not alter the overall landform of the area.
Vegetation cover	• Predominantly urban areas • Remnant stands of bushland along Tomago Road, Old Punt Road and between utility easements • Vegetation is associated with the Tomago Village Van Park and some industrial units.	The project would be located in predominantly cleared areas. Removal of tree cover would be minor and any associated character changes would be reduced over time through vegetation provided as part of the project.
Built form	• Predominantly low rise urban form with a range of uses • Mix of built form including industrial sheds and factories, high voltage transmission lines, a small number of residential dwellings and port structures along the Hunter River.	• There would be an increase in road infrastructure parallel to the Pacific Highway • One dwelling on land identified for the proposed Newcastle Power Station (**Chapter 10**) would need to be removed.
Heritage	• No non-Aboriginal heritage items • One Aboriginal heritage site.	• The project would not impact on any non-Aboriginal heritage items • Aboriginal heritage would be salvaged from the construction footprint as part of Aboriginal heritage management measures (refer to the ACHAR in Appendix L of the EIS). Removal would not affect the overall landscape character.
Spatial quality	• Enclosed in urban areas except for interfaces with LCZ 2 which enjoy expansive views over the floodplain.	• Greater degree of spatial enclosure in the northern part of the zone, due to the Tomago interchange, disrupting the interface to LCZ 2 • The realigned Pacific Highway would provide new opportunities to view across the adjoining Hunter River floodplain landscape in LCZ 2.
Public domain	• Public roads and footpaths in the Tomago urban area, mostly located outside the project's operational footprint.	The project would not result in any changes to public domain areas.
Key activity areas	• Tomago has the largest industrial area in the Port Stephens Council LGA, providing major employment opportunities • The Tomago Bowling and Sporting Club is a local recreation venue • The Tomago Village Van Park provides short and long stay accommodation	The project would not result in any changes to existing activity areas.
Connectivity and access	• Main routes for vehicular access and connectivity are the Pacific Highway and Tomago Road • Public bus routes utilise the Pacific Highway, Old Punt Road and Tomago Road • Limited provision for cycling, generally on-road • Limited footpaths in urban areas including along Tomago Road.	• Improved regional and national transport connectivity • Reduced traffic along the Pacific Highway constitutes a beneficial change • Improved cycle connectivity through a more direct and continuous route for cyclists from the Black Hill interchange to the existing Pacific Motorway north of Heatherbrae • No changes to existing access arrangements.

7.6.3 Landscape character impact assessment summary

Sensitivity

The Tomago LCZ is an existing urban area that comprises predominantly industrial and infrastructure uses that would be compatible with the change of the nature involved with the project. Sensitive character elements include large stands of remnant bushland and long-distance views over the Hunter River floodplain from the edge of the LCZ.

The sensitivity of the Tomago LCZ to change is considered to be **low**.

Magnitude

The project infrastructure would be consistent in character with existing industrial and road corridor uses in LCZ 4. The most notable changes would be associated with the new Tomago interchange including the realignment of the Pacific Highway north of the Tomago Road intersection, with separation of the northbound and southbound travel lanes. This would affect the spatial qualities in the northern portion of the LCZ and increase the amount of the road-related infrastructure in the zone. The spatial experience along the Pacific Highway would be replaced with a similar experience along the project.

The project would remove one rural residential dwelling which would otherwise be removed as part of the proposed Newcastle Power Station. There would be no impacts on public domain and key activity areas. Improved traffic flow would benefit the functionality of industrial and employment areas. The provision of a more direct cycle route along the project delivers additional connectivity improvements.

Overall, the assessment indicates the magnitude of impact of the project in this zone would be **low**.

Conclusion

The assessment indicates the landscape character impact on this zone would be **low**.

Summary - LCZ 4	Rating
Sensitivity	Low
Magnitude	Low
Landscape character impact	**Low**

7.7 Operational impacts in LCZ 5 – Tomago Sandbeds

The existing landscape character of the Tomago Sandbeds is discussed in **Table 7–6**, together with a description of changes in the LCZ as a result of the project. The landscape character of the Tomago Sandbeds is illustrated on **Figure 7–6**.

7.7.1 Project elements

The major project elements in LCZ 5 include:

- A new interchange at Tomago including lighting and traffic signals at the junction of Old Punt Road and the Pacific Highway
- Modifications to Old Punt Road and Masonite Road including bridge (B10) over the project's main alignment
- Realignment of the Pacific Highway further to the north
- Modified property access to the Hunter Region Botanic Gardens underneath a bridge (B09) including:
  - A signalised intersection with the Pacific Highway
  - A shared path to provide access between the bus stop located on the eastern side of the Pacific Highway and the Hunter Region Botanic Gardens.
- Road drainage and water quality control measures
- Roadside furniture and elements such as safety barriers, fences and signs.

Figure 7–6 Landscape character images Tomago Sandbeds

7.7.2 Landscape character assessment

Table 7–6 Tomago Sandbeds existing landscape character and likely changes

Character attribute	Existing landscape character	Landscape character changes
Landform	• Gently undulating landform, rising in an easterly direction	Embankments are associated with interchanges and the project alignment but are closely aligned with the natural landform. The project would not alter the overall landform of the area.
Vegetation cover	• Dense native bushland in the bisected by utility easements and maintenance tracks.	Removal of bushland vegetation within the operational footprint. Revegetation as part of project landscaping would partly reduce this change over time.
Built form	• Built form is limited to utility infrastructure and the Hunter Region Botanic Gardens.	There would be an increase in road infrastructure parallel to the Pacific Highway.
Heritage	• No non-Aboriginal heritage items • Two Aboriginal heritage sites.	• The project would not impact on any non-Aboriginal heritage items • Aboriginal heritage would be salvaged from the construction footprint as part of Aboriginal heritage management measures (refer to the ACHAR in Appendix L of the EIS). Removal would not affect the overall landscape character.
Spatial quality	• Predominantly enclosed but with expansive views over the Hunter River floodplain at the interface with LCZ 2.	The overall spatial qualities would be retained with some localised changes including: • Greater spatial enclosure to a small portion of the interface with LCZ 2 • Greater spatial enclosure of the Hunter Region Botanic Gardens due to the raised motorway embankment • Reduced spatial enclosure as a result of the main alignment through bushland east of Heatherbrae and Masonite Road realignment.
Public domain	• The are no public domain areas.	The project would not result in any changes to public domain areas.
Key activity areas	• Hunter Region Botanic Gardens including visitor centre with gift shop and café.	The project would not result in any changes to the use of existing activity areas.
Connectivity and access	• Main routes for vehicular access and connectivity are the Pacific Highway and Masonite Road • Public bus routes use the Pacific Highway, with two stops located within this zone • Limited provision for cycling, generally on-road • No pedestrian paths.	• Improved regional and national transport connectivity • Reduced traffic along the Pacific Highway constitutes a beneficial change • Improved cycle connectivity through a more direct and continuous route for cyclists from the Black Hill interchange to the existing Pacific Motorway north of Heatherbrae • Improved pedestrian and cyclist access to the Hunter Region Botanic Gardens via a shared path and signalised intersection at the Hunter Region Botanic Gardens access road junction with the Pacific Highway • All existing access arrangements would be retained with some modifications.

7.7.3 Landscape character impact assessment summary

Sensitivity

The majority of the Tomago Sandbeds LCZ constitutes a greenfield site densely vegetated with remnant bushland. Due to extensive tree cover, changes within the bushland portion of the LCZ would not be widely perceived beyond the project. However, bushland in the LCZ is important as a spatial boundary to both the open Hunter River floodplain and the urban areas of Heatherbrae. Accommodating change of the order of the project would not be possible without altering the spatial qualities of the LCZ. The portion of the LCZ along the existing Pacific Highway is already characterised by road infrastructure and would be less sensitive to further road infrastructure upgrades.

Overall, the sensitivity of the Tomago Sandbeds LCZ to change is considered to be **moderate**.

Magnitude

The project would result in an increase in the amount of the road related infrastructure including a new cleared road corridor through remnant bushland areas. It would alter the bushland backdrop to Heatherbrae, replacing it with road infrastructure.

It would require clearing of a large tract of remnant bushland and result in changes to the natural landform to accommodate the project's geometric requirements, resulting in a deep cutting. The changes would affect the spatial character of this zone.

Beneficial outcomes from the project would be a reduction in traffic volumes on the Pacific Highway, reducing congestion and improving connectivity. The provision of a more direct cycle route along the project delivers cycling connectivity improvements. The shared path along Masonite Road provides the opportunity for future expansion of the cycle network by Port Stephens Council, should this be desired. The signalised intersection at the Hunter Region Botanic Gardens access road would improve pedestrian and cyclist access to the Hunter Region Botanic Gardens, including from the bus stop on the western side of the Pacific Highway.

Overall, the assessment indicates the magnitude of impact of the project in this zone would be **high**.

Conclusion

The assessment indicates the landscape character impact on this zone is likely to be **high to moderate**.

Summary - LCZ 5	Rating
Sensitivity	Moderate
Magnitude	High
Landscape character impact	**High to moderate**

7.8 Operational impacts in LCZ 6 - Heatherbrae

The existing landscape character of Heatherbrae is discussed in **Table 7–7**, together with a description of changes in the LCZ as a result of the project. The landscape character of Heatherbrae is illustrated on **Figure 7–7**.

7.8.1 Project elements

The project generally skirts LCZ 6, with only small parts of the project located within the LCZ. Project elements partly located in the LCZ 6 include:

- Modifications to Masonite Road
- Road drainage and water quality control measures
- Roadside furniture and elements such as safety barriers, fences and signs.

Figure 7–7 Landscape character images Heatherbrae

7.8.2 Landscape character assessment

Table 7–7 Heatherbrae existing landscape character and likely changes

Character attribute	Existing landscape character	Landscape character changes
Landform	• Flat and gently rising in an easterly direction	Minor embankments. The project would not alter the overall landform of the area.
Vegetation cover	• Predominantly urban areas • Vegetation is associated with private residential properties, open space areas and street trees and road corridors.	Some removal of bushland vegetation within the operational footprint. Revegetation as part of project landscaping would partly reduce this change over time.
Built form	• Predominantly low rise urban form with a range of uses.	Removal of a shed and one dwelling within Royal Wolfe Shipping Containers property is required and would not alter the overall character of built form within this LCZ.
Heritage	• Non-Aboriginal heritage items include Moreton Bay Figs along the Pacific Highway and are well outside the project's construction footprint • Aboriginal heritage includes part of one site that has been discussed as part of LCZ 5 (**Section 7.7**).	• The project would not impact on any non-Aboriginal heritage items • The project would not result in any additional impacts to Aboriginal heritage items beyond those discussed in LCZ 5 – refer **Section 7.7.2**.
Spatial quality	• Enclosed in urban areas and at the interface with LCZ 5. The interface with LCZ 2 is open with expansive views over the floodplain.	The project would result in changes to the spatial quality at the interface to LCZ 5: • Removal of the bushland backdrop to the urban area for the project's main alignment • Lifting of Masonite Road to bridge (B10) over the main alignment, creating a more open character along the elevated section of road.
Public domain	• Streets, footpaths, parks and public places in urban areas, generally located well outside project's operational footprint.	The project would not result in any direct changes to public domain areas. The reduction in through traffic as a result of the project would enhance the amenity of the existing public domain.
Key activity areas	• Heatherbrae is a commercial and service centre • Heatherbrae is the second largest industrial employment area in the Port Stephens Council LGA.	The project would not result in any direct changes to existing activity areas. There may be some reduction in passing trade that would not alter the landscape character of the area as Heatherbrae would continue to function as a primarily local centre. Business impacts are described and assessed in the Socio-economic Working Paper (Appendix M of the EIS).
Connectivity and access	• Main routes for vehicular access and connectivity are the Pacific Highway and Masonite Road • Public bus routes connect Heatherbrae to other urban areas but do not interface with the project • Limited provision for cycling, generally on-road • Footpaths in urban areas outside the project operational footprint.	• Improved regional and national transport connectivity • Reduced traffic along the Pacific Highway constitutes a beneficial change • Improved cycle connectivity through a more direct and continuous route for cyclists from the Black Hill interchange to the existing Pacific Motorway north of Heatherbrae • Improved walking and cycling access due to the provision of a shared path along Masonite Road • All existing access arrangements would be retained.

7.8.3 Landscape character impact assessment summary

Sensitivity

The Heatherbrae LCZ is an existing urban area that comprises a wide range of uses. Existing and planned industrial areas constitute the predominant land use next to the project. Industrial areas are generally compatible with the change of the kind associated with the project. Higher levels of sensitivity are associated with residential and community uses, as well as with remnant and heritage-listed vegetation.

Overall, the sensitivity of the Heatherbrae LCZ to change is considered to be **moderate**.

Magnitude

The project would result in a relatively minor increase in road related infrastructure in the Heatherbrae LCZ. It would alter the bushland backdrop to Heatherbrae through clearing in the adjoining Tomago Sandbeds and Windeyers Creek LCZs, although this change would be somewhat reduced over time by vegetation provided as part of the project landscape design. Removal of one shed and one dwelling would not alter the overall landscape character of the LCZ.

Beneficial outcomes from the project would be a reduction in traffic volumes on the Pacific Highway, reducing congestion and enhancing town centre amenity for residential and community uses. The provision for cycling along the project's shoulders delivers cycling connectivity improvements. The shared path along Masonite Road provides the opportunity for future expansion of the cycle network by Port Stephens Council, should this be desired.

Overall, the assessment indicates the magnitude of impact of the project in this zone would be **low**.

Conclusion

The assessment indicates the landscape character impact on this zone is likely to be **moderate to low**.

Summary - LCZ 6	Rating
Sensitivity	Moderate
Magnitude	Low
Landscape character impact	**Moderate to low**

7.9 Operational impacts in LCZ 7 – Windeyers Creek

The existing landscape character of Windeyers Creek is discussed in **Table 7–8**, together with a description of changes in the LCZ as a result of the project. The landscape character of Windeyers Creek is illustrated on **Figure 7–8**.

7.9.1 Project elements

The major project elements in LCZ 7 include:

- A new interchange at Raymond Terrace including lighting
- Modifications to Masonite Road
- Road drainage and water quality control measures
- Roadside furniture and elements such as safety barriers, fences and signs.

Figure 7–8 Landscape character images Windeyers Creek

7.9.2 Landscape character assessment

Table 7–8 Windeyers Creek existing landscape character and likely changes

Character attribute	Existing landscape character	Landscape character changes
Landform	• Low-lying and flat, rising gradually towards the east.	Embankments are associated with interchanges and the main alignment but are closely aligned with the natural landform. The project would not alter the overall landform of the area.
Vegetation cover	• Predominantly vegetated including native bushland remnants, pine plantations and wetland vegetation communities • Some cleared grazing areas.	Removal of bushland vegetation within the construction footprint. Revegetation as part of project landscaping would partly reduce this change over time.
Built form	• Limited built form includes rural dwellings and farm structures, the Raymond Terrace Wastewater Treatment Works and high voltage power lines.	The project would not impact on existing built form but constitutes new road infrastructure through greenfield areas. The main alignment would provide the boundary to urban development in Heatherbrae and is consistent with the desired future character of the area.
Heritage	• Non-Aboriginal heritage items include Raymond Terrace Cemetery, Pioneer Hill Cemetery and Boomerang Park, all of which are located several hundred metres from the construction footprint • Two Aboriginal heritage sites.	• The project would not impact on any non-Aboriginal heritage items • Aboriginal heritage would be salvaged from the construction footprint as part of Aboriginal heritage management measures (refer to the ACHAR in Appendix L of the EIS). Removal would not affect the overall landscape character.
Spatial quality	• Overall heavily enclosed with localised pockets of more open character around wetlands, cleared and grazing areas and the wastewater treatment works.	The overall spatial qualities would be retained with some localised changes including: • Lifting of Masonite Road to bridge (B10) over the main alignment, creating a more open character along the elevated section of road • Additional pockets of cleared areas such as around Windeyers Creek. They would be consistent with the existing pattern of localised areas with a more open character • Changes to the interface with LCZ 6 altering the spatial enclosure of industrial areas in Heatherbrae (**Section 7.8**).
Public domain	• There are no public domain areas.	The project would not result in any changes to public domain areas.
Key activity areas	• Activity areas are associated with employment at the wastewater treatment works and with Raymond Terrace and Pioneer Hill cemeteries.	The project would not result in any changes to existing activity areas.
Connectivity and access	• Main routes for vehicular access and connectivity are the Pacific Highway and Masonite Road • No dedicated cycling infrastructure • No pedestrian paths.	• Improved regional and national transport connectivity • Reduced traffic along the Pacific Highway constitutes a beneficial change • Improved cycle connectivity through a more direct and continuous route for cyclists from the Black Hill interchange to the existing Pacific Motorway north of Heatherbrae • Improved walking and cycling access due to the provision of a shared path along Masonite Road • All existing access arrangements would be retained.

7.9.3 Landscape character impact assessment summary

Sensitivity

The majority of the Windeyers Creek LCZ comprises of dense vegetation including remnant native bushland and pine plantations. Changes in heavily vegetated areas would not be widely visible beyond the project but would be more difficult to absorb in open areas. The cemeteries and wastewater treatment works would be sensitive to change while upgrades to the Pacific Highway and M1 Pacific Motorway would be consistent with their existing character as major road corridors.

Overall, the sensitivity of the Windeyers Creek LCZ to change is considered to be **moderate**.

Magnitude

The project would result in a large increase in the amount of the road-related infrastructure including a new motorway through greenfield areas. However, much of the project's operational footprint is already cleared, with the exception of minor portions north-east of Heatherbrae. The spatial qualities within the Windeyers Creek LCZ overall would not be altered by the project and the project would be compatible with the character of the existing M1 Pacific Motorway as well as with the industrial area in the adjoining Heatherbrae LCZ.

Beneficial outcomes from the project would be a reduction in traffic volumes on the Pacific Highway, reducing congestion and improving connectivity. The provision for cycling along the main alignment delivers cycling connectivity improvements. The shared path along Masonite Road provides the opportunity for future expansion of the cycle network by Port Stephens Council, should this be desired.

Overall, the assessment indicates the magnitude of impact of the project in this zone would be **moderate**.

Conclusion

The assessment indicates the landscape character impact on this zone is likely to be **moderate**.

Summary - LCZ 7	Rating
Sensitivity	Moderate
Magnitude	Moderate
Landscape character impact	**Moderate**

7.9.4 Summary of operational landscape character impacts

The landscape character impacts of the project are summarised in **Table 7–9**.

Table 7–9 Summary of landscape character impacts during operation

Landscape Character Zone	Sensitivity	Magnitude	Landscape character impact
LCZ 1 Black Hill	Moderate	Moderate	Moderate
LCZ 2 Hunter River Floodplain	High	Moderate	High to moderate
LCZ 3 Beresfield – Tarro – Woodberry	Moderate	Low	Moderate to low
LCZ 4 Tomago	Low	Low	Low
LCZ 5 Tomago Sandbeds	Moderate	High	High to moderate
LCZ 6 Heatherbrae	Moderate	Low	Moderate to low
LCZ 7 Windeyers Creek	Moderate	Moderate	Moderate

As can be seen from **Table 7–9,** the project's landscape character impacts would vary along its length as result of the different levels of landscape character sensitivity and magnitude of the project elements. The landscape character impacts of the project on the seven LCZs would be:

- High to moderate for two LCZs
- Moderate for two LCZs
- Moderate to low for two LCZs
- Low for one LCZ.

Beneficial landscape character impacts would be associated with:

- Enhanced access and connectivity within and between LCZs through improved flood immunity
- Reduced congestion and a reduction in freight movements in existing road corridors and urban centres
- A more direct and continuous cycle route option between Black Hill and Raymond Terrace along the project road shoulders
- Enhanced town centre amenity in Heatherbrae as a result of reduced traffic, in particular freight traffic
- Opportunities for new views over the open Hunter River floodplain landscape, enhancing the experience for motorists and cyclists with improved orientation and wayfinding.

Residual adverse landscape character impacts would be associated with:

- Built form changes including new motorway infrastructure duplicating existing road corridors in some areas and extending through greenfield sites in others
- Impacts on heritage items including removal of non-Aboriginal heritage and Aboriginal heritage items
- Clearing of remnant native vegetation resulting in changes to the spatial character and increased fragmentation of bushland
- Changes to the spatial character altering the outlook and views including as a result of noise barriers in new locations.

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8 VISUAL IMPACT ASSESSMENT

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8.

Visual impact assessment

8.1 Overview

The visual impact assessment consists of the assessment of visual impacts during construction (**Section 8.2**) and during operation **Section 8.3.1** to **Section 8.3.20**).

Consistent with the methodology in **Chapter 3**, 19 viewpoints were chosen within the project's visual envelope to analyse how well the project responds to what people see. Indicative viewpoint locations and the project's visual envelope are shown on **Figure 8–1**. A figure for each viewpoint is provided as part of the assessment of visual impacts during project operation (**Section 8.3.1** to **Section 8.3.19**).

8.2 Visual impacts during construction

Temporary visual impacts would result from general construction activities, the movement and operation of plant and machinery as well as the erection of temporary structures including fencing, hoarding, working platforms and ancillary facilities. The typical sources of construction impacts are described in **Section 7.2** and Chapter 5 of the EIS. They would typically include a combination of vegetation removal, the visibility of temporary structures, barriers, hoardings, signage and ancillary facilities including stockpiles, machinery and plant, buildings, lighting, construction work activities and increased vehicle movements. Sources of change to the view during construction also include the operational project elements that would be constructed in the view.

Therefore, project construction would result in at least the same amount of change to existing views as operation of the project, without the benefit of progressive vegetation and visual impact mitigation through the project landscape design that would reduce the visual impacts of the project during operation and once vegetation matures. As a consequence, construction visual impacts would generally be of equal or greater magnitude than operational visual impacts but for a limited length of time.

Table 8–1 details the construction impacts typically experienced for a project of this nature. The assessment details the sources of change to the view, the magnitude of change to the view derived as a result and the overall visual impact rating based on the sensitivity of the view. **Figure 5–1** in Chapter 5 of the EIS illustrates the project elements during construction.

The type and intensity of construction facilities and activities would vary throughout the duration of construction. As the nature and intensity of construction activities changes, temporary visual impacts would also vary. The visual impact ratings would therefore constitute a worst case and may at times be lower than those identified.

Impacts during construction would be temporary in nature and would be mitigated where possible through appropriate siting of infrastructure, materials and finishes of structures and hoardings, the management of light spill and progressive rehabilitation of vegetation. Management measures would be detailed in the CEMP.

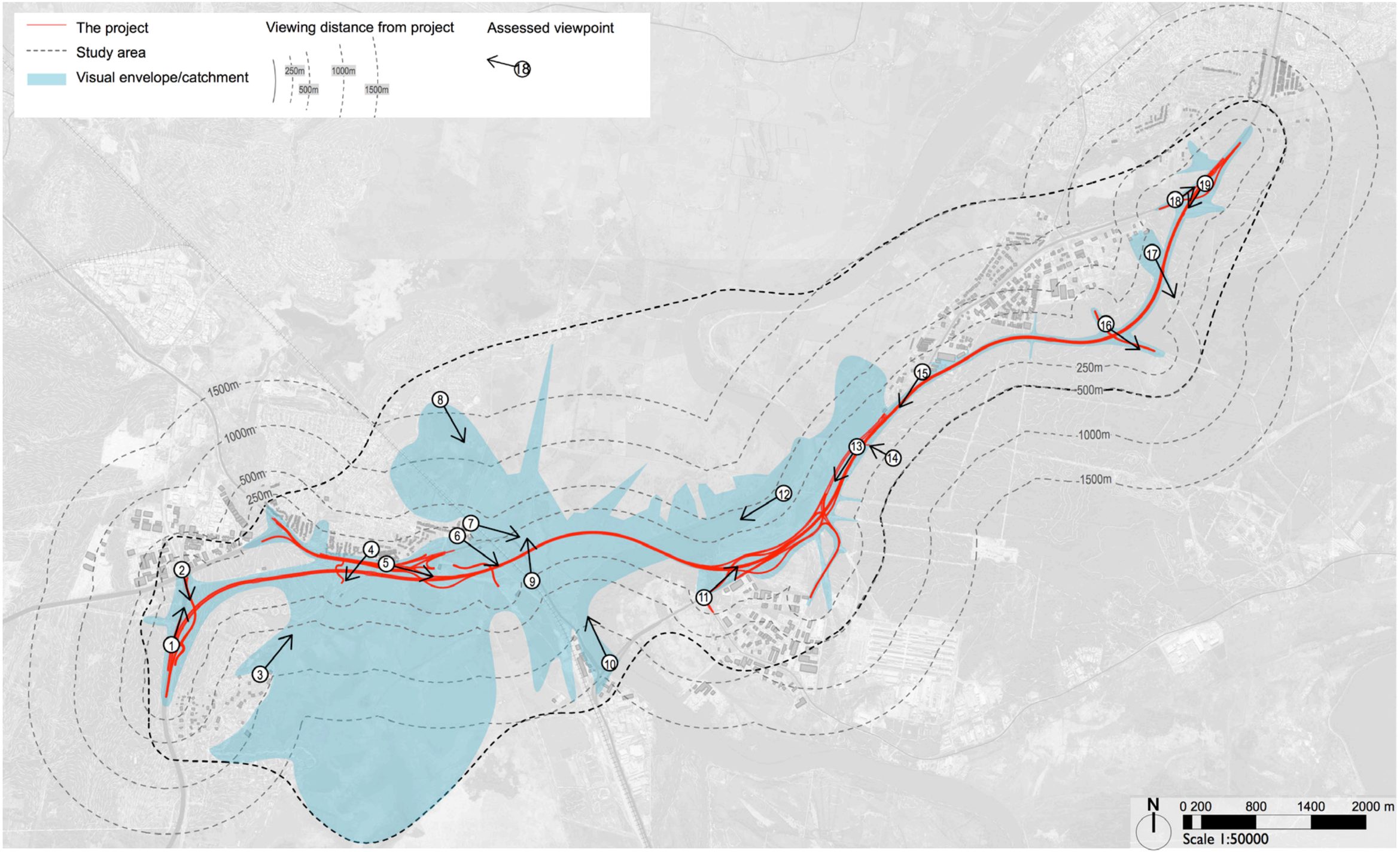

Figure 8–1 Visual envelope and viewpoint locations

Table 8–1 Visual impacts during construction

View-point #	Visual sensitivity	Sources of visual change during project construction: Project elements for which construction activities would be visible	Construction facilities visible in addition to works for project elements	Magnitude of visual change to the view	Visual impact
1	M	• Black Hill interchange including the main alignment, northbound exit, southbound entry ramp, bridge B01 and associated earthworks • Adjustment of unnamed tributary of Viney Creek • Drainage infrastructure including basins • Vegetation removal • New tree, shrub and groundcover vegetation.	• Crane pads and crane for bridge B01 • Construction-related traffic and haulage • Traffic diversions and traffic management measures	H	HM
2	L	• Black Hill interchange including the new southbound entry ramp, bridge B01 and associated earthworks • Adjustment of unnamed tributary to Viney Creek • Drainage infrastructure including basins • Vegetation removal • New tree, shrub and groundcover vegetation..	• Crane pads and crane for bridge B01 • Construction-related traffic and haulage • Traffic diversions and traffic management measures • Temporary drainage basin TB01	H	M
3	H	• Main alignment including earthworks • Removal of the weatherboard cottage at Glenrowan Homestead • Tarro Interchange including associated ramps, earthworks and bridges B03 and B04 • Upgraded New England High including vegetation removal • Drainage infrastructure including basins • New tree, shrub and groundcover vegetation.	• Construction-related traffic and haulage • Ancillary facility AS4 • Crane pads and crane for bridges B02, B03 and B04	M	HM
4	H	• Main alignment including earthworks • Upgrade of the New England Highway including widening, new fill embankments and removal of landscaped median • Demolition of the weatherboard cottage at the Glenrowan Homestead • Changes to the access road to the Glenrowan Homestead • Vegetation removal • New tree, shrub and groundcover vegetation.	• Ancillary facilities AS3 and AS4 • Construction-related traffic and haulage • Crane pads and crane for bridge B02 • Traffic diversions and traffic management measures • Temporary drainage basin TB03	H	H

View-point #	Visual sensitivity	Sources of visual change during project construction: Project elements for which construction activities would be visible	Construction facilities visible in addition to works for project elements	Magnitude of visual change to the view	Visual impact
5	H	• Noise barrier NB03 • Upgrade of the New England Highway including widening and splitting into westbound and eastbound alignments • Earthworks embankments associated with the westbound New England Highway • Main alignment including fill embankments • Vegetation removal • New tree, shrub and groundcover vegetation.	• Construction-related traffic and haulage • Crane pads and crane for bridges B03 and B04 • Traffic diversions and traffic management measures • Temporary drainage basin TB05	H	H
6	M	• Main alignment including associated fill embankments • Viaduct across the Hunter River floodplain (bridge B05) • Purgatory Creek adjustments • Drainage infrastructure including basins • Realignment of Aurizon access road • New tree, shrub and groundcover vegetation.	• Ancillary facility AS5 • Construction-related traffic and haulage • Crane pads and cranes for bridge B05	H	HM
7	H	• Viaduct over the Hunter River floodplain (B05).	• Construction-related traffic and haulage • Ancillary facilities AS6 and AS7 including concrete batching plant • Crane pads and crane for bridge B05	H	H
8	H	• Viaduct over the Hunter River floodplain (B05).	• Construction-related traffic and haulage • Ancillary facilities AS6 and AS7 including concrete batching plant • Crane pads and crane for bridge B05	L	M
9	M	• Viaduct over the Main North Rail Line and the Hunter River floodplain (bridge B05).	• Construction-related traffic and haulage • Access and haulage roads • Ancillary facilities AS6 and AS7 including concrete batching plant • Crane pads and crane for bridge B05	H	HM
10	H	• Viaduct over the Main North Rail line and the Hunter River floodplain (bridge B05) • Tarro interchange.	• Construction-related traffic and haulage • Ancillary facilities AS6, AS7 and AS8 including concrete batching plant • Crane pads and crane for bridge B05	L	M
11	M	• Bridge over the Hunter River (northern extent of B05) • Tomago interchange including realigned northbound Pacific Highway and associated fill embankments • Tomago Road intersection adjustment • Vegetation removal • New tree, shrub and groundcover vegetation.	• Construction-related traffic and haulage • Access and haulage roads • Ancillary facility AS10 including concrete batching plant • Cranes for bridges B05 and B07 • Traffic diversions and traffic management measures.	H	HM

View-point #	Visual sensitivity	Sources of visual change during project construction: Project elements for which construction activities would be visible	Construction facilities visible in addition to works for project elements	Magnitude of visual change to the view	Visual impact
12	H	• Bridge over the Hunter River (northern extent of B05) including bridge piers and pile caps • Directional signage • New tree, shrub and groundcover vegetation.	• Access and haulage roads • Ancillary facilities AS9 and AS11 including wharf facilities and concrete batching plant • Cranes and barge for bridge B05 and B06.	H	H
13	M	• Main alignment • Bridge over the Hunter Region Botanic Gardens access road (B09) and associated earthworks • Realigned Pacific Highway and associated earthworks • Modified access road to the Hunter Region Botanic Gardens including signalised intersection • Drainage infrastructure including basins • Vegetation removal • New tree, shrub and groundcover vegetation.	• Construction-related traffic and haulage • Access and haulage roads • Crane pads and cranes for bridge B09 • Traffic diversions and traffic management measures • Temporary drainage basins TB18, TB19, TB20 and TB21.	H	HM
14	H	• Main alignment including B09 over the Hunter Region Botanic Gardens access road and associated earthworks • Modified access road to the Hunter Region Botanic Gardens including signalised intersection • New tree, shrub and groundcover vegetation.	• Crane pads and cranes for bridge B09 • Traffic diversions and traffic management measures.	H	H
15	M	• Main alignment and associated fill embankments • Drainage infrastructure including swales • Vegetation removal • New tree, shrub and groundcover vegetation.	• Construction-related traffic and haulage • Access and haulage roads • Ancillary facility AS14 • Traffic diversions and traffic management measures • Temporary barriers along the Pacific Highway	H	HM
16	M	• Realignment of Masonite Road and associated embankments • Concrete and turf-lined drainage channels • Shared path along the northern side of Masonite Road • Vegetation removal • New tree, shrub and groundcover vegetation.	• Construction-related traffic and haulage • Access and haulage roads • Ancillary facility AS16 • Crane pad and crane for bridge B10 • Traffic diversions and traffic management measures including concrete batching plant.	H	HM
17	L	• Main alignment including earthworks • Vegetation removal • New tree, shrub and groundcover vegetation.	• Construction-related traffic and haulage • Access and haulage roads • Temporary drainage basin TB28.	M	ML

View-point #	Visual sensitivity	Sources of visual change during project construction			
		Project elements for which construction activities would be visible	**Construction facilities visible in addition to works for project elements**	**Magnitude of visual change to the view**	**Visual impact**
18	M	• Raymond Terrace interchange including southbound exit ramp bridging (B12) over the main alignment and associated fill embankments • Northbound Pacific Highway merging onto the main alignment entry ramp • Vegetation removal • New tree, shrub and groundcover vegetation.	• Construction-related traffic and haulage • Access and haulage roads • Ancillary facilities AS20 and AS21 • Crane pad and crane for bridge B12 • Traffic diversions and traffic management measures • Temporary drainage basins TB29, TB30 and TB31.	H	HM
19	M	• Raymond Terrace Interchange, including the main alignment, southbound exit ramp, bridge B12 and associated fill embankments • Modifications to the existing northbound Pacific Highway to provide a northbound entry ramp and tie-in with the main alignment • Drainage infrastructure including basins • Vegetation removal • New tree, shrub and groundcover vegetation.	• Construction-related traffic and haulage • Ancillary facilities AS20 and AS21 • Crane pad and crane for bridge B12 • Traffic diversions and traffic management measures • Temporary drainage basins TB32.	H	HM

Table legend:

H	High	L	Low
M	Moderate	N	Negligible

8.2.1 Summary of visual impact assessment during construction

Visual impact ratings during construction of the project would be as follows:

- Five viewpoints would have a high visual impact
- Ten viewpoints would have a high to moderate visual impact
- Three viewpoints would have a moderate visual impact
- One viewpoint would have a moderate to low visual impact.

8.3 Visual impacts during operation

8.3.1 Viewpoint 1

Location

Existing M1 Pacific Motorway near Lenaghans Drive at Black Hill, looking north-east (**Figure 8–2**). The viewpoint is representative of the existing M1 Pacific Motorway between the southern project extent and John Renshaw Drive intersection.

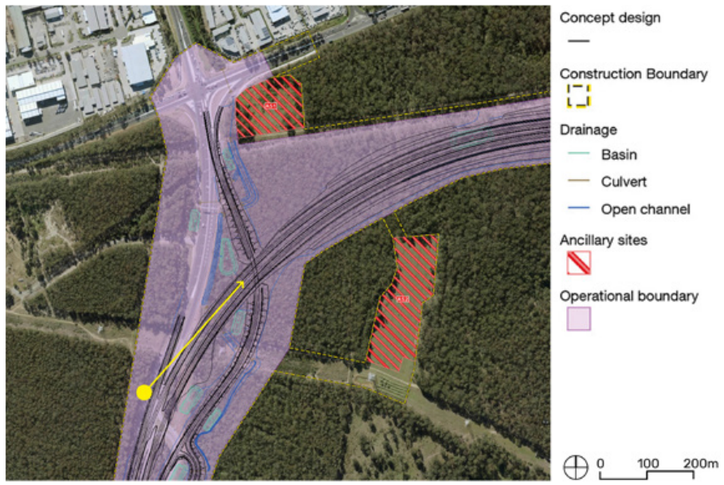

Figure 8–2 Viewpoint 1 location

Primary viewers

Motorists travelling north on the M1 Pacific Motorway.

Visible project elements

- Black Hill interchange including the main alignment, northbound exit, southbound entry ramp, bridge B01 and associated earthworks and road furniture such as safety screens
- Adjustment of unnamed tributary of Viney Creek
- Drainage infrastructure including basins
- Removal of bushland vegetation
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 1 is illustrated on **Figure 8–3**. Existing road and utility infrastructure and the grassed median comprise a large portion of the existing view composition. However, a notable portion of the view consists of remnant bushland that frames and characterises this section of the existing M1 Pacific Motorway. The sensitivity of the existing road corridor to change is low, whereas bushland would be highly sensitive. Overall, the sensitivity of the viewpoint to change is **moderate**.

Magnitude of change

The view would undergo a notable change with an increase in road infrastructure and associated bushland removal. Compensatory native vegetation between the project's southbound main alignment and the southbound entry ramp would mitigate changes to the view as vegetation matures over time. The magnitude of change within this view would be **high**.

A photomontage illustrating the project at viewpoint 1 is shown on **Figure 8–4**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Moderate	High	High to moderate

Figure 8–3 Viewpoint 1

Figure 8–4 Photomontage at viewpoint 1
Image indicative only. Final layout to be determined through detailed design

8.3.2 Viewpoint 2

Location

Existing M1 Pacific Motorway, about 150 metres south of the Weakleys Drive and John Renshaw Drive intersection, looking south-east towards the new Black Hill interchange (**Figure 8–5**). The viewpoint is representative of a number of views from the road network surrounding the intersection.

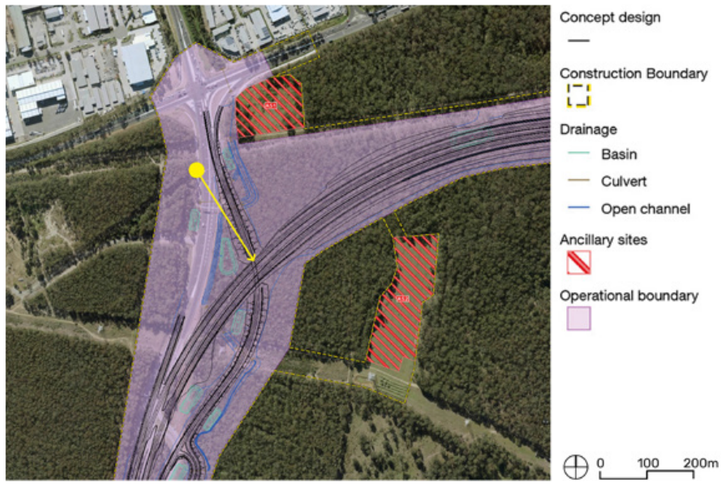

Figure 8–5 Viewpoint 2 location

Primary viewers

Motorists travelling:

- North along the existing M1 Pacific Motorway which would become the northbound Black Hill exit
- South along Weakleys Drive
- South onto the M1 Pacific Motorway
- East or west along John Renshaw Drive.

Visible project elements

- Black Hill interchange including the new southbound entry ramp, bridge B01 and associated earthworks and road furniture such as safety screens
- Adjustment of unnamed tributary to Viney Creek
- Drainage infrastructure including basins
- Removal of bushland vegetation
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 2 is illustrated in **Figure 8–6**. Existing road infrastructure comprises a large portion of the existing view composition, especially from the motorists' perspective when travelling along the road. The sensitivity of the existing road corridor to change would be low. Remnant bushland that frames the M1 Pacific Motorway and John Renshaw Drive would, however, be sensitive to change. Overall, the sensitivity of the viewpoint to change is **low**.

Magnitude of change

The southbound entry would introduce a prominent new landform into this view, requiring the removal of bushland. Bushland would also need to be removed for drainage infrastructure including the adjustment to the drainage channel connected to Viney Creek, resulting in changes to a notable portion of this view. Vegetation installed as part of the project landscape design would somewhat reduce the visual effect of change over time. Overall, the magnitude of change within this view would be **high**.

A photomontage illustrating the project at viewpoint 2 is shown on **Figure 8–7**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Low	High	Moderate

Figure 8-6 Viewpoint 2

Figure 8–7 Photomontage at viewpoint 2
Image indicative only. Final layout to be determined through detailed design

8.3.3 Viewpoint 3

Location

Eastern end of Walter Parade at Lenaghan looking north-east across the floodplain (**Figure 8–8**). This viewpoint is representative of a number of views from residential properties in Walter Parade. Private property access was not able to be obtained, therefore a view from Walter Parade was photographed. It is noted that the actual view from residences in this area would be more open, without the clutter of fence lines and buildings in the view as photographed.

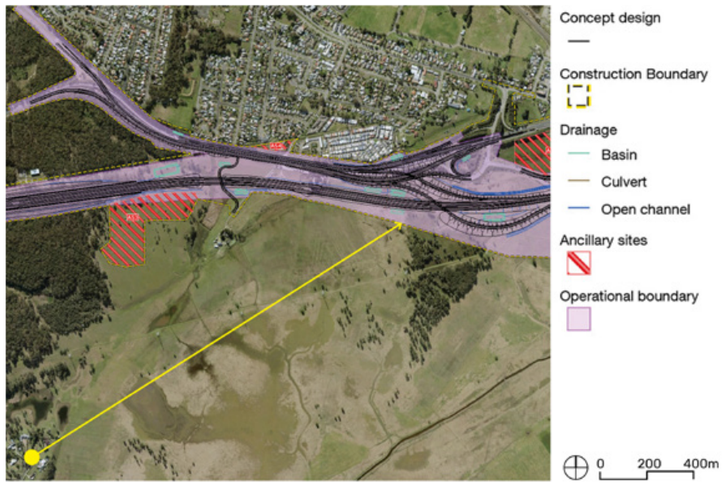

Figure 8–8 Viewpoint 3 location

Primary viewers

Residents in Black Hill overlooking the Hunter River floodplain.

Visible project elements

- Main alignment parallel to the New England Highway including earthworks
- Removal of the weatherboard cottage associated with the Glenrowan Homestead
- Tarro Interchange including associated ramps, earthworks and bridges B03 and B04
- Upgraded New England Highway including vegetation removal along the northern edge
- Drainage infrastructure including basins
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 3 is illustrated on **Figure 8–9.** Residents have an open rural outlook over pastures and wetlands in the Hunter River floodplain. The sensitivity of this viewpoint to change is **high**.

Magnitude of change

New road infrastructure would be visible from this viewpoint. However, the project would be at least about 1.3 kilometres from this viewpoint. Given this distance, only a minor portion of the view would change and the changes would be difficult to discern in detail. The magnitude of the change within this view would be **low**.

A photomontage illustrating the project at viewpoint 3 is shown on **Figure 8–10**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
High	Low	Moderate

Figure 8–9 Viewpoint 3

Figure 8–10 Photomontage at viewpoint 3
Image indicative only. Final layout to be determined through detailed design

8.3.4 Viewpoint 4

Location

Quarter Sessions Road, corner of the New England Highway, Tarro, looking south-west (**Figure 8–11**). This viewpoint is representative of a number of residential views from properties in the area between Christie Road and the Palm Valley Village, as well as of views from the public domain along Quarter Sessions Road.

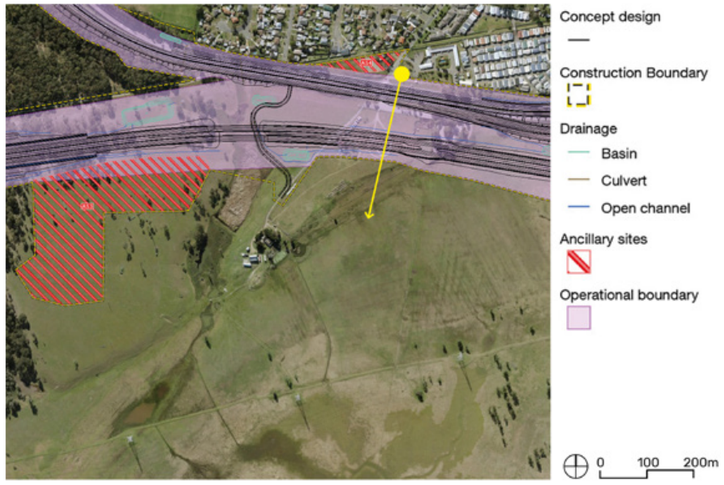

Figure 8–11 Viewpoint 4 location

Primary viewers

Residents of nearby properties, visitors to Palm Valley Village and motorists travelling south on Quarter Sessions Road.

Visible project elements

- The main alignment parallel to New England Highway including earthworks
- Upgrade of the New England Highway including:
  - Widening between John Renshaw Drive and the existing Anderson Drive at Tarro interchange
  - Fill embankments and removal of the landscaped median.
- Demolition of the weatherboard cottage associated with the Glenrowan Homestead
- Changes to the access road to the Glenrowan Homestead
- Vegetation removal including tree removal
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 4 is illustrated on **Figure 8–12**. This viewpoint provides for open views from the edge of the Tarro urban area across the Hunter River floodplain, towards the wooded hills surrounding Hexham Swamp. The openness of the view would be sensitive to change. The New England Highway is in the foreground of the view but constitutes a relatively small portion of the composition of this view.

The sensitivity of this viewpoint to change is **high**.

Magnitude of change

The upgrade of the New England Highway including associated earthworks, fill embankments and removal of the landscaped median would result in the highway constituting a larger visual element in the eastern foreground of this view. The main alignment would also alter the midground of the view. The main alignment would be on embankments ranging in height from about one metre to three metres above the existing ground. This would close off much of the existing view across the floodplain and towards the distant hills. The magnitude of the change within this view would be **moderate**.

A photomontage illustrating the project at viewpoint 4 is shown on **Figure 8–13**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
High	Moderate	High to moderate

Figure 8–12 Viewpoint 4

Figure 8–13 Photomontage at viewpoint 4
Image indicative only. Final layout to be determined through detailed design

8.3.5 Viewpoint 5

Location

Tarro residential areas, looking in a south-easterly direction (**Figure 8–14**).

This viewpoint is representative of a number of views from residential properties within both Palm Valley Village and in Eastern Avenue, Tarro including the heritage listed residence at 29 Eastern Avenue.

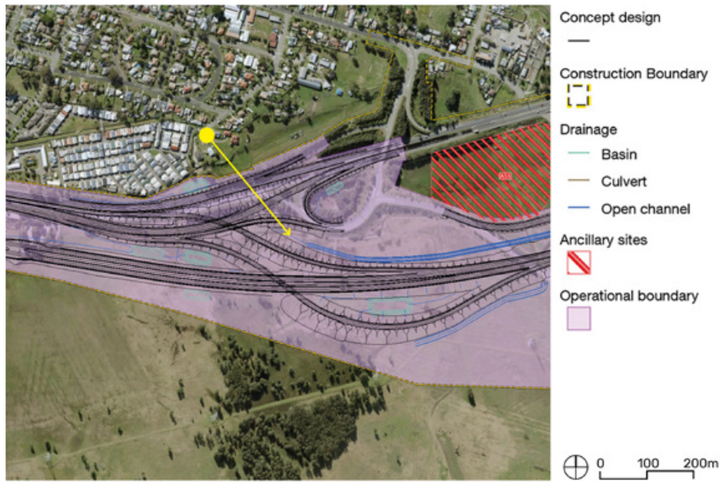

Figure 8–14 Viewpoint 5 location

Primary viewers

Residents and visitors at the Palm Valley Village and residents in Eastern Avenue including the historic residence at 29 Eastern Avenue.

Visible project elements

- Noise barrier NB03
- Upgrade of the New England Highway including:
  - Split into westbound and eastbound alignments
  - Widening between John Renshaw Drive and the existing Anderson Drive.
- Earthworks embankments associated with the westbound New England Highway
- Main alignment parallel to the New England Highway including fill embankments up to about four metres above the existing ground
- Vegetation removal including trees
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 5 is illustrated on **Figure 8–15**. Sensitive elements in this view include vegetation such as mature trees that provide visual separation between the rear of residences in Eastern Avenue and the existing New England Highway exit ramp. Residential viewers would be highly sensitive to change in the outlook from their homes and private outdoor areas.

The sensitivity of this viewpoint to change is **high**.

Magnitude of change

The major change to this view would result from noise barrier NB03 that would replace mature screening vegetation, notably altering the outlook for the residents. Project elements including the westbound New England Highway supported on a fill embankment on the approach to bridge B03 would be visible above the noise barrier and would notably alter the central part of the view. The magnitude of change to this view would be **high**.

A photomontage illustrating the project at viewpoint 5 is shown on **Figure 8–16**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
High	High	High

Figure 8–15 Viewpoint 5

Figure 8–16 Photomontage at viewpoint 5
Image indicative only. Final layout to be determined through detailed design

8.3.6 Viewpoint 6

Location

Eastern end of Anderson Drive, Tarro looking south (**Figure 8–17**). The viewpoint represents multiple views including views from the heritage listed Pumping Station, the heritage-listed Tarro substation and from nearby residential viewers in eastern Anderson Road.

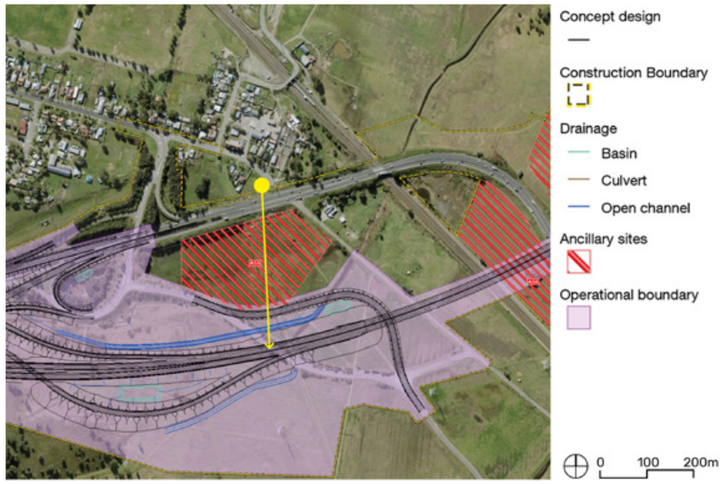

Figure 8–17 Viewpoint 6 location

Primary viewers

Residents of Anderson Drive. Staff and visitors to the Pumping Station and Tarro Substation.

Visible project elements

- Main alignment associated fill embankments up to ten metres in height above existing ground
- Viaduct across the Hunter River floodplain (bridge B05)
- Purgatory Creek adjustment
- Drainage infrastructure including basins
- Realigned Aurizon access road
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 6 is illustrated on **Figure 8–18**. This viewpoint provides for open views across the Hunter River floodplain and towards the hills surrounding Hexham Swamp. The open view of grazing lands, wetlands and stands of trees would be highly sensitive to change. The foreground of the viewpoint is comprised of the New England Highway and would have a low level of sensitivity. Overall, the sensitivity of the viewpoint to change is **moderate**.

Magnitude of change

The project would alter the central portion of this view, replacing the low-lying open floodplain with a view of the main alignment on fill embankments up to 10 metres above the ground. The effect of the project would be major new visual elements in the mid distance of the view and the loss of long-distance views across the floodplain. There would be no change to the foreground of the view. Distant glimpses of the hills are a defining feature of the view and would be lost. Traffic on the main alignment would be highly visible silhouetted against the sky, increasing the visibility of the project in the view. Vegetation provided as part of the project at the base of the embankments would somewhat compensate for the removal of existing stands of trees. Over time this would reduce the visual effect of the project through integration with the existing landscape setting. The magnitude of change to this view would be **moderate**.

A photomontage illustrating the project at viewpoint 6 is shown on **Figure 8–19**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Moderate	Moderate	Moderate

Figure 8–18 Viewpoint 6

Figure 8–19 Photomontage at viewpoint 6
Image indicative only. Final layout to be determined through detailed design

8.3.7 Viewpoint 7

Location

Tarro Station, Tarro, looking in a south-easterly direction from the southbound station platform – refer **Figure 8–20**.

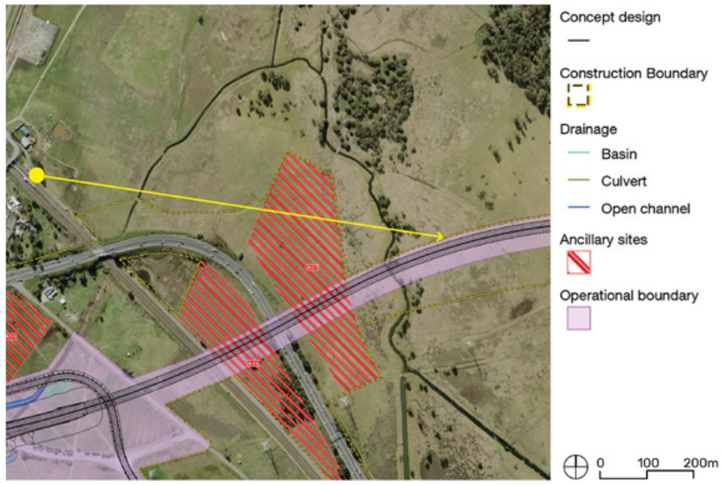

Figure 8–20 Viewpoint 7 location

Primary viewers

Rail customers.

Visible project elements

- Viaduct over the Hunter River floodplain (bridge B05).

Sensitivity

The view from viewpoint 7 is illustrated on **Figure 8–21**. The viewpoint is comprised of the grazing landscape of the Hunter River floodplain. Detracting elements reducing sensitivity include existing low and high voltage power lines as well as degraded rural structures. However, the landscape is open to long-distance views and would not easily absorb change. It would be seen by a relatively large number of rail customers for possibly extended periods of time while they wait for the train. The sensitivity of the viewpoint to change is **high**.

Magnitude of change

The viaduct over the Hunter River floodplain would introduce a large new structure, elevated up to 16 metres above the ground. While the bridge deck itself would be relatively thin, the piers supporting the viaduct appear staggered and closely spaced in this viewpoint, affecting the open views across the floodplain. In addition, trucks travelling along the viaduct would further increase visibility of the project in the view. The magnitude of these changes would be somewhat mitigated by the viewing distance of at least 700 metres. Mangrove forests currently terminating the view would be replaced with the viaduct and its substructure. The open sky would also be affected, with parts of the viaduct and traffic travelling along it visually exposed against the sky. Overall, the magnitude of change to the view would be **moderate**.

A photomontage illustrating the project at viewpoint 7 is shown on **Figure 8–22**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
High	Moderate	High to moderate

Figure 8–21 Viewpoint 7

Figure 8–22 Photomontage at viewpoint 7
Image indicative only. Final layout to be determined through detailed design

8.3.8 Viewpoint 8

Location

Open space in Redbill Drive, Woodberry, opposite the intersection with Eagle Close, looking south-east (**Figure 8–23**). This viewpoint is representative for a number of residential viewers in the suburb of Woodberry that are overlooking the Hunter River floodplain.

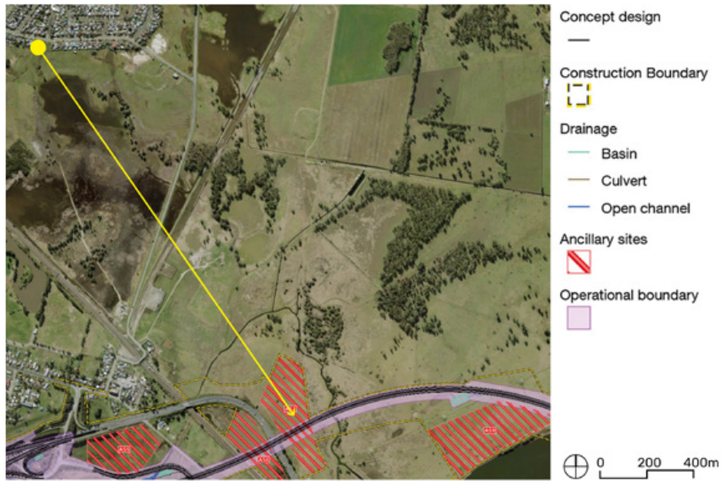

Figure 8–23 Viewpoint 8 location

Primary viewers

Residents of Woodberry.

Visible project elements

- Viaduct over the Hunter River floodplain (bridge B05).

Sensitivity

The view from viewpoint 8 is illustrated on **Figure 8–24**. This viewpoint is comprised of open space, grazing lands and wetlands in the Hunter River floodplain. It illustrates expansive views over the open landscape that would be sensitive to change. The sensitivity of the view to change is **high**.

Magnitude of change

The viaduct over the Hunter River floodplain would introduce a large new structure, elevated up to 16 metres above the ground. While the bridge deck itself would be relatively thin, it would be elevated far above natural ground and supported by a large number of piers that would interrupt views along the floodplain. In some areas, the viaduct would intrude into the open skyline above existing tree cover. Trucks and other vehicles travelling along the viaduct would increase the overall size of the project in the view, however, at a minimum distance of about 1.95 kilometres from the viewpoint, only a small portion of the view would be altered. The magnitude of visual change would be **negligible**.

A photomontage illustrating the project at viewpoint 8 is shown on **Figure 8–25**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
High	Negligible	Negligible

Figure 8-24 Viewpoint 8

Figure 8–25 Photomontage at viewpoint 8
Image indicative only. Final layout to be determined through detailed design

8.3.9 Viewpoint 9

Location

New England Highway in Tarro, looking north (**Figure 8–26**). The viewpoint represents both views from the New England Highway and the Main North Rail Line.

Figure 8–26 Viewpoint 9 location

Primary viewers

Motorists travelling along the New England Highway westbound and train passengers traveling on the Main North Rail Line.

Visible project elements

- Viaduct over the Main North Rail Line and the Hunter River floodplain (bridge B05).

Sensitivity

The view from viewpoint 9 is illustrated on **Figure 8–27**. A large portion of this viewpoint is comprised of the New England Highway road corridor and would have a low level of sensitivity towards change. This is balanced by highly sensitive elements in the view which include existing roadside tree cover and views across the open floodplain in the east. Overall, the sensitivity of the view to change is **moderate**.

Magnitude of change

The viaduct supported on piers above the open floodplain landscape would introduce a new focal point into this view. The underside of the viaduct would vary from about 12 metres to about 16 metres above natural ground. Piers supporting the viaduct would be a major visual element in the view, altering the open outlook across the floodplain. The change to the view would be further amplified by the visual effect of traffic travelling along the viaduct including large trucks. Sensitive vegetation would be retained in the foreground, while some tree removal may be required close to the viaduct to enable construction. The magnitude of change to this view would be **high**.

A photomontage illustrating the project at viewpoint 9 is shown on **Figure 8–28**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Moderate	High	High to moderate

Figure 8–27 Viewpoint 9

Figure 8–28 Photomontage at viewpoint 9
Image indicative only. Final layout to be determined through detailed design

8.3.10 Viewpoint 10

Location

Pacific Highway Hexham Bridge over the Hunter River at Hexham, looking north-west (**Figure 8–29**).

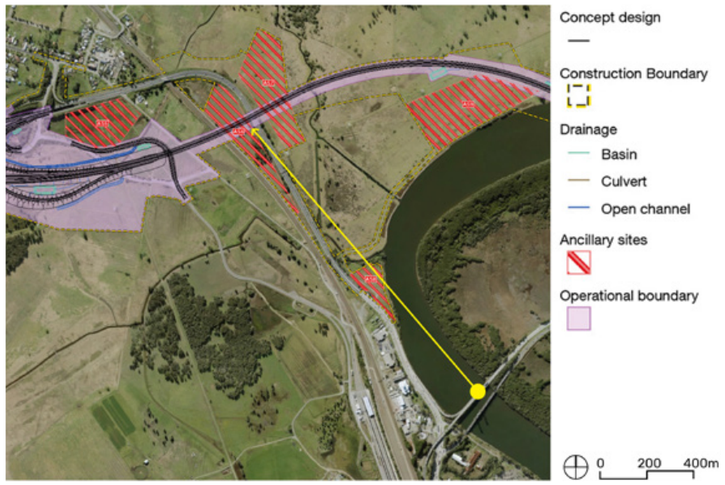

Figure 8–29 Viewpoint 10 location

Primary viewers

Motorists travelling along the Pacific Highway towards Taree. The viewpoint is also representative of the view from the parallel, heritage-listed Hexham Bridge where motorists travel towards Hexham.

Visible project elements

- Viaduct over the Main North Rail Line and the Hunter River floodplain (bridge B05)
- Tarro interchange.

Sensitivity

The view from viewpoint 10 is illustrated on **Figure 8–30**. The elevated viewing position from the Hexham Bridge provides for open and panoramic views over the floodplain towards the hills and mountains beyond. The major visual element in the view is the Hunter River itself which would be highly sensitive to change. Despite the prominence of high voltage transmission line stanchions, this viewpoint represents a memorable event along the route. The sensitivity of this view to change is considered **high**.

Magnitude of change

The viaduct over the Hunter River floodplain would introduce a large new structure into this view. The viaduct would be elevated up to 16 metres above natural ground. However, it would generally not protrude above the horizon line. As a result of the viewing distance (about 1.5 kilometres), the viaduct would comprise a relatively small portion of the view. Being seen by viewers primarily in moving cars, and looking sideways at a perpendicular angle would also reduce the ability to perceive change to the view. Tree cover and grazing lands in the floodplain, as well as the view of the hills in the background would not be affected. The magnitude of change to the view would be **negligible**.

A photomontage illustrating the project at viewpoint 10 is shown on **Figure 8–31**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
High	Negligible	Negligible

Figure 8–30 Viewpoint 10

Figure 8–31 Photomontage at viewpoint 10
Image indicative only. Final layout to be determined through detailed design

8.3.11 Viewpoint 11

Location

Tomago Road at the existing Pacific Highway intersection in Tomago, looking north-east (**Figure 8–32**).

Figure 8–32 Viewpoint 11 location

Primary viewers

Motorists travelling along Tomago Road and north along the Pacific Highway. The view is also representative of industrial workers in Tomago and residents and visitors at the Tomago Village Van Park.

Visible project elements

- Bridge over the Hunter River (northern extent of bridge B05)
- Tomago interchange including the realigned northbound Pacific Highway bridging over the M1 Pacific Motorway (bridge B06) and associated fill embankments and road furniture including safety screens
- Tomago Road intersection adjustment
- Vegetation clearing including existing mature tree cover north of the Pacific Highway
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 11 is illustrated on **Figure 8–33**. Located at an important intersection, much of this is comprised of existing road infrastructure which has a low level of sensitivity to change. Mature tree cover on the northern side of the Pacific Highway provides a strong visual frame to the road corridor and would be sensitive to change. Overall, the sensitivity of this viewpoint to change is **moderate**.

Magnitude of change

Clearing within the operational footprint and the construction of the new northbound Pacific Highway alignment and associated fill embankments would alter the bushland frame of the view, resulting in a high level of change. The magnitude of change in this view would be **high**.

A photomontage illustrating the project at viewpoint 11 is shown on **Figure 8–34**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Moderate	High	High to moderate

Figure 8–33 Viewpoint 11

Figure 8–34 Photomontage at viewpoint 11
Image indicative only. Final layout to be determined through detailed design

8.3.12 Viewpoint 12

Location

South side of the Hunter River, about 500 metres east of the Hunter River bridge (B05), near the confluence of a small drainage canal with the Hunter River in Tomago. The view is looking west (**Figure 8–35**). The view is representative of a number of views along the Hunter River and from adjoining grazing lands.

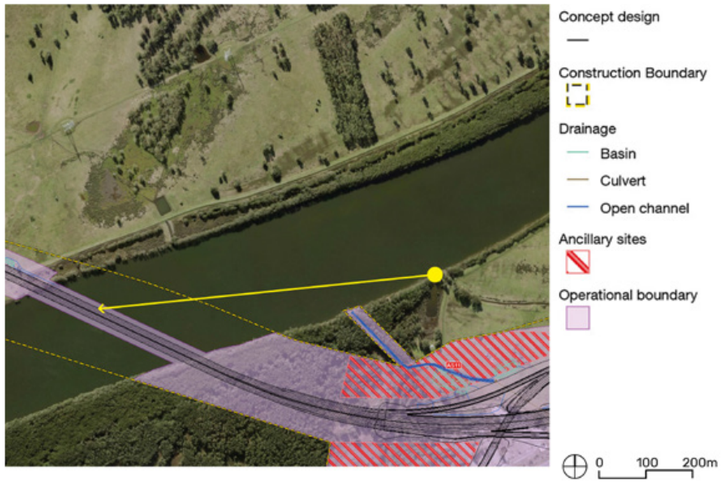

Figure 8–35 Viewpoint 12 location

Primary viewers

Water-based viewers, including tourists on river charter services and people engaged in commercial and recreational boating, as well as farmers on the adjacent land.

Visible project elements

- Bridge over the Hunter River (northern extent of B05) including bridge piers and pile caps
- Directional signage
- New tree, shrub and groundcover vegetation including reinstatement of existing mangrove forests disturbed by the project.

Sensitivity

The view from viewpoint 12 is illustrated on **Figure 8–36**. The view is characterised by the natural setting of the Hunter River and its riverside forests. Views are expansive with the open sky above the wider river a second important, visually highly sensitive component of the view. High voltage transmission line stanchions are visual detractors but overall, the natural environment dominates the composition. Overall, the sensitivity of the view to change is **high**.

Magnitude of change

The Hunter River bridge (B05) would be a large structure. The underside of the bridge deck would be elevated up to about 14 metres above the adjoining river bank. The bridge would alter the vista along the Hunter River. However, due to the winding nature of the river and dense tree cover along its edge, bridge B05 would not constitute a major element in many views along the Hunter River. The magnitude of change to the view would be **moderate.**

A photomontage illustrating the project at viewpoint 12 is shown on **Figure 8–37**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
High	Moderate	High to moderate

Figure 8–36 Viewpoint 12

Figure 8–37 Photomontage at viewpoint 12
Image indicative only. Final layout to be determined through detailed design

8.3.13 Viewpoint 13

Location

Bus stop and U-turn bay along the northbound Pacific Highway, opposite the Hunter Region Botanic Gardens in Heatherbrae, looking south-west (**Figure 8–38**).

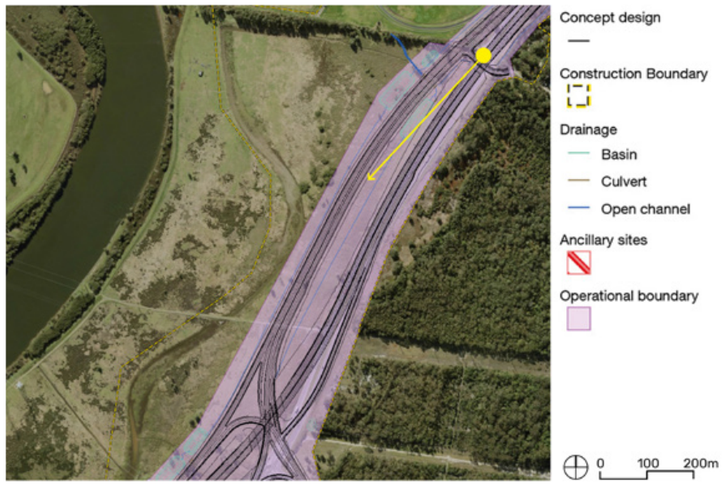

Figure 8–38 Viewpoint 13 location

Primary viewers

Motorists travelling south along the realigned Pacific Highway and the main alignment. The viewpoint is representative of the section of the Pacific Highway between Heatherbrae and Tomago generally that follows the edge of the floodplain and provides for long-distance views across it.

Visible project elements

- Main alignment
- Bridge (B09) over the Hunter Region Botanic Gardens access road and associated earthworks and road furniture such as safety screens
- Realigned Pacific Highway about 50 metres further north from the existing alignment and associated earthworks
- Modified access road to the Hunter Region Botanic Gardens including a signalised intersection at the junction with the Pacific Highway and a shared path
- Tree clearing east of the existing Pacific Highway
- Drainage infrastructure including basins
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 13 is illustrated on **Figure 8–39**. This viewpoint provides for open views from the Pacific Highway across the Hunter River floodplain, towards the hills and mountains in the west. The open vistas, clumps of tree cover and the overall rural landscape character would be sensitive to change, despite the detracting presence of high voltage transmission lines. The Pacific Highway comprises the left portion of the view and would be much less sensitive to change. Overall, the sensitivity of this viewpoint to change is **moderate**.

Magnitude of change

The project would introduce a second major road corridor into the sensitive natural area component of the view, changing the view to a large degree. Additional change to the view would result from the fill embankments associated with bridge B09. The magnitude of change to the view would be **high.**

A photomontage illustrating the project at viewpoint 13 is shown on **Figure 8–40**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Moderate	High	High to moderate

Figure 8-39 Viewpoint 13

Figure 8–40 Photomontage at viewpoint 13
Image indicative only. Final layout to be determined through detailed design

8.3.14 Viewpoint 14

Location

Hunter Region Botanic Gardens entrance, looking west (**Figure 8–41**).

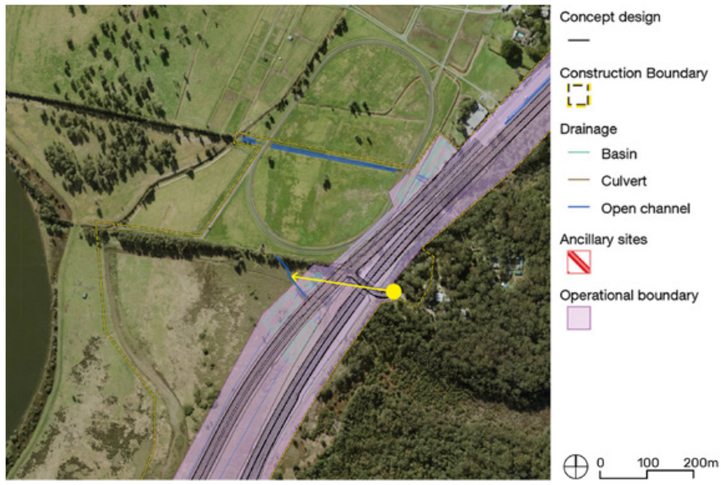

Figure 8–41 Viewpoint 14 location

Primary viewers

Visitors and staff at the Hunter Region Botanic Gardens.

Visible project elements

- Main alignment including bridge B09 over the Hunter Botanic Gardens access road and associated earthworks and road furniture such as safety screens
- Modified access road to the Hunter Region Botanic Gardens including a signalised intersection with the realigned Pacific Highway and a shared path
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 14 is illustrated on **Figure 8–42.** The Hunter Region Botanic Gardens are a tourism and local recreation destination. The entrance road currently looks out over the Hunter River floodplain with its combination of grazing lands and tree cover. This outlook would be highly sensitive to change. The existing Pacific Highway constitutes only a minor portion of the view. The visual sensitivity of this view is **high**.

Magnitude of change

The project would almost completely alter this view as a result of the fill embankments required to bridge the main alignment over the access road. The embankments, bridge abutments and bridge superstructure would become the main compositional items in the foreground. In the background of the view, vegetation would be removed and replaced with the realigned Pacific Highway including its intersection with the modified Hunter Region Botanic Gardens access road. The magnitude of change to this view would be **high**.

A photomontage illustrating the project at viewpoint 14 is shown on **Figure 8–43**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
High	High	High

Figure 8–42 Viewpoint 14

Figure 8–43 Photomontage at viewpoint 14
Image indicative only. Final layout to be determined through detailed design

8.3.15 Viewpoint 15

Location

Northern edge of the Pacific Highway at No 2,179C Pacific Highway, Heatherbrae, looking south-west (**Figure 8–44**). This viewpoint is representative of a number of viewpoints from residential and commercial properties at the southern entrance to Heatherbrae, as well as of the bus stop.

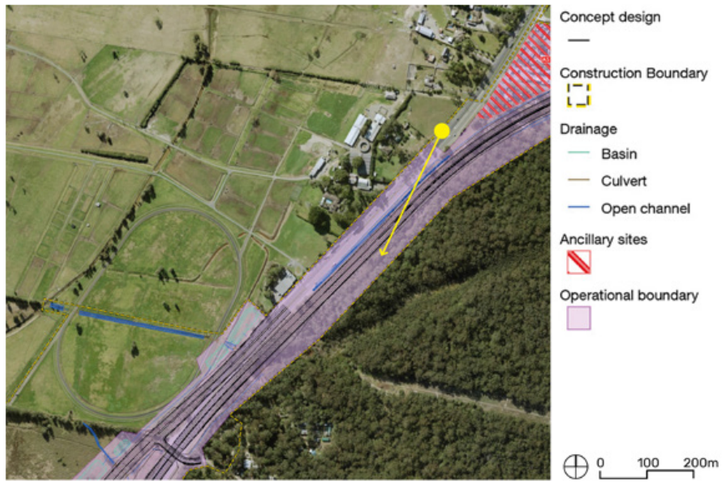

Figure 8–44 Viewpoint 15 location

Primary viewers

Motorists on the Pacific Highway, adjoining residents and business in southern Heatherbrae and people waiting for the bus.

Visible project elements

- Main alignment parallel to the Pacific Highway and associated fill embankments
- Drainage infrastructure including swales
- Removal of vegetation including bushland on the eastern side of the project
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 15 is illustrated on **Figure 8–45**. The view is at the southern entrance to Heatherbrae, an important centre for employment and services including schools and residential living. The view is along the existing Pacific Highway road corridor which would have a low sensitivity to change. Sensitive elements in the view include the large stand of bushland on the southern side of the road corridor, the long vista along the road corridor and the avenue of mature trees on the northern side of the road corridor. Overall, the sensitivity to change is be **moderate**.

Magnitude of change

The main alignment would result in the removal of bushland on the southern side of the road corridor. Bushland would be replaced with a second road corridor within the view, resulting in change to a large portion of the view. Due to space constraints, there would be limited opportunity for vegetation to visually separate the road corridors which might contribute to reducing the visual effect over time. The magnitude of change to this view would be **high**.

A photomontage illustrating the project at viewpoint 15 is shown on **Figure 8–46**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Moderate	High	High to moderate

Figure 8–45 Viewpoint 15

Figure 8–46 Photomontage at viewpoint 15
Image indicative only. Final layout to be determined through detailed design

8.3.16 Viewpoint 16

Location

Masonite Road in Heatherbrae, looking south-east (**Figure 8–47**).

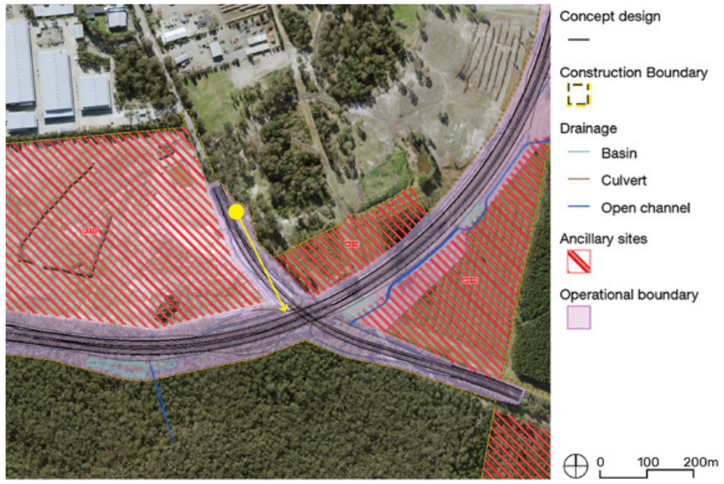

Figure 8–47 Viewpoint 16 location

Primary viewers

Motorists travelling along Masonite Road.

Visible project elements

- Realignment of Masonite Road including associated cut and fill embankments on the approach to the Masonite Road bridge (B10) over the main alignment
- Concrete and turf-lined drainage channels
- Shared path along the northern side of Masonite Road
- Clearing of vegetation including trees along the northern side of Masonite Road
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 16 is illustrated on **Figure 8–48**. The view along Masonite Road is comprised of the two lane road formation, adjoining grass and gravel verges, cleared land in future employment areas framed by bushland within the project's operational footprint. A mix of tree cover is also present along the eastern side of the road. Overall, the sensitivity of the view to change is **moderate**.

Magnitude of change

The project would relocate the road corridor further to the right in the view and increase the amount of road-related infrastructure, primarily as a result of the widened footprint of Masonite Road and a fill embankment between the existing and future alignment of Masonite Road. Part of the existing road infrastructure would be able to be removed and vegetation provided to integrate with the adjoining landscape.

Another change to the view would be the removal of bushland vegetation along Masonite Road and in the background, to facilitate project construction. Vegetation provided as part of the project landscape work along the main alignment would partially reduce this effect over time, as vegetation matures. The magnitude of change to this view would be **high**.

A photomontage illustrating the project at viewpoint 16 is shown on **Figure 8–49**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Moderate	High	High to moderate

Figure 8–48 Viewpoint 16

Figure 8–49 Photomontage at viewpoint 16
Image indicative only. Final layout to be determined through detailed design

8.3.17 Viewpoint 17

Location

South-eastern end of Camfield Drive, Heatherbrae (near Ivory Close) looking south-east (**Figure 8–50**). The view is representative of views from the industrial area.

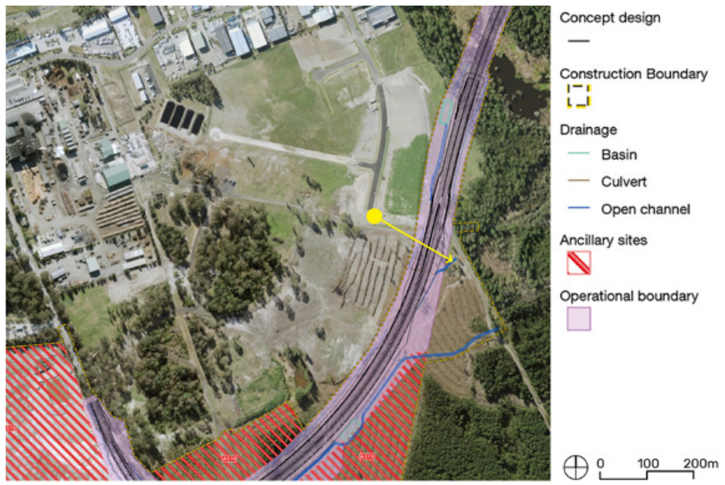

Figure 8–50 Viewpoint 17 location

Primary viewers

Workers and visitors to the Camfield Drive industrial estate and the Kinross Industrial Estate Heatherbrae/Weathertex.

Visible project elements

- Main alignment including fill embankments
- Vegetation clearing and some tree removal
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 17 is illustrated on **Figure 8–51**. The view is located within the developing industrial estate. Most of the view is composed of the subdivision under development and represents a visually poor outlook across future industrial lots and the project operational footprint which is already mostly cleared. Pine plantations are located beyond the project's operational footprint and provide a visual backdrop that would have higher level of sensitivity to change. The sensitivity of the view to change is **low**.

Magnitude of change

The project would introduce a new motorway in the middle ground of the view. Given the minor embankments, the project itself would not be obvious and alter only a minor portion of the view. The visibility of the project and changes to the outlook would primarily result from traffic along the project' main alignment, including large vehicles. Vehicles would take up a small portion of the view and would be partially obscured by vegetation provided as part of the project landscape design between the view and the main alignment. Project vegetation would make a positive contribution to the view over time, especially as trees mature. The backdrop of plantations would not be affected by the project.

The view would be subject to notable change as a result of the continuing development of the industrial area as part of the Kinross Industrial Estate/Weathertex. This will involve construction of industrial buildings that will likely block a large part of the view and would likely exceed and conceal the changes to the view brought about by the project. The magnitude of change to this view would be **low**.

A photomontage illustrating the project at viewpoint 17 is shown on **Figure 8–52**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Low	Low	Low

Figure 8–51 Viewpoint 17

Figure 8–52 Photomontage at viewpoint 17
Image indicative only. Final layout to be determined through detailed design

8.3.18 Viewpoint 18

Location

Pacific Highway north of the existing Windeyers Creek bridge north of Heatherbrae, looking north-east (**Figure 8–53**).

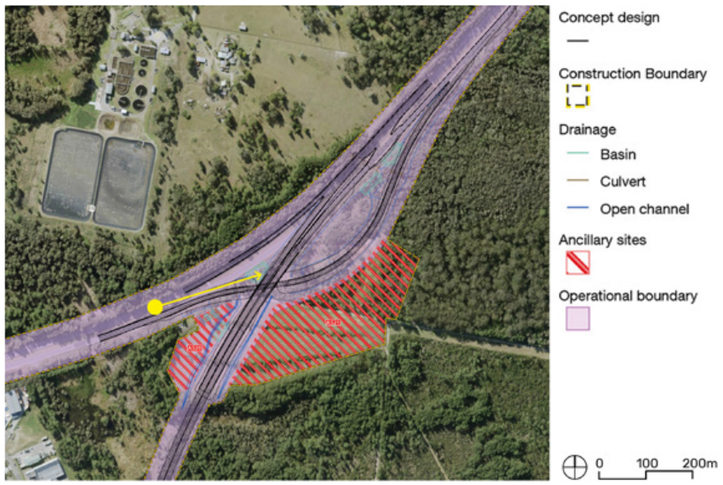

Figure 8–53 Viewpoint 18 location

Primary viewers

Motorists travelling north along the Pacific Highway.

Visible project elements

- Raymond Terrace interchange including southbound exit ramp onto the existing southbound Pacific Highway bridging (B12) over the main alignment, including associated fill embankments and road furniture such as safety screens
- Northbound Pacific Highway merging onto the main alignment entry ramp
- Drainage infrastructure including basins
- Removal of vegetation including trees on both sides of the existing Pacific Highway
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 18 is illustrated on **Figure 8–54**. The view is taken along the existing northbound Pacific Highway travel lanes. The Pacific Highway constitutes the major compositional element and would have a low level of sensitivity to change. Mature vegetation provides a consistent green and dense edge along both sides of the road corridor and would be sensitive to change. Overall, the visual sensitivity is **moderate**.

Magnitude of change

The major new element in the view would be the southbound exit ramp descending onto the existing Pacific Highway in the right-hand side of the view. The fill embankments required for the exit ramp as well as removal of vegetation along the eastern side of the existing road corridor would further alter this portion of the view. Removal of the existing southbound travel lanes and replacement with vegetation provided as part of the project landscape design would over time reduce the amount of road infrastructure in the view and provide a visual buffer between the northbound Pacific Highway travel lanes and the southbound exit ramp of the interchange. The magnitude of change to this view would be **moderate**.

A photomontage illustrating the project at viewpoint 18 is shown on **Figure 8–55**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Moderate	Moderate	Moderate

Figure 8-54 Viewpoint 18

Figure 8–55 Photomontage at viewpoint 18
Image indicative only. Final layout to be determined through detailed design

8.3.19 Viewpoint 19

Location

Pacific Highway in Raymond Terrace, about 300 metres north of the proposed Raymond Terrace interchange, looking south-west (**Figure 8–56**).

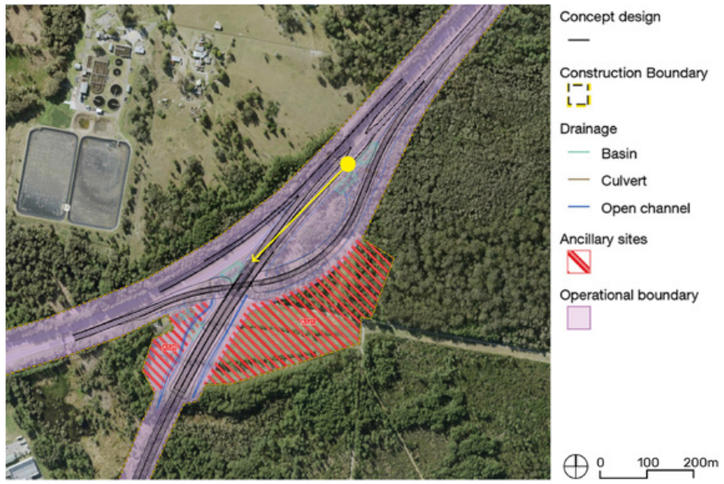

Figure 8–56 Viewpoint 19 location

Primary viewers

Motorists travelling south along the existing Pacific Highway.

Visible project elements

- Raymond Terrace interchange, including the main alignment, southbound exit ramp and bridge (B12) over the main alignment, associated fill embankments and road furniture such as safety screens
- Modifications to the existing northbound Pacific Highway travel lanes to provide a northbound entry ramp and tie-in with the main alignment
- Drainage infrastructure including basins
- Removal of vegetation including trees on both sides of the existing Pacific Highway
- New tree, shrub and groundcover vegetation.

Sensitivity

The view from viewpoint 19 is illustrated on **Figure 8–57**. The view is located on the existing southbound Pacific Highway travel lanes. The Pacific Highway constitutes the major compositional element and would have a low level of sensitivity to change. Mature vegetation provides a consistent and dense green edge along both sides of the road corridor and would be highly sensitive to change. Overall, the visual sensitivity is **moderate**.

Magnitude of change

The project would involve the removal of mature vegetation on both sides of the view, altering this view to a large extent. Bridge 12 would be located over the main alignment. Together with its associated fill embankments, it would change the centre of the view. Vegetation provided as part of the project landscape design between the main alignment and the northbound entry ramp, and between the main alignment and the southbound exit ramp would over time reduce the amount of road infrastructure in the view. It would also create a visual buffer and a green frame to the view, somewhat compensating for removal of mature vegetation. The magnitude of change to the view would be **high**.

A photomontage illustrating the project at viewpoint 19 is shown on **Figure 8–58**.

Visual impact summary

Visual sensitivity	Magnitude of change	Visual impact
Moderate	High	High to moderate

Figure 8–57 Viewpoint 19

Figure 8–58 Photomontage at viewpoint 19
Image indicative only. Final layout to be determined through detailed design

8.3.20 Summary of visual impact assessment during operation

The visual impact assessment comprised the assessment of 19 representative viewpoints selected in accordance with the methodology in **Section 3.4**. This assessment has considered the management measures as part of the urban design (**Section 11.1**) and so has identified residual visual impacts. The assessment of viewpoints is summarised in **Table 8–2**. The range of visual impact ratings were determined to be:

- Two viewpoints would have a high visual impact
- Ten viewpoints would have a high to moderate visual impact
- Four viewpoints would have a moderate visual impact
- One viewpoint would have a low visual impact
- Two viewpoints would have a negligible visual impact.

Table 8–2 Summary of visual impacts during operation

View-point #	Visual sensitivity	Magnitude of visual effect	Overall rating of visual impact
1	Moderate	High	High to moderate
2	Low	High	Moderate
3	High	Low	Moderate
4	High	Moderate	High to moderate
5	High	High	High
6	Moderate	Moderate	Moderate
7	High	Moderate	High to moderate
8	High	Negligible	Negligible
9	Moderate	High	High to moderate
10	High	Negligible	Negligible
11	Moderate	High	High to moderate
12	High	Moderate	High to moderate
13	Moderate	High	High to moderate
14	High	High	High
15	Moderate	High	High to moderate
16	Moderate	High	High to moderate
17	Low	Low	Low
18	Moderate	Moderate	Moderate
19	Moderate	High	High to moderate

8.3.21 Lighting during operation

As outlined in **Section 6.7**, lighting would be limited to interchanges and associated ramps.

Where permanent operational lighting is provided, increased traffic and light spill from the roadway would add to changes to the visual environment at night. The impact from operational lighting is expected to be low as the majority of the project is located within and near existing road infrastructure. Where the project is located in rural areas in Black Hill, Tarro and across the Hunter River and its floodplain, operational lighting may represent a notable change from the existing rural area which has limited lighting. The increase in lighting may impact on the night-time outlook from rural properties close to the sections of the project where lighting is proposed.

Although changes to night time amenity may be a concern for some property owners lighting would be designed in accordance with relevant Australian standards, as outlined in **Section 6.7**. It is expected that illumination and light spill would be mostly confined within the operational footprint. Therefore, light impacts are considered to be low in the context of the project as a whole.

9 SHADOWING ASSESSMENT

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9.

Shadowing assessment

The analysis of shadowing impacts focused on large three-dimensional project elements with the potential to cause shadowing in areas with sensitive receivers. Refer to **Section 3.5** for the methodology used.

The majority of the project comprises of roads and associated elements that lack sufficient three-dimensional form to cause shadowing impacts. In addition, with much of the project located within and next to existing road and utility corridors and in rural areas, there are limited receivers that would be sensitive to shadowing impacts.

Outside of the focus areas, the tallest project element would be the viaduct (B05) over the Hunter River and associated floodplain. At its highest point, the viaduct would be about 15 metres above the existing ground. There are no dwellings or other receivers sensitive to overshadowing close to the viaduct. Therefore, assessment of overshadowing impacts associated with the viaduct was not considered necessary from an urban design perspective. For shadowing impacts on biodiversity refer to the BAR (Appendix I of the EIS).

The assessment of shadowing impacts is detailed in **Table 9–1** and shadow diagrams provided in **Appendix C**.

Table 9–1 Shadowing assessment

Project elements with the potential to cause shadowing	Sensitive receivers within 50m of project elements	Shadow analysis and impacts
Focus Area 1: Beresfield		
Noise barrier NB02, consisting of: • Existing noise walls that would be repaired • A section of new noise barrier along the south-western boundary of Pasadena Crescent Reserve.	• Residents in Pasadena Crescent, Beth Street, Jacqualine Street and Allandale Street in Beresfield, north of the New England Highway • Open space users in Pasadena Crescent Reserve.	The shadow analysis on **Figure A3–1** to **Figure A3–12** in **Appendix C** shows that there would be no overshadowing of sensitive receivers as a result of noise barrier NB02.
Focus Area 2: Tarro		
Noise barriers NB02 and NB03 in Tarro, consisting of • Existing noise walls that would be repaired west of Aldwick Close • New noise barriers east of Aldwick Close.	• Residents in Christie Road and Sapphire Drive, immediately next to NB02 along the New England Highway • Residents in Palm Valley Village, located about 25m north of noise barrier NB03.	Sensitive receivers would be located to the north of the project and would not experience shadowing impacts due to prevailing sun angles from the north. This is demonstrated by the shadow analysis diagrams on **Figure A3–13** to **Figure A3–24** in **Appendix C**.
Focus Area 3: Hunter Region Botanic Gardens		
• Bridge (B10) over the modified Hunter Botanic Gardens access road • Associated fill embankments supporting the main alignment.	• Hunter Region Botanic Gardens.	Hunter Region Botanical Gardens would be sensitive to changes to shadowing due to the potential effects on visitor amenity and growing conditions for vegetation. Bridge (B10) and the associated fill embankments supporting the main alignment would be located to the north east of the Hunter Region Botanic Gardens. The shadow analysis on **Figure A3–25** and **Figure A3–36** in **Appendix C** demonstrates that shadows cast throughout the year would be limited to the project's operational footprint. Therefore, the Hunter Region Botanic Gardens is not expected to be affected by overshadowing as a result of the project.

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10 CUMULATIVE IMPACTS

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10.

Cumulative impacts

Cumulative landscape character and visual impacts may arise from the interaction of construction and operation activities of the project and other approved or proposed projects in the area. When considered in isolation, specific project impacts may be considered minor. These minor impacts may however be more substantial, when the impact of multiple projects on the same receivers is considered.

The projects detailed in **Table 10–1** are in varying stages of planning and delivery. This chapter provides an assessment of cumulative visual impacts based on the most current and publicly available information for these projects. In many instances, this is a high-level qualitative assessment.

The interaction with projects listed in **Table 10–1** may change the landscape character and visual impacts or benefits of the project. During construction, cumulative impacts may be associated with prolonged disturbance and disruptions for local communities as a result of projects occurring sequentially. Prolonged duration of construction impacts could result in:

- Extended periods of traffic disruptions and altered access arrangements for motorists, public transport users, pedestrians and cyclists, and commercial vehicle movements
- Extended periods of impacts on communities in the study area, associated with increased noise, dust, traffic, lighting and visual disruptions, leading to construction fatigue for some community members
- Increase in construction traffic, associated with haulage of materials, plant and equipment for the various construction projects, impacting on community perceptions of safety and liveability.

Table 10–1 illustrates that the project is located in an area undergoing considerable change and development. In this context, the contribution of the project to cumulative landscape character and visual impacts on communities in the area is minor.

Table 10–1 Assessment of cumulative impacts for relevant identified projects

Project (approval status)	Relevance in consideration of cumulative impacts	Cumulative impacts
Black Hill Employment Lands (Northern Estates) (In planning)	Located south of John Renshaw Drive and west of the M1 Pacific Motorway, in and adjoining LCZ 1 - Black Hill Potential to be some overlap in construction program, likelihood of concurrent construction and operation.	During construction, extended periods of exposed, temporarily cleared areas as a result of vegetation removal, temporary hoardings and fencing, increased construction traffic, lighting, plant and equipment would lead to ongoing disruptions to the landscape character and potentially affecting perceptions of the area as a desirable place to live. Cumulative operational impacts include increased landscape character and visual impacts as a result of permanent land uses changes including vegetation removal to accommodate employment lands development. This would also involve changes to the built form and spatial character of the area.
Black Hill Business Park, Cessnock (In planning)	Located south of John Renshaw Drive and west of the M1 Pacific Motorway, in and adjoining LCZ 1 - Black Hill Likely to be some overlap in construction program, meaning likelihood of concurrent (simultaneous) construction and operation.	This development is currently in planning and is anticipated to be similar to the Northern Estates development. Due to the differing time frames involved, it is not expected there would be any cumulative impacts during construction. Cumulative operational impacts include increased landscape character and visual impacts as a result of permanent land uses changes including vegetation removal to accommodate the business park development. This would also involve changes in the built form and spatial character of the area.
Kinross Industrial Estate Heatherbrae/ Weathertex (Approved)	Partially located within the construction of the project footprint (AS16) on Masonite Road, Heatherbrae, within LCZ 6 - Heatherbrae. Likely to be some overlap in construction program, meaning likelihood of concurrent (simultaneous) construction and operation.	During construction, extended periods of exposed, temporarily cleared areas as a result of vegetation removal, temporary hoardings and fencing, increased construction traffic, lighting, plant and equipment would lead to ongoing disruptions to the landscape character. Cumulative operational impacts include increased landscape character and visual impacts as a result of permanent land uses changes including vegetation removal to accommodate industrial development. This would also involve changes to the built form and spatial character of the area. Once operational, the project would support industrial development in the area through improved access and connectivity for freight and commercial vehicles.

Project (approval status)	Relevance in consideration of cumulative impacts	Cumulative impacts
Newcastle Power Station (In planning)	Located within the construction of the project footprint at Tomago near Old Punt Road in LCZ 4 Potential to be consecutive construction and concurrent (simultaneous) operation.	AGL propose to construct a 250 Mega Watt (MW) gas fired power station at Tomago, with gas pipelines and electricity transmission lines. The site for the proposed power station is located between the Pacific Highway and Old Punt Road, north of the Tomago industrial area (AGL, 2019). Construction of the power station is due to commence in 2021 with the power station expected to be operational in 2022. Extended periods of exposed, temporarily cleared areas as a result of vegetation removal, temporary hoardings and fencing, increased construction traffic, lighting, plant and equipment would lead to ongoing disruptions to the landscape character during construction. Cumulative operational impacts include increased landscape character and visual impacts as a result of permanent land uses changes including vegetation removal and changes to built form including utility infrastructure.
Hexham Straight (In planning)	Located about one kilometre south of the project at Hexham, in and adjoining LCZ 2 Potential to be consecutive (back to back) construction and concurrent (simultaneous) operation.	This road project is currently in planning. The Hexham Straight project is located along the Pacific Highway (Maitland Road) at Hexham, between Sandgate and Hexham Bridge, south of the construction footprint. The proposed scope of the Hexham Straight project involves the addition of an extra lane in both directions and associated adjustments to bridges, connecting roads and utilities. During construction, extended periods of temporary hoardings and fencing, increased construction traffic, lighting plant and equipment would lead to ongoing disruptions to the landscape character. Once operational, the projects would support each other through improved access and connectivity and a complementary design response.
Lower Hunter Freight Corridor (In planning)	Investigation area includes Hexham in and south of LCZ 2.	The Transport Lower Hunter Freight Corridor (LHFC) website (TfNSW, July 2018) indicates that in 2018 preliminary investigations were being carried out to assess options for a dedicated freight rail line between Fassifern and Hexham. No options were available on the website to review. An investigation area figure between Fassifern and Hexham was available. As corridor options and environmental assessment are not available for the LHFC, the level of impact that would be generated by this project is currently unknown. Consequently, cumulative impacts associated with the construction or operation of the project are unknown.

Project (approval status)	Relevance in consideration of cumulative impacts	Cumulative impacts
Richmond Vale Rail Trail to Shortland, including Shortland to Tarro cycleway (In planning)	Intersects the project at Tarro. Partially located within LCZ 2 and LCZ 3.	This project would generally upgrade existing access tracks to deliver an off-road cycle link. Due to the relatively minor scale of the infrastructure, the planned cycleway is not expected to result in cumulative landscape character and visual impacts with the project. The Richmond Vale Rail Trail to Shortland would have beneficial landscape character impacts through the provision of additional cycling connectivity.
Hunter Gas Pipeline (Approved)	Intersects the project at Tomago in LCZ 4 - Tomago.	This project would cross the M1 Pacific Motorway at Tomago. Construction is planned between 2024 and 2028. During construction, extended periods of increased construction traffic, lighting plant and equipment would lead to ongoing disruptions to the landscape character. Due to restrictions surrounding the establishment of vegetation near major utilities, the pipeline would locally influence the project landscape design. Being located at a minimum depth of 750mm below ground, the pipeline is unlikely to constitute a major constraint. It would be addressed during the detailed landscape design for the project, in the same manner as existing utilities would be integrated into the design to ensure integration with the existing natural, built and community context. Any cumulative impacts would be highly concentrated along the pipeline alignment and not lead to widespread landscape character and visual impacts.

11 MITIGATION STRATEGY

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11.

Mitigation strategy

11.1 Measures embedded in the project

The project design process has embedded measures in the project design to mitigate landscape character and visual impacts, through the application of the urban design strategy (**Chapter 5**) including the urban design vision, objectives and principles. Embedded management measures have assisted the project in meeting the performance outcomes outlined in **Section 1.3**.

Specifically, the design development considered the built, natural and community context of the project and sought to maximise integration of the project design while achieving relevant design standards and requirements for major road infrastructure. The following is a summary of project elements and desired future character and how they were addressed in the design development in order to avoid and mitigate impacts:

1. Desired future character
   - The project design would support the desired future character of the area in terms of the anticipated growth in housing and industrial areas (**Section 2.1.1**) including approved development near the project (**Chapter 10**)
   - The project would enhance the functioning of the road network in the study area, resulting in an important improvement to the National Land Transport Network, reducing congestion as well as network outages as a result of flooding (refer to **Section 4.8,** the Traffic and Transport Working Paper and Hydrology and Flooding Working Paper (Appendix G and Appendix J of the EIS respectively)).
2. Main alignment
   - The project's alignment was designed to follow existing road and utility corridors as much as possible, in order to reduce the visual and land use severance impacts of the project (refer to the Land Use and Property Working Paper (Appendix N of the EIS))
   - The design would maximise integration with existing interchanges, reducing the number of new interchanges required to facilitate connectivity.
3. Access and connectivity
   - The project has been designed to maintain access and connectivity, some with minor modifications including property access such as to the Glenrowan Homestead, the Aurizon access road and the Hunter Region Botanic Gardens access (refer **Section 6.9** and to the Land Use and Property Working Paper (Appendix N of the EIS))
   - The project would enhance opportunities for cycling by providing a more direct and continuous cycle route along the main alignment road shoulders between Black Hill and Raymond Terrace (refer to **Section 6.8** and the Traffic and Transport Working Paper (Appendix G of the EIS)).
4. Bridges
   - Bridges were designed to span across creeks, wetlands and floodplains, minimising impacts on these waterways and existing native vegetation communities (**Section 6.2**)
   - The bridge design approach would support legibility and way-finding through the use of colour integrated into bridges (**Section 6.2.1**)
   - Consistency of substructure and materials was maximised for bridges of similar types (**Section 6.2**)
   - The bridges would integrate a contemporary bridge design approaches, would be robust and avoid unnecessary clutter (**Section 6.2**).
5. Retaining walls
   - The design for retaining walls (**Section 6.12.4**) would maximise opportunities for vegetation to be installed to assist in the integration of the walls into the landscape setting. This involved the design of batter slopes that maximise opportunities for successful vegetation establishment.
6. Noise barriers
   - Noise barriers would be provided in locations where there are either existing noise barriers present or where the project closely follows existing road corridors (**Section 6.4**), minimising changes to the setting and therefore landscape character and visual impacts
   - The assessment of taller noise barriers in **Appendix C** describes additional landscape character, visual and shadowing impacts of taller noise barriers and would inform the decision on the appropriate barrier to be ultimately adopted.
7. Landscape design
   - The landscape design for the project maximises revegetation with local PCTs to maximise biodiversity outcomes and integration of the project with the existing landscape character (**Section 6.10**)
   - Vegetation has been used to mitigate project elements and provide visual buffers to reinforce the character of the area and avoid the appearance of project infrastructure incongruous with a regional setting
   - Vegetation is used to guide views from the project, maximising opportunities for views of the landscape while screening detracting elements to enhance the experience of the project setting overall.

11.1.1 Environmental management measures

The urban design strategy (**Chapter 5**) will continue to provide guidance on the design development during detailed design of the project in order to minimise landscape character and visual impacts.

During detailed design consideration would be given to major project elements such as bridges, abutments and walls to refine the design in relation to the project's landscape character impacts (**Chapter 7**) and visual impacts (**Chapter 8**). This is particularly relevant in the Hunter River floodplain where the viaduct would be an enduring built legacy.

To this end, the ongoing design development process will continue to refine the project's design to achieve a high quality outcome that ensures the project is fully integrated with its built, natural and community setting.

Environmental management measures to minimise landscape character and visual amenity impacts during design, construction and operation of the project are presented in **Table 11–1**. Further opportunities to improve urban design outcomes for the project are suggested in **Appendix A**.

Refer to the BAR (Appendix I of the EIS) for management measures in respect of biodiversity.

Table 11–1 Environmental management measures

Area of consideration	ID	Environmental management measure	Responsibility	Indicative timing
Landscape character and visual impacts including during construction	UD01	An Urban Design and Landscape Plan (UDLP) will be prepared to support the project. The plan will present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the EIS. The plan will include: • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining walls, bridges and noise barriers • Walking and cyclist elements including footpath locations, paving types and pedestrian crossings • Fixtures such as lighting, fencing and signs • Details on the staging of landscape work including related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas • The project will consider CPTED principles during detailed design to minimise safety and security risks to all users and communities in the study area. The project will carry out CPTED reviews at each milestone by a qualified professional. Additional recommendations as a result of reviews will be implemented where reasonable and feasible. • Water sensitive urban design solutions. The plan will be prepared in accordance with TfNSW urban design policy guidelines including: • Beyond the Pavement - Urban design approach and procedures for road and maritime infrastructure planning, design and construction (TfNSW 2020b) • Landscape design guideline: Design guideline to improve the quality safety and cost effectiveness of green infrastructure in road corridors (TfNSW 2018) • Bridge Aesthetics: Design Guidelines to improve appearance of bridges in NSW (TfNSW 2019) • Noise wall design guideline: Design guideline to improve the appearance of noise walls in NSW (TfNSW 2016b) • Shotcrete Design Guideline: Design guidelines to avoid, minimise and improve the appearance of shotcrete in NSW (TfNSW 2016a) • Water sensitive urban design guideline, Applying water sensitive urban design principles to NSW transport projects (TfNSW 2017b)	Contractor	Prior to construction

Area of consideration	ID	Environmental management measure	Responsibility	Indicative timing
	UD02	Disturbed areas outside the operational footprint and within the construction footprint will be revegetated following completion of construction activities.	Contractor	Progressively during construction
	UD03	Cut batters and fill embankments for the project will be designed to allow revegetation to assist with the integration of the project into the surrounding landscape where possible depending on site conditions.	Contractor	Progressively during construction
	UD04	Project construction elements such as fencing and hoardings will be designed to minimise impacts to landscape character and visual amenity where practicable.	Transport / Contractor	Prior to construction/ during construction
	UD05	Temporary and permanent lighting will be installed and operated in accordance with AS/NZS1158 Lighting for Roads and Public Spaces.	Transport / Contractor	Prior to construction/ during construction
Aboriginal cultural heritage	UD06	The project detailed design will incorporate relevant Aboriginal cultural heritage elements of Beyond the Pavement (TfNSW, 2020) and Designing with Country (GANSW, 2020), where practical.	Transport / Contractor	Prior to construction/ during construction

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12 CONCLUSION

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12.

Conclusion

This working paper describes the urban design strategy and concept for the project. In addition, it assesses the landscape character and visual impacts associated with the project and defines a mitigation strategy that outlines project commitments to ensure the project is fully integrated with its built, natural and community setting.

The project would introduce new road infrastructure into the study area. Its key features comprise twelve new bridges including the 2.6 kilometre viaduct (B05) over the Hunter River and its floodplain, two new interchanges at Black Hill and Tomago and upgrades and amendments to existing interchanges at Tarro and Raymond Terrace. The design has been developed in recognition of existing natural, built and community values and has sought to minimise impacts by mainly passing within or near to existing road corridors.

Transport would continue to develop the urban design during detailed design. Once operational, the project would achieve the desired performance outcomes in complementing the visual amenity, character and quality of the surrounding environment, contributing to the accessibility and connectivity of communities, and minimising the adverse impacts of the project.

12.1 Landscape character impacts

The landscape character of the study area is varied. Seven distinct landscape character zones were identified, based on the combination of natural, built and community factors. The project would result in a number of changes to the existing landscape character of the study area as a result of:

- Land use changes including construction of the project partly through greenfield areas
- Vegetation clearing
- Changes to the landform and spatial character of the study area
- Changes to views including within heritage curtilages
- Changes to built form including heritage items
- Changes to accessibility and connectivity which are generally of a beneficial nature.

The magnitude of impact as a result of the project varies between landscape character zones based on the sensitivity of each zone and the degree of change within each zone. Overall, the landscape character impacts of the project would be consistent with what would be expected of a project of this nature. They would be higher where the project would introduce a road corridor (including the viaduct) through greenfield areas such as the Hunter River floodplain and remnant bushland vegetation. Where the project would be closely aligned with or within existing road corridors, landscape character impacts would remain in the low to moderate range. Over time, the implementation of the urban design concept would assist with integrating the project into the surrounding environment.

12.2 Visual impacts

Nineteen viewpoints were selected within the project's visual envelope and represent a number of different viewers and view angles of the project. Based on the sensitivity of the views to change and the magnitude of change to the view as a result of the project, the project's visual impacts would vary in intensity. Higher impacts would result where elements that are sensitive to change would be altered by the project, such as removal of remnant bushland for an interchange at Black Hill the loss of open views of the landscape such as at Tarro and the Hunter Region Botanic Gardens. The range of visual impacts from 'negligible' to 'high' reflects the diversity of both the landscape setting and the project elements as they interact with the setting. This is consistent with what would be expected of a project of this nature.

The introduction of elevated bridge and viaduct structures, noise barriers in new locations, removal and severance of remnant bushland, the introduction of embankments to negotiate interchanges and the creation of parallel road corridors adjoining each other with little visual separation result in moderate to high impacts.

Where the project aligns with existing urban areas and road corridors, such as the Heatherbrae industrial area and Masonite Road, views would have a higher ability to accommodate change, reducing the overall level of impact within the moderate to low range.

Due to the open landscape setting of the Hunter River floodplain, project elements would potentially be seen from areas at a considerable distance from the project. The size of project elements generally quickly diminishes with increasing viewing

distance. All but the largest project elements have substantially reduced visibility at viewing distances greater than about 1.5 kilometres. When seen from this distance, the project would have a low to negligible visual impact.

12.3 Construction impacts

During construction of the project both landscape character and visual impacts would be at least equal to and often more severe than the project's operational impacts. Landscape character impacts during construction would range from low to high, and visual impacts during construction would range from 'moderate to low' to 'high'. This would result from the removal of vegetation, increased haulage and construction traffic, the need for 21 ancillary facilities and the temporary presence of machinery and equipment including batching plants, pre-casting yards, wharves, cranes and the like. However, the degree of impact would be temporary and would not be continuous throughout the construction period but instead would fluctuate with workflow intensities and construction activities.

13 REFERENCES

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APPENDICES

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Appendices

Appendix A Urban design opportunities

The project is regionally important within Greater Newcastle and the Lower Hunter, as well as of national importance within the National Land Transport Network. **Table A1-1** details urban design opportunities identified in recognition of the project's importance that have the potential to enhance the urban design outcome for the project.

Table A1-1 Urban design opportunities

Design aspect	Description of opportunity for further investigation
Major structures	Explore opportunities to refine the girder depth on bridge B05 near the Main North Rail Line and the Hunter River to ensure a visually pleasing transition.
	Explore design, material and finishes options to maximise views from bridges and ramps over the Hunter River floodplain.
	Consider opportunities for integrating feature lighting on bridges to enhance the night-time experience for motorists.
	Investigate opportunities to further increase space for vegetation in front of retaining walls in order to soften the appearance of walls.
	Investigate the most appropriate colour and detailing for the viaduct (B05) to ensure a harmonious contrast with the Hunter River floodplain.
	Investigate visually recessive colours and low glare finishes for retaining walls to ensure the landscape remains the visually dominant element.
	Investigate opportunities for interpretive elements to be integrated into the project design's major structures such as retaining walls and noise barriers. These major design elements may offer scope for further design effort to maximise integration with the project location.
	Consider the resolution of retaining walls on sloping sites to maximise integration with the landscape and avoid visually jarring tops of walls, angles and corners.

Design aspect	Description of opportunity for further investigation
Project alignment	Investigate the removal of existing travel lanes that would no longer be required for the project. Consider the potential for vegetation in these areas to maximise the project's landscape integration. Locations to be considered include: The existing northbound Pacific Highway travel lanes north of the Tomago Road interchange where the Pacific Highway splits into northbound and southbound travel lanes Sections of the existing Masonite Road made redundant The existing southbound Pacific Highway travel lanes at the Raymond Terrace interchange.
Landscape design	Investigate if the project can offer scope for provision of non-frangible vegetation (including trees) through the use of wire-rope barriers or other types of safety barriers, to maximise integration of the project with the landscape setting of nearby bushland areas.
	Investigate opportunities for trees to be provided around the viaduct (bridge B05) embankments to maximise integration with the Hunter River floodplain by mirroring existing bands of mature trees.
	Investigate opportunities for the installation of trees on bridge approaches to mitigate the scale of bridges in the low-lying landscape.
	Work with utility providers to ensure the utility design and placement allows the project landscape to integrate with adjoining remnant bushland and to provide visual screens to detracting elements.
	Investigate potential opportunities and timing requirements for the use of local provenance seed and plants grown locally.

Design aspect	Description of opportunity for further investigation
Drainage	Verify flow velocities in drainage channels and confirm the most suitable surface treatments to maximise the use of soft landscape finishes to drainage swales and other drainage structures, in order to filter stormwater and maximise visual integration with the landscape.
	Investigate opportunities to refine the design of drainage basins to provide more organic shapes that integrate with the natural landscape.
	Where possible, locate scour protection and other hard elements so that they would be visually concealed from the project and sensitive receivers. Where possible, integrate opportunities for landscape work to provide a visual buffer to hard drainage infrastructure.
	Refine maintenance access locations and details with a view to maximising the landscape outlook from the project.
Safety	Maximise the use of vegetation for the purposes of headlight screening where possible.
Construction methodology	Continue to refine the design and the project construction methodology with a view to minimising disturbance to and clearing of bushland in sensitive areas to retain the experience of a spatially enclosed drive through bushland at the project's southern and northern extents. Locations for consideration include: • Between the southbound entry ramp at Black Hill and John Renshaw Drive • The eastern portion of ancillary facility AS10 in Tomago, in order to retain a bushland backdrop and a sense of spatial enclosure • Around the Heatherbrae urban area, in order to retain a bushland backdrop to the project • Around the Raymond Terrace interchange, west of the road corridor • At the Raymond Terrace interchange, between the main alignment and the southbound exit ramp.

Appendix B Assessment of impacts from increased noise barrier heights

The assessment in this section is intended to provide an understanding of the impacts associated with different options for noise barrier heights and will assist in determining the appropriate noise barrier height to be ultimately adopted for the project.

As outlined in **Section 6.4**, three noise barriers have been identified for the project, two of which are being assessed for alternative barrier heights:

- Noise barriers in new locations (part of NB02, NB03)
- Upgrading of existing noise barriers (part of NB02).

As outlined in **Section 3.1**, the assessment of impacts in **Chapter 7** to **Chapter 9** of this report assumed barrier heights of 3.8 metres for NB02 and four metres for NB03. The following sections provide an assessment of the operational landscape character, visual and shadowing impacts that would result from project noise barriers based on a height of about seven metres for NB02 and eight metres for NB03. For the existing parts of NB02, this would involve replacement of existing noise barrier sections with a taller noise barrier in a similar alignment.

Landscape character impact

Noise barriers assessed for alternative heights would be located in two of the seven LCZs in the study area (**Figure 6–4**), including:

- LCZ 1 – Black Hill
- LCZ 3 – Beresfield-Tarro-Woodberry.

The following sections contain the assessment of additional landscape character impact in these zones as a result of increased noise barrier heights.

LCZ 1 – Black Hill

The replacement of NB02 in LCZ 3 – Beresfield-Tarro-Woodberry would impact on the character of the New England Highway corridor within LCZ 1 – Black Hill through removal of established screening vegetation at the interface with LCZ 3 – Beresfield-Tarro-Woodberry. Due to a number of constraints, it would be unlikely that similar screening vegetation would be able to be reinstated following noise barrier replacement. This would alter the character of a small section of the New England Highway corridor.

Given the localised nature of the change with the existing New England Highway corridor and the magnitude of change to LCZ 1 – Black Hill as a result of other project elements, the increase in noise barrier height would not further increase the overall magnitude of change within LCZ 1 – Black Hill. The landscape character impacts of the project in LCZ 1 – Black Hill would be similar irrespective of the noise barrier height adopted. The landscape character impact of the project in LCZ 1 – Black Hill is summarised in the following table:

Summary - LCZ 1	Rating, based on	
	Lower noise barriers (3.8m – 4m)	Taller noise barriers (7m – 8m)
Sensitivity	Moderate	
Magnitude	Moderate	Moderate
Landscape character impact	**Moderate**	**Moderate**

LCZ 3 – Beresfield-Tarro-Woodberry

The landscape character impact assessment in **Section 7.5** found that the new portion of noise barrier NB02 east of Aldwick Close, and noise barrier NB03, would result in the loss of the open interface with LCZ 2 – Hunter River Floodplain and in the loss of vegetation respectively, changing the spatial character at the edge of the LCZ 3 – Beresfield-Tarro-Woodberry. This change would be irrespective of the noise barrier height adopted for the project.

However, greater magnitude of impact would result from the inconsistency in the scale of built form that would result from an increase in noise barrier height to seven and eight metres in height for NB02 and NB03 respectively. The height of the noise barriers would contrast with the scale of existing predominantly single storey dwellings in Beresfield and Tarro.

In addition, replacement of existing noise barriers in Beresfield and Tarro west of Aldwick Close with taller noise barriers would require the removal of established vegetation along existing noise barriers. This vegetation provides a green backdrop to urban areas and a visual screen to noise barriers. Due to a number of constraints, it would be unlikely that similar screening vegetation would be able to be reinstated following noise barrier replacement. This would alter the character of nearby residential areas, as well as that of the New England Highway corridor in the adjoining LCZ 1 – Black Hill and LCZ 2 – Hunter River Floodplain.

For these reasons an increase in noise barrier height would increase the landscape character impact of the project on LCZ 3 – Beresfield-Tarro-Woodberry. The landscape character impact of the project in LCZ 3 – Beresfield-Tarro-Woodberry is summarised in the following table:

Summary – LCZ 3	Rating, based on	
	Lower noise barriers (3.8m – 4m)	Taller noise barriers (7m – 8m)
Sensitivity	Moderate	
Magnitude	Low	Moderate
Landscape character impact	**Moderate to low**	**Moderate**

Landscape character impact assessment summary

The adoption of greater noise barrier heights would result in an increase in landscape character impact in one of the seven LCZs within the study area. The increase in landscape character impact in LCZ 3 – Beresfield-Tarro-Woodberry would be associated with an increased barrier height that would be inconsistent in scale with the existing built form and with the loss of established screening vegetation that would not be able to be replaced.

Visual impact

Noise barriers would be visible from the following viewpoints (**Figure 8–1**):

- Viewpoint 3 from Walter Parade in Lenaghan
- Viewpoint 4 from Quarter Session Road
- Viewpoint 5 from Tarro residential areas.

The following sections contain the assessment of additional visual impact on these viewpoints as a result of increased noise barrier heights.

Viewpoint 3 from Walter Parade in Lenaghan

Parts of noise barriers NB02 and NB03 would theoretically be visible from this viewpoint. Given the large viewing distance of about 1.3 kilometres, the noise barriers would be difficult to discern and would not increase the magnitude of change to the view.

The visual impact of the project on viewpoint 3 is summarised in the following table:

Summary - Viewpoint 3	Rating, based on	
	Lower noise barriers (3.8m – 4m)	Taller noise barriers (7m – 8m)
Sensitivity	High	
Magnitude	Low	Low
Visual impact	**Moderate**	**Moderate**

Viewpoint 4 from Quarter Session Road

The new section of noise barrier NB02 would be a prominent element in the view from viewpoint 4 regardless of its height, removing the open outlook from Tarro to the Hunter River floodplain. The magnitude of change to this viewpoint has been assessed as high taking into account all project elements including NB02 at the lower height (**Section 8.3.4**). Increasing the height of noise barrier NB02 would not further increase the magnitude of change to the view.

The visual impact of the project on viewpoint 4 is summarised in the following table:

Summary - Viewpoint 4	Rating, based on	
	Lower noise barriers (3.8m – 4m)	Taller noise barriers (7m – 8m)
Sensitivity	High	
Magnitude	High	High
Visual impact	**High**	**High**

Viewpoint 5 from Tarro residential areas

Noise barrier NB03 would be a prominent visual element when seen from viewpoint 5, replacing mature screening vegetation in the view and altering the outlook from the heritage listed property at 29 Eastern Avenue, as well as that of nearby residents. The magnitude of change to this viewpoint has been assessed as high taking into account all project elements including NB03 at the lower height (**Section 8.3.5**). Increasing the height of noise barrier would not further increase the magnitude of change to the view.

The visual impact of the project on viewpoint 5 is summarised in the following table:

Summary - Viewpoint 5	Rating, based on	
	Lower noise barriers (3.8m – 4m)	Taller noise barriers (7m – 8m)
Sensitivity	Moderate	
Magnitude	High	High
Visual impact	**High to moderate**	**High to moderate**

Visual impact assessment summary

Noise barriers would be visible from three of the 19 assessed viewpoints in the study area. For these three viewpoints:

- The magnitude of change as a result of project is assessed as 'high' for two viewpoints irrespective of noise barrier height (viewpoint 4 and viewpoint 5)
- The noise wall would be difficult to discern from one viewpoint due to the large viewing distance (viewpoint 3).

The assessment found that the adoption of greater noise barrier heights would not result in an increase in visual impacts on viewpoints within the study area.

Shadowing impact

Shadowing impact of the project was assessed for three focus areas (**Chapter 9**). Of these, Focus area 1: Beresfield and Focus area 2: Tarro were identified to be potentially affected by shadowing impacts as a result of noise barriers.

The following sections contain the assessment of additional shadowing impacts on these focus areas as a result of increased noise barrier heights.

Focus area 1: Beresfield

The shadow diagrams on **Figure A3–1** to **Figure A3–12** demonstrate that increasing the height of noise barrier NB02 would not result in any overshadowing impacts on sensitive residential receivers in Beresfield.

Focus area 2: Tarro

The shadow diagrams on **Figure A3–13** to **Figure A3–24** demonstrate that increasing the height of noise barriers NB02 and NB03 to seven and eight metres respectively would not result in any overshadowing impacts on sensitive residential receivers in Tarro.

Shadowing impact summary

The assessment of project shadowing found that noise barriers, irrespective of the height adopted, would not result in any overshadowing of sensitive receivers between the hours of 9am and 3pm year round.

Appendix C Shadow diagrams

Shadow diagrams for Focus area 1: Beresfield

20 March

Lower noise barrier height

Taller noise barrier height

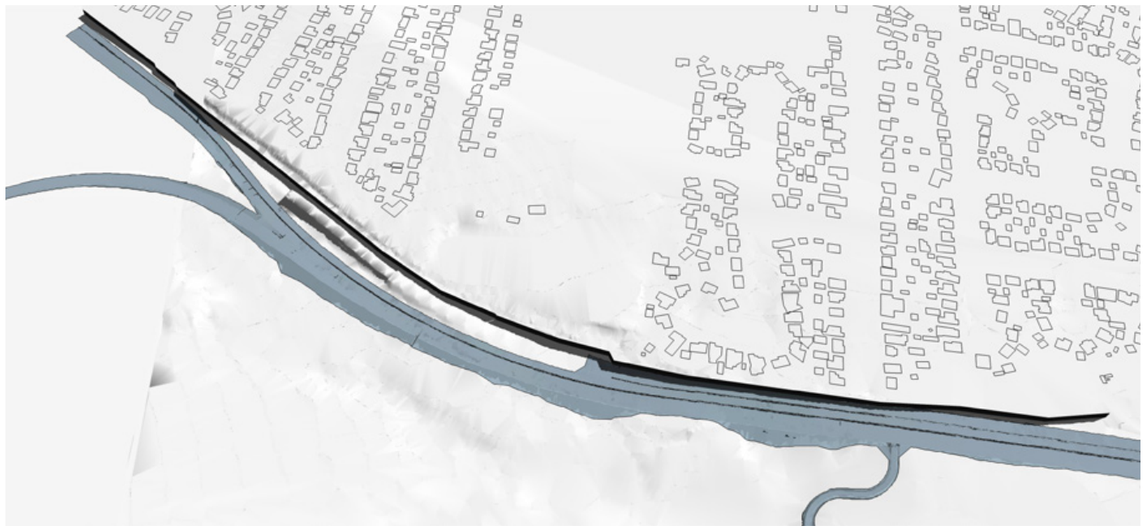


Figure A3–1 Shadow analysis for Beresfield on 20 March at 9am

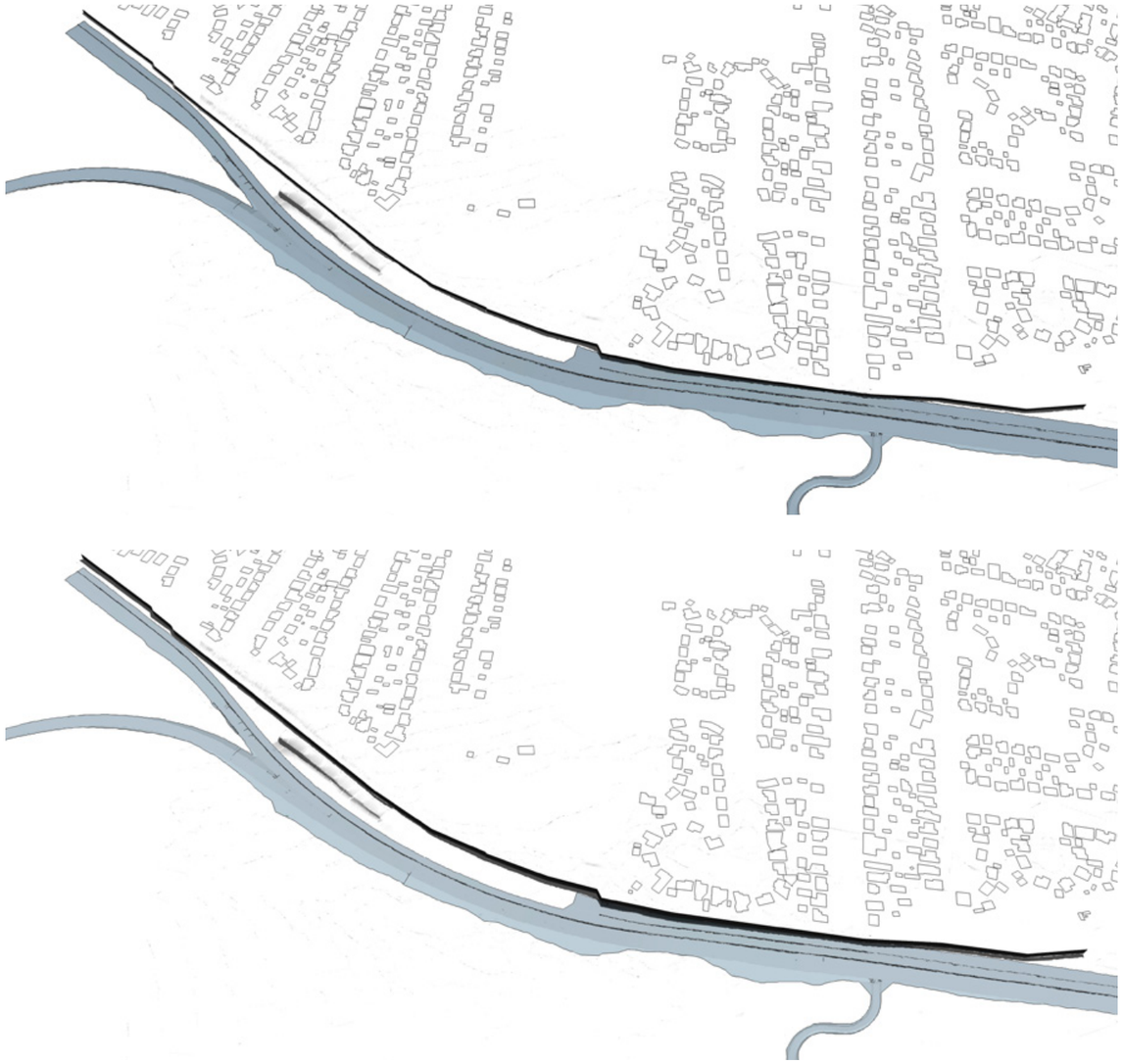
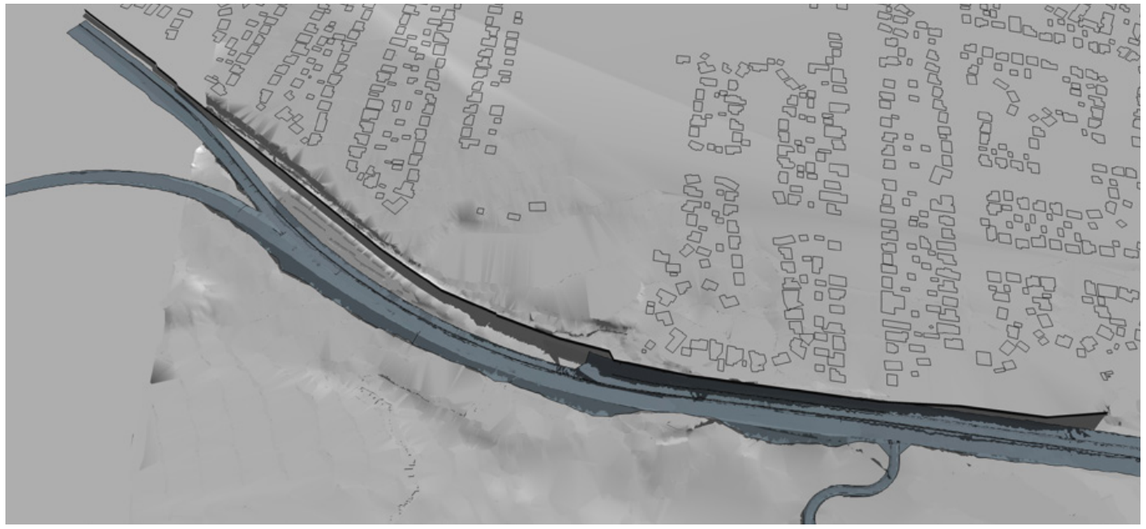


Figure A3–2 Shadow analysis for Beresfield on 20 March at 12pm

Figure A3–3 Shadow analysis for Beresfield on 20 March at 3pm

20 June

Lower noise barrier height



Taller noise barrier height

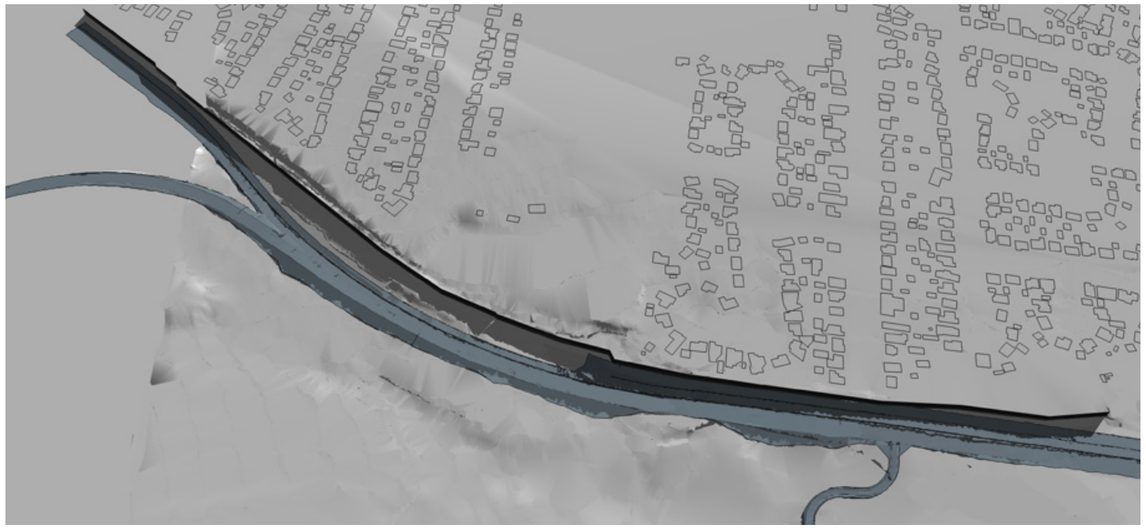


Figure A3–4 Shadow analysis for Beresfield on 20 June at 9am

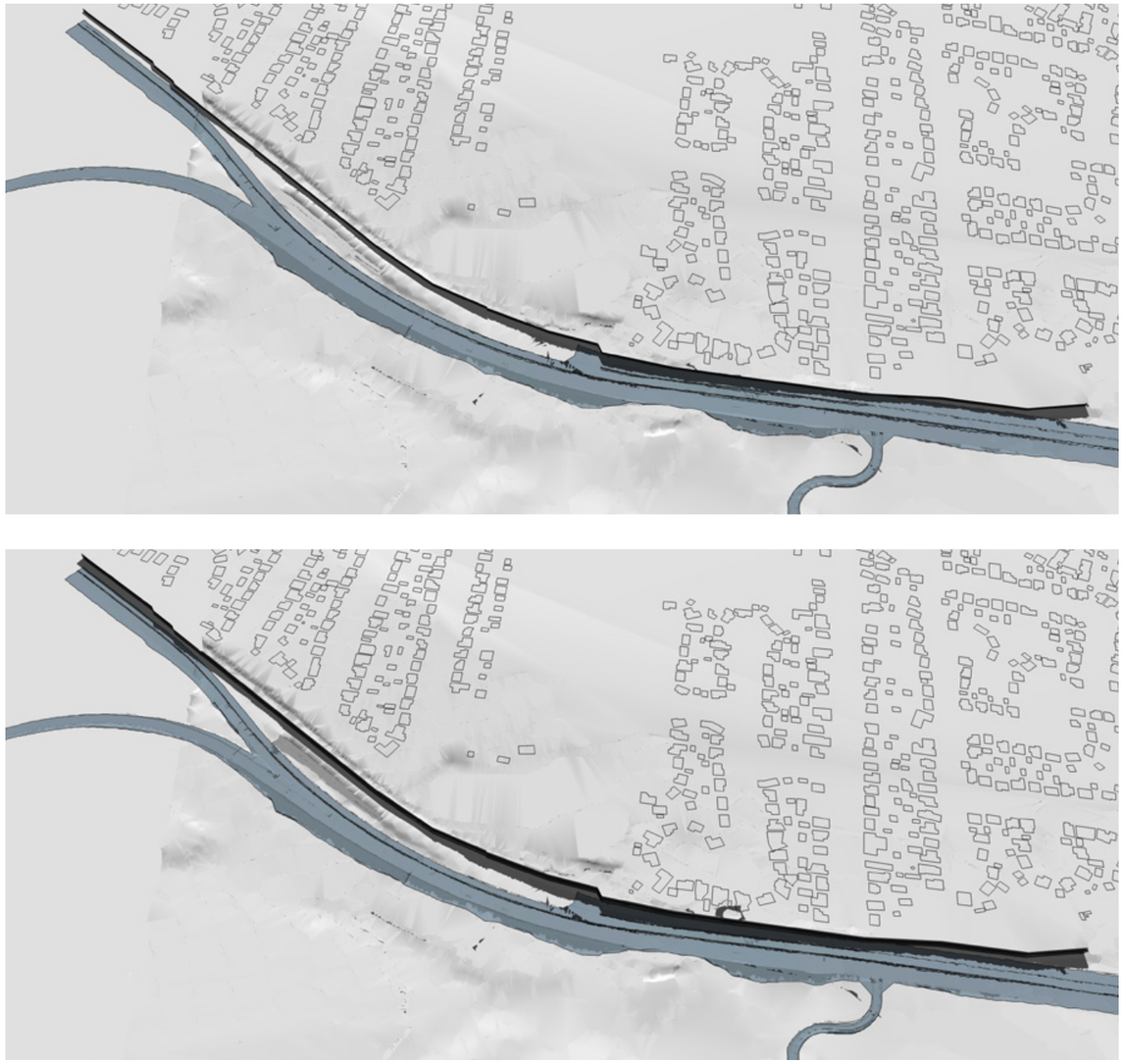


Figure A3–5 Shadow analysis for Beresfield on 20 June at 12pm

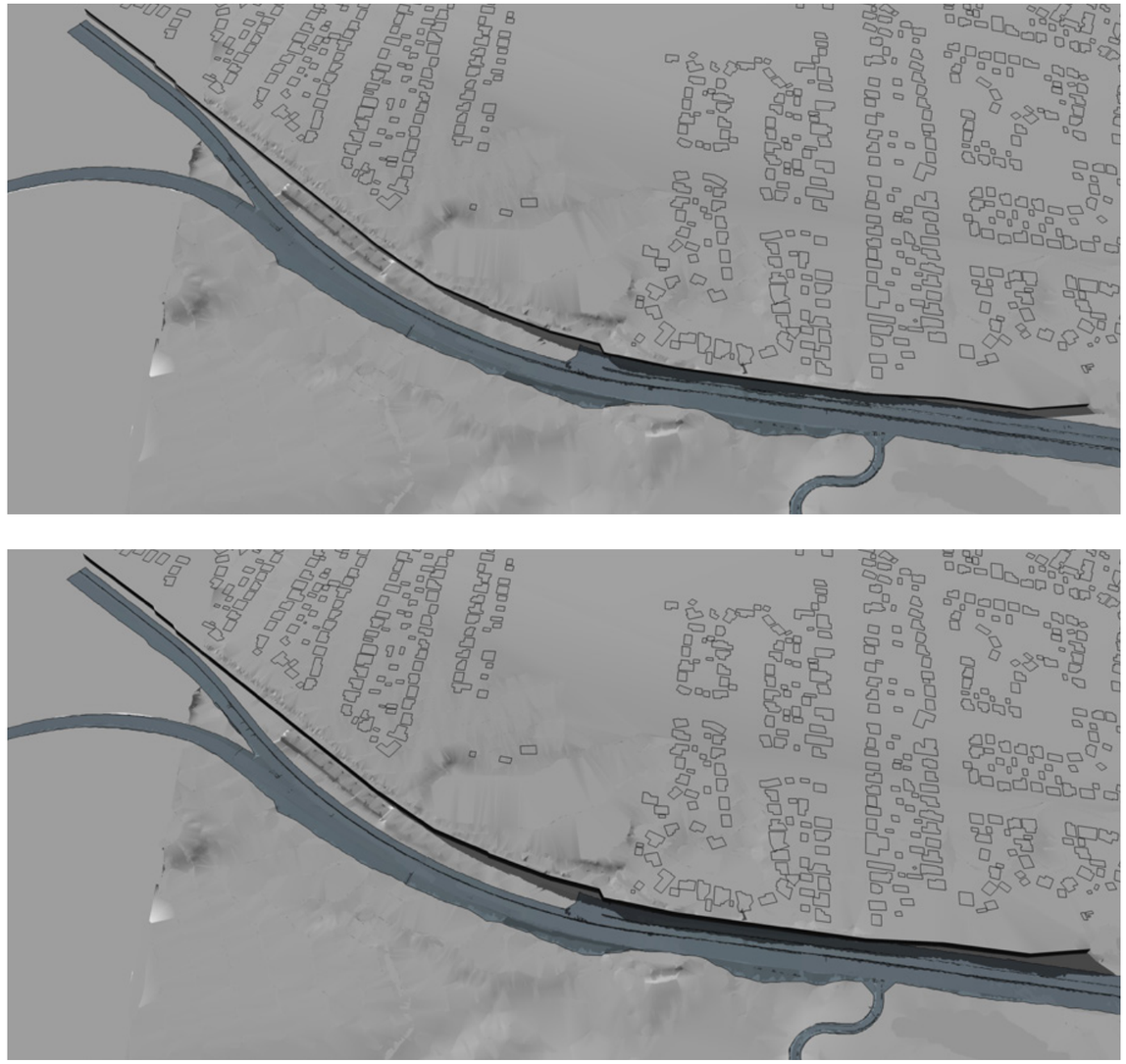


Figure A3–6 Shadow analysis for Beresfield on 20 June at 3pm

20 September

Lower noise barrier height

Taller noise barrier height

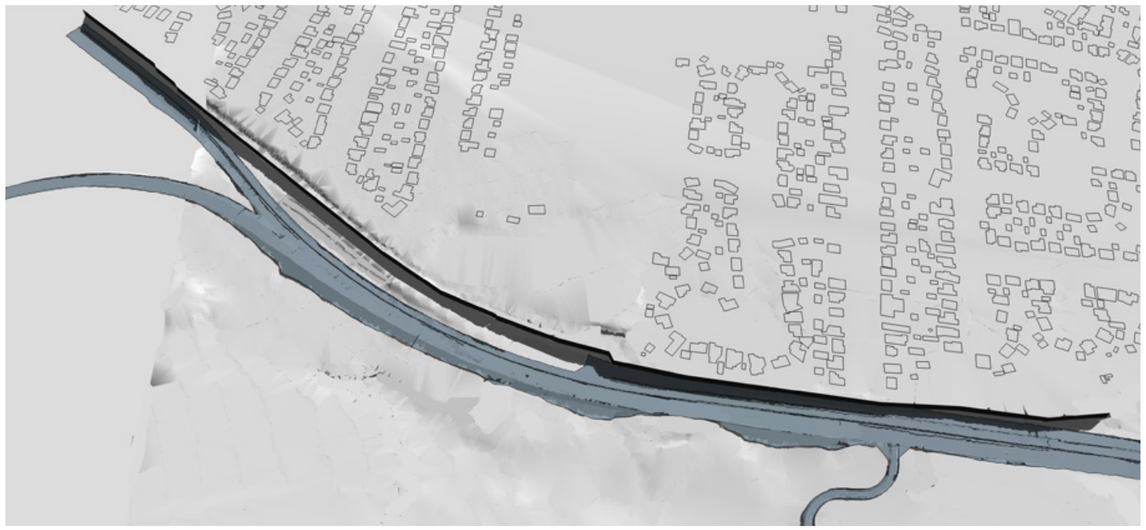


Figure A3–7 Shadow analysis for Beresfield on 20 September at 9am

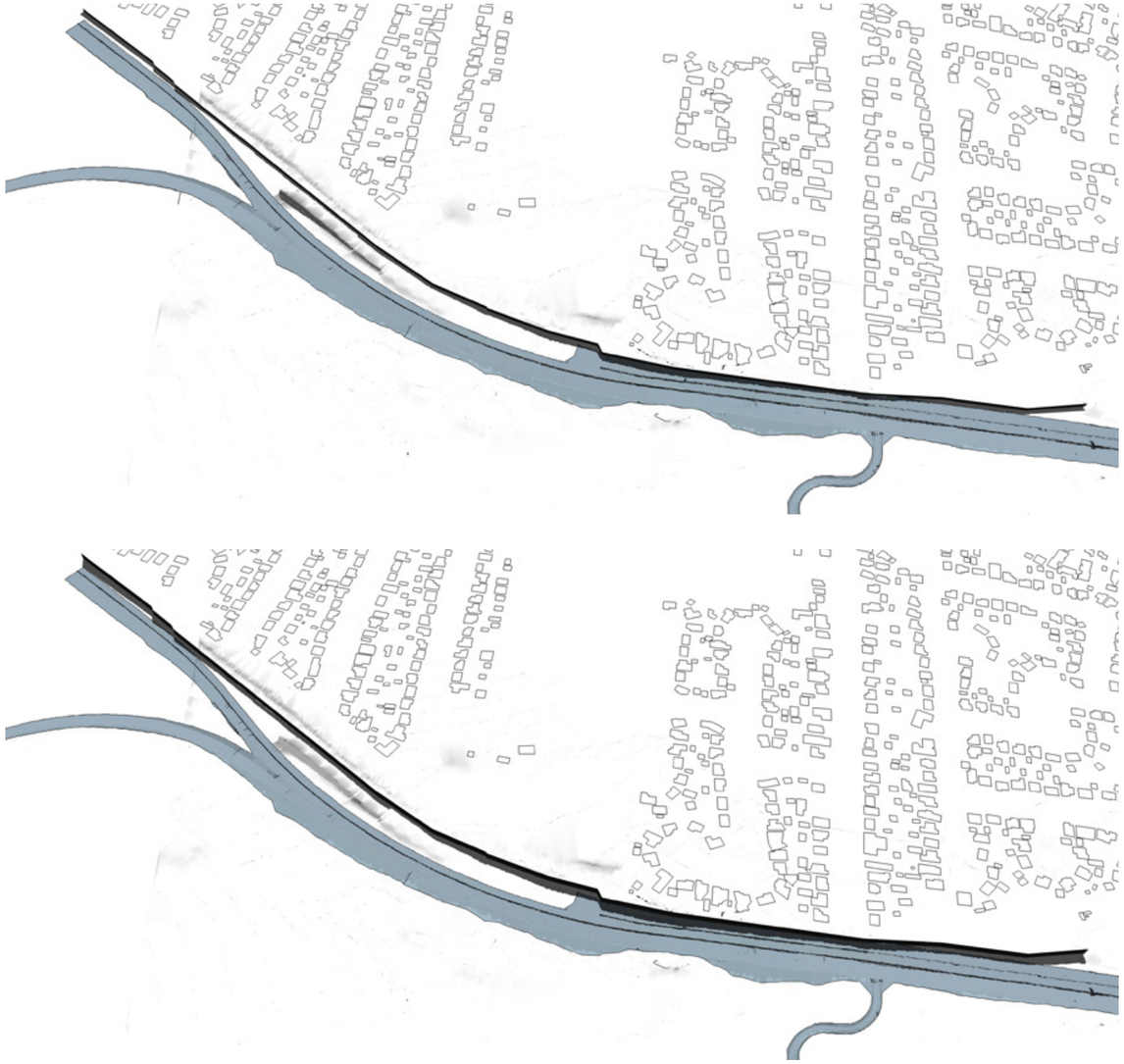


Figure A3–8 Shadow analysis for Beresfield on 20 September at 12pm

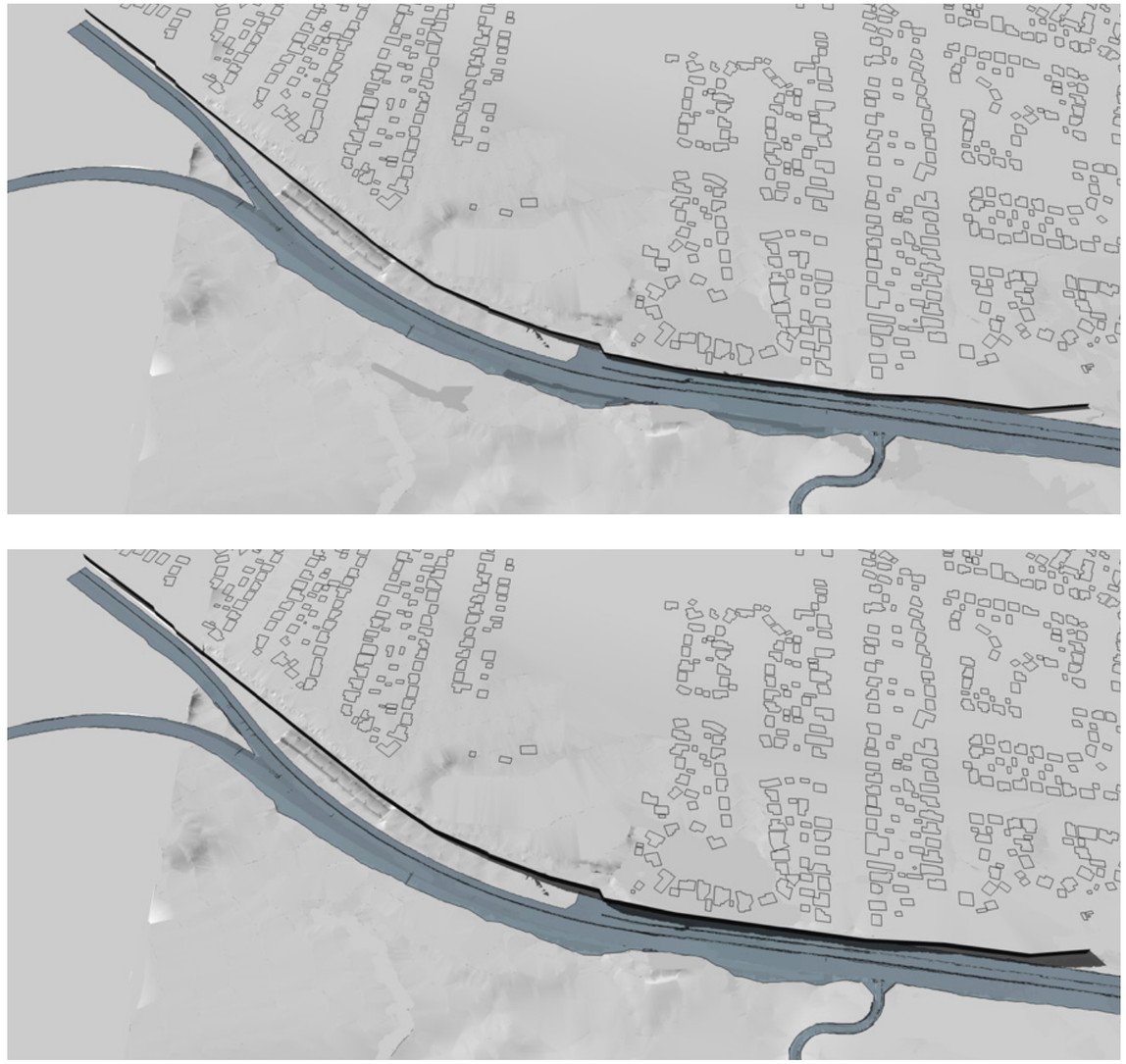


Figure A3–9 Shadow analysis for Beresfield on 20 September at 3pm

20 December

Lower noise barrier height

Taller noise barrier height

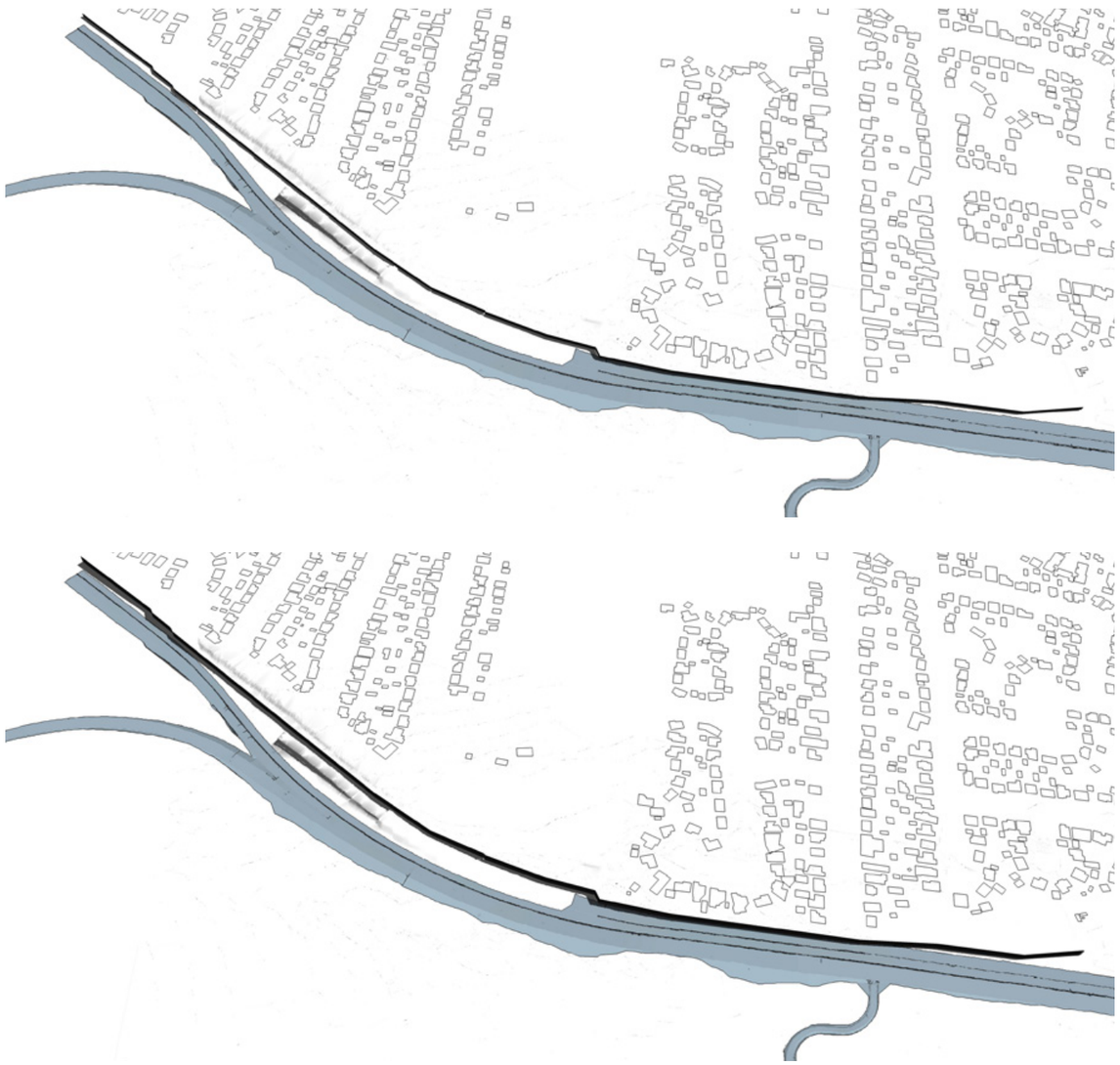


Figure A3–10 Shadow analysis for Beresfield on 20 December at 9am

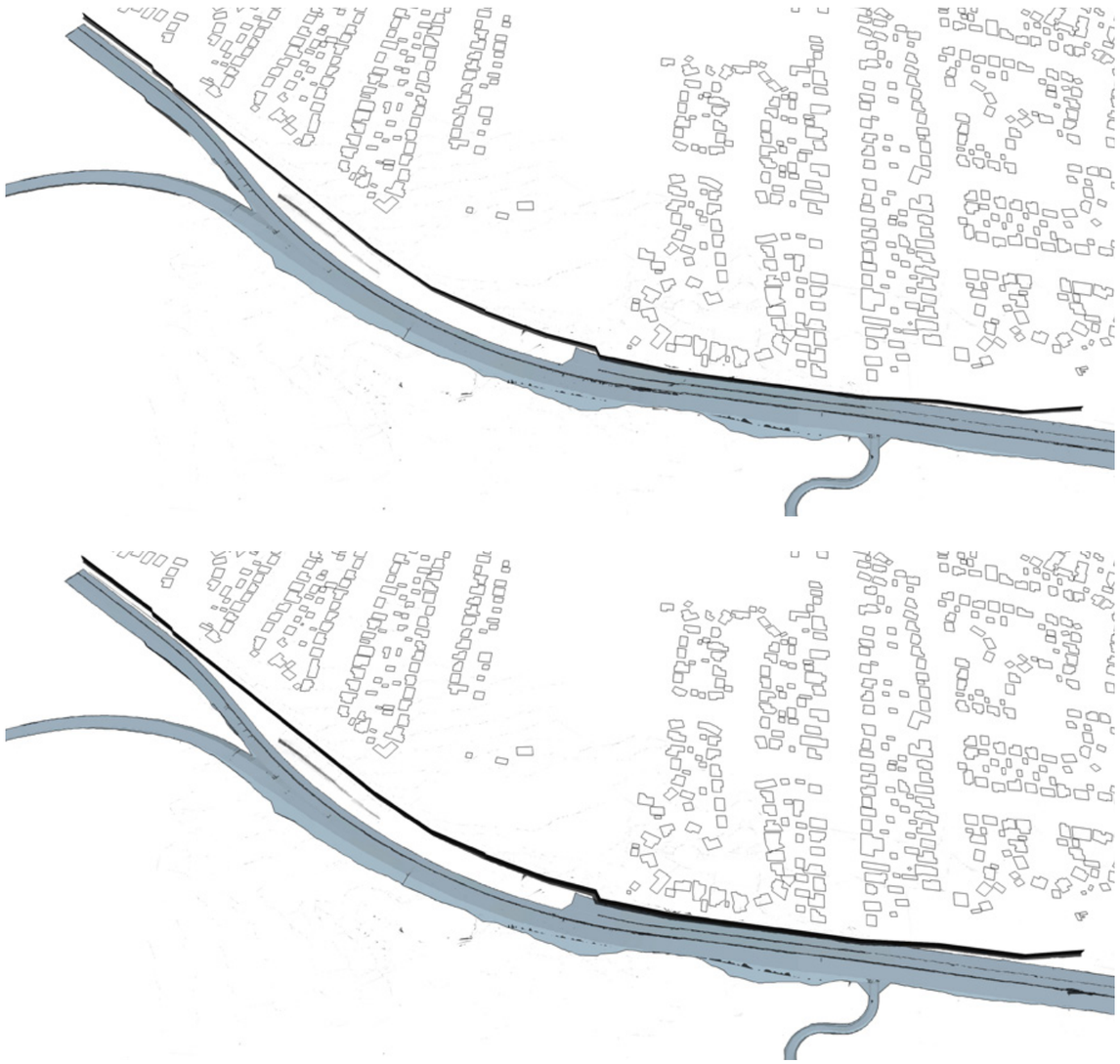


Figure A3–11 Shadow analysis for Beresfield on 20 December at 12pm

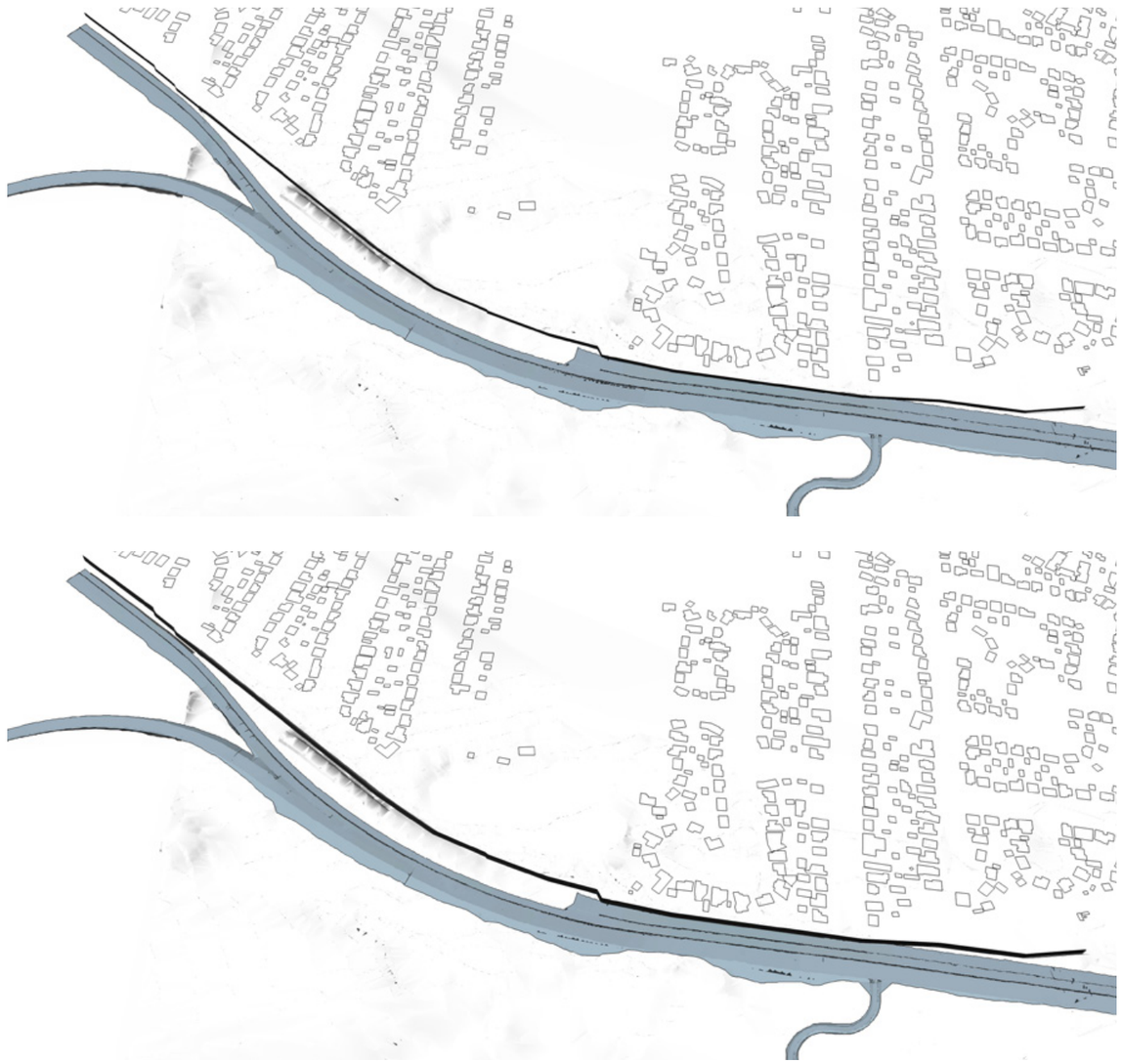
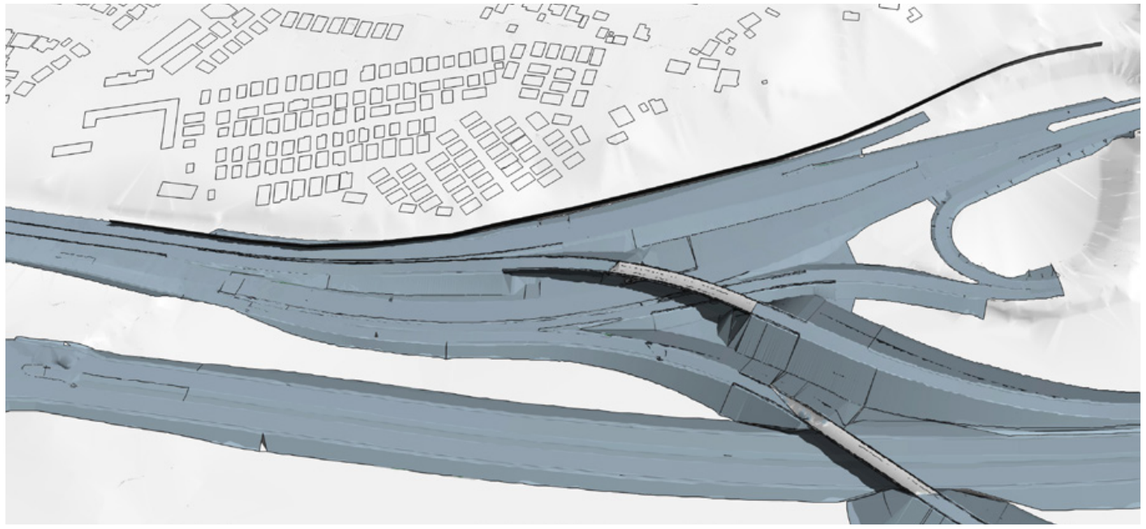


Figure A3–12 Shadow analysis for Beresfield on 20 December at 3pm

Shadow diagrams for Focus area 2: Tarro

20 March

Lower noise barrier height



Taller noise barrier height

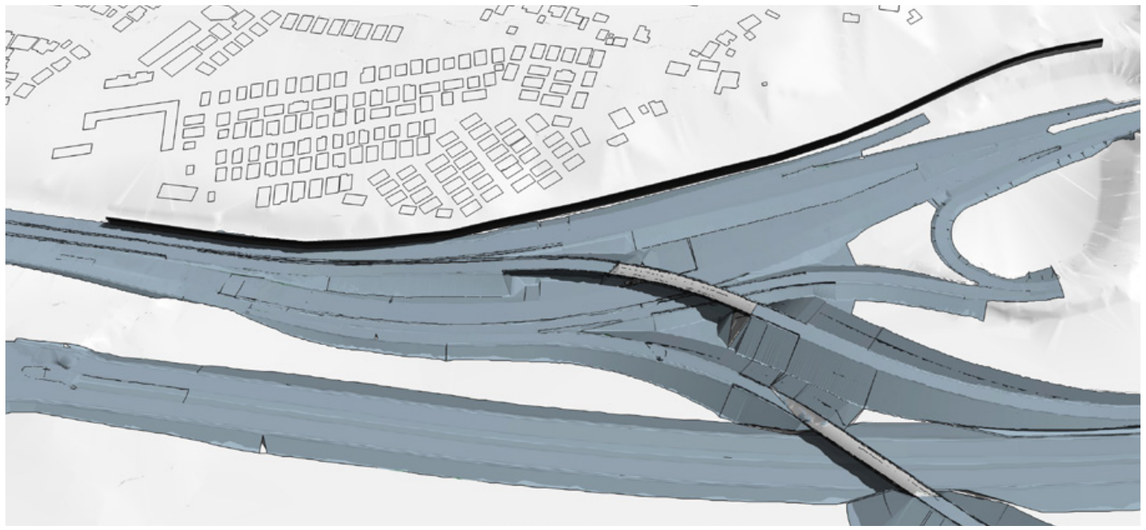


Figure A3–13 Shadow analysis for Tarro on 20 March at 9am

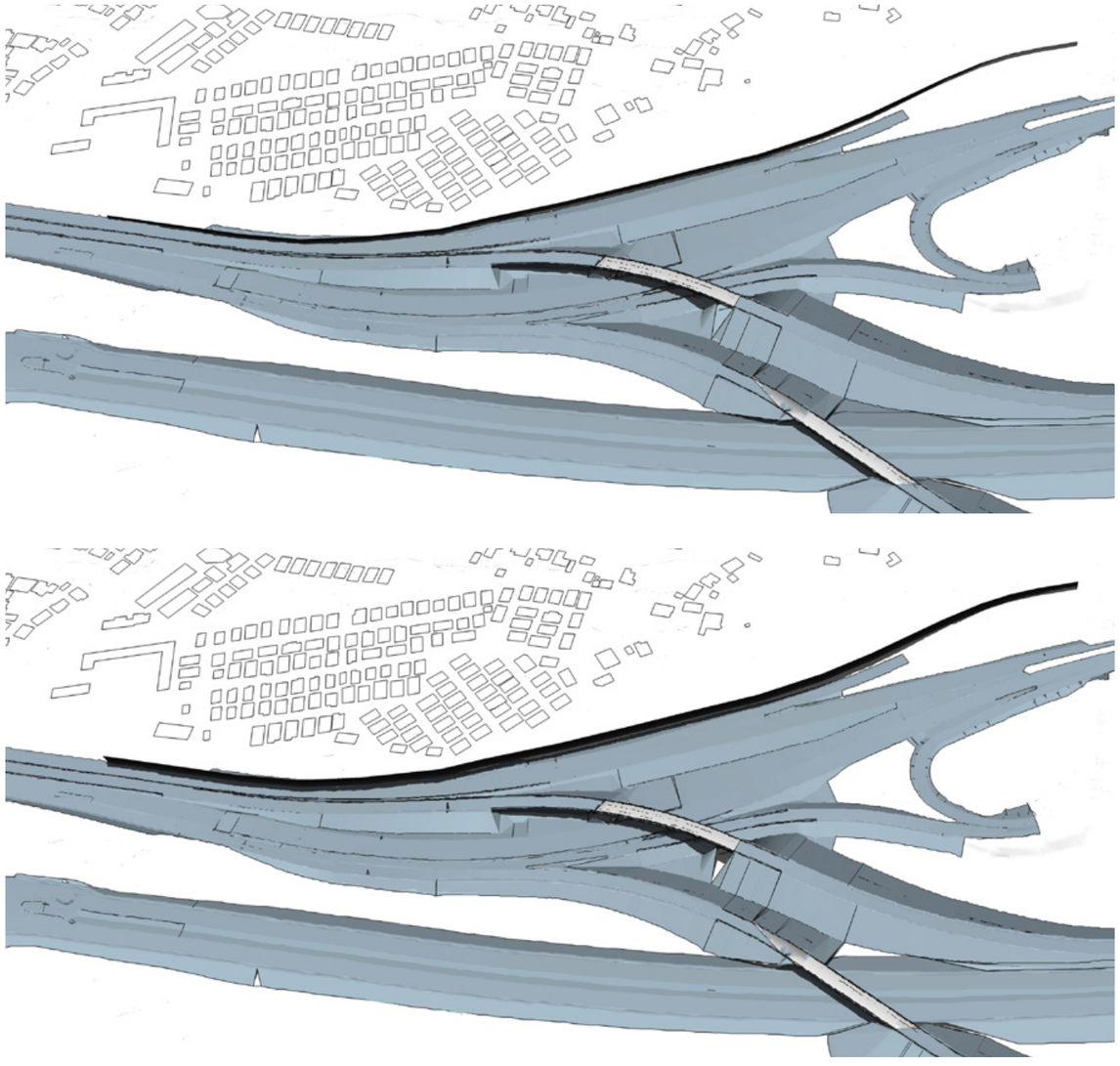


Figure A3–14 Shadow analysis for Tarro on 20 March at 12pm

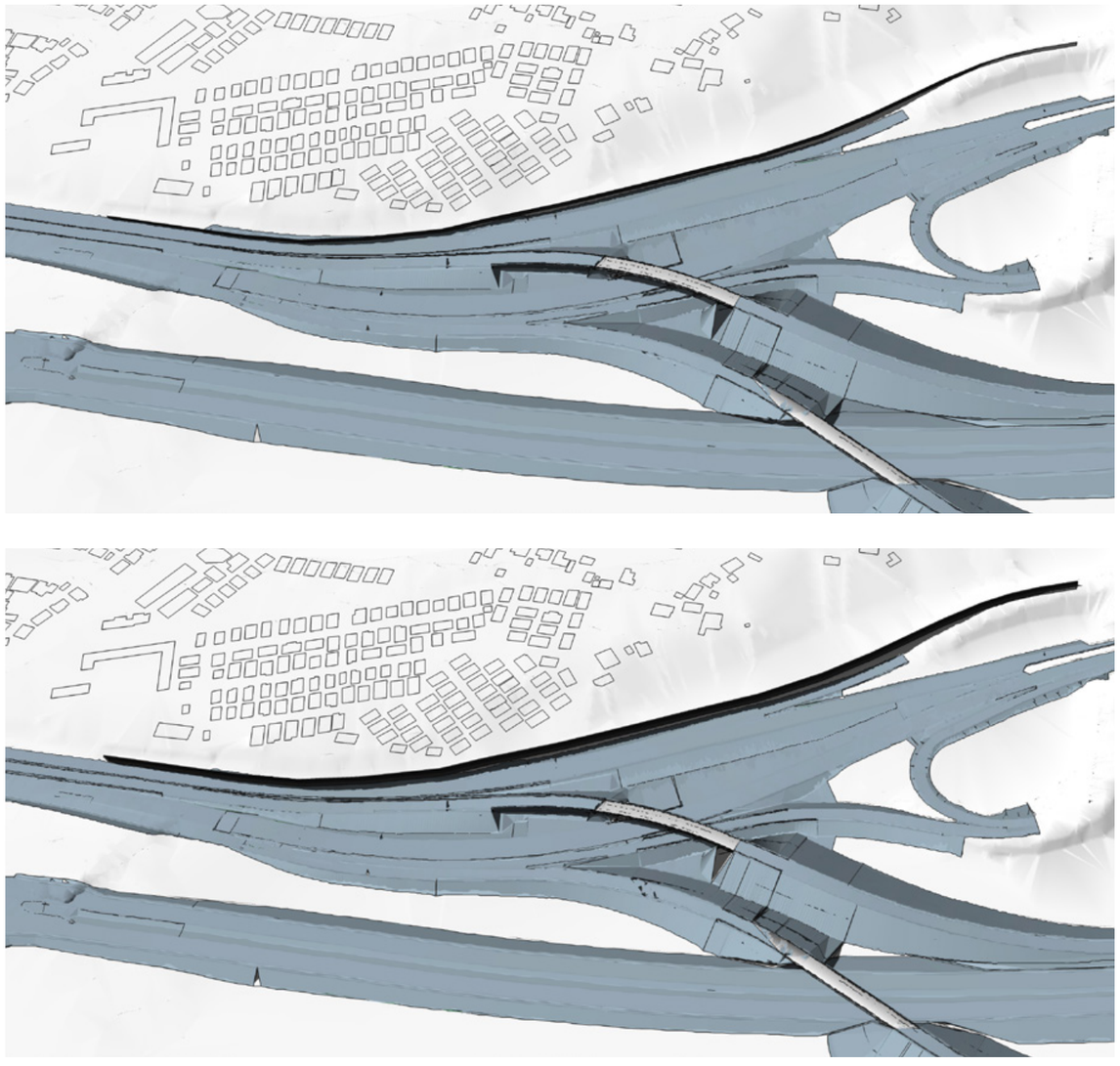
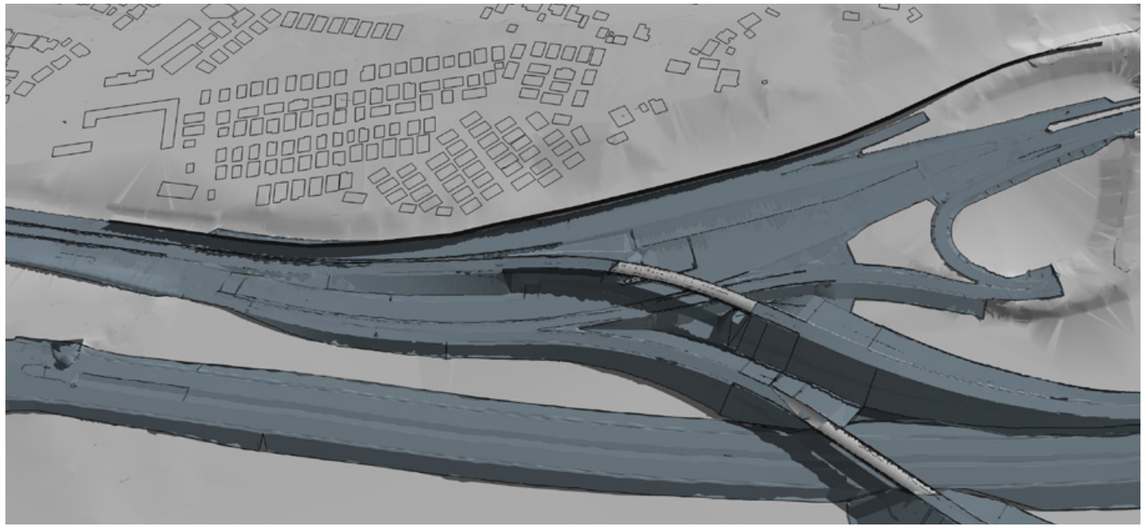


Figure A3–15 Shadow analysis for Tarro on 20 March at 3pm

20 June

Lower noise barrier height



Taller noise barrier height

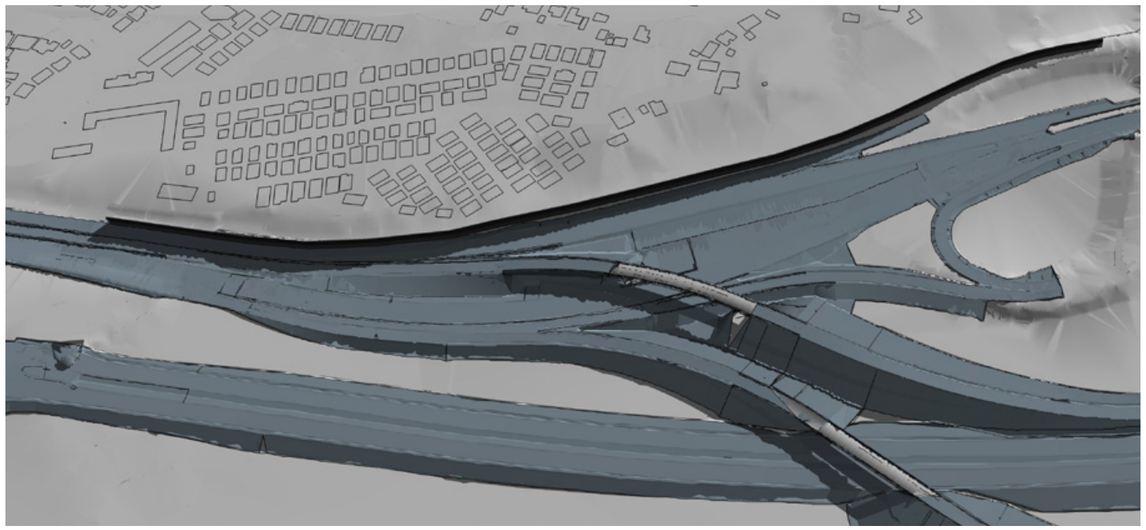


Figure A3–16 Shadow analysis for Tarro on 20 June at 9am

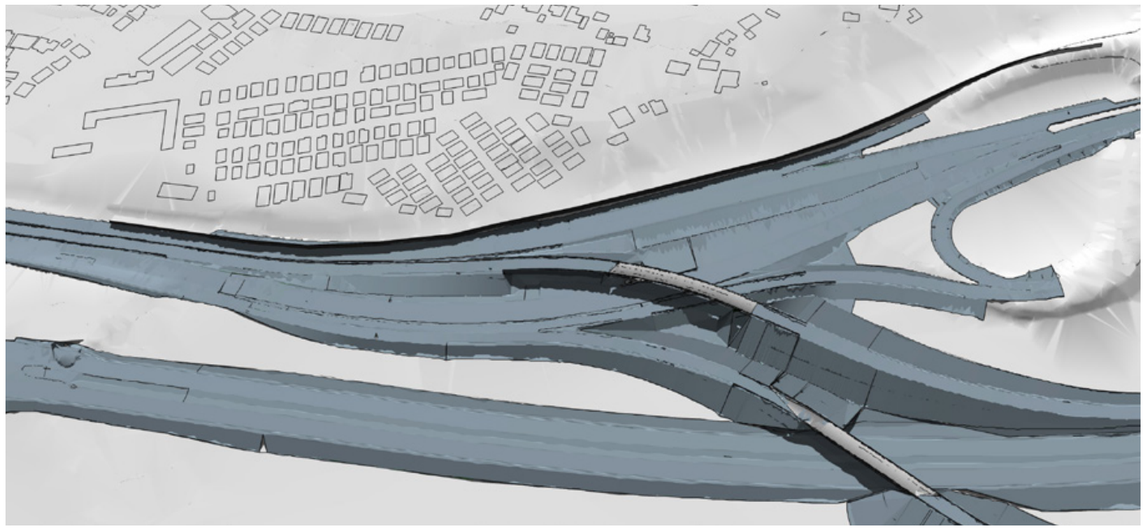


Figure A3–17 Shadow analysis for Tarro on 20 June at 12pm

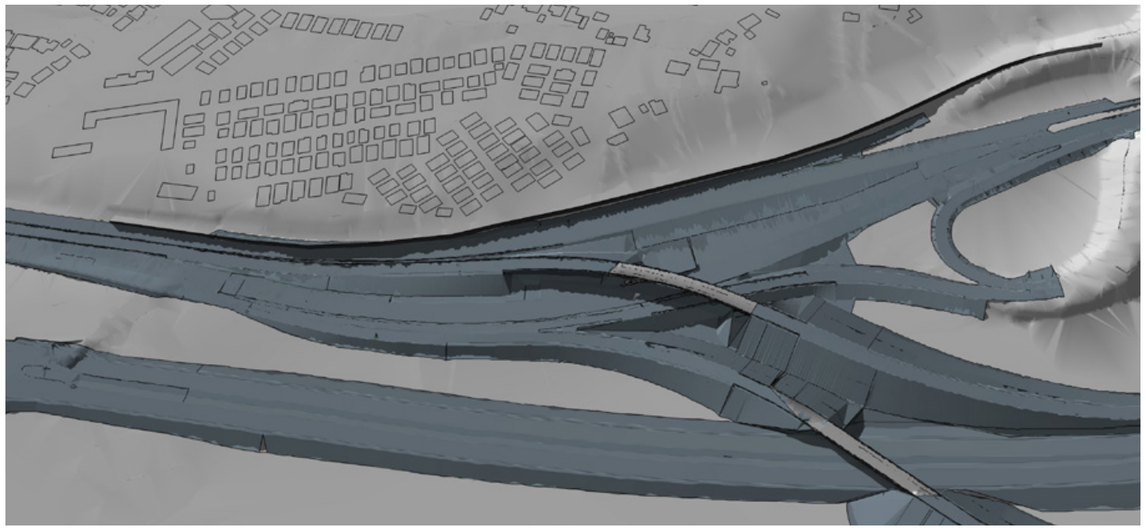
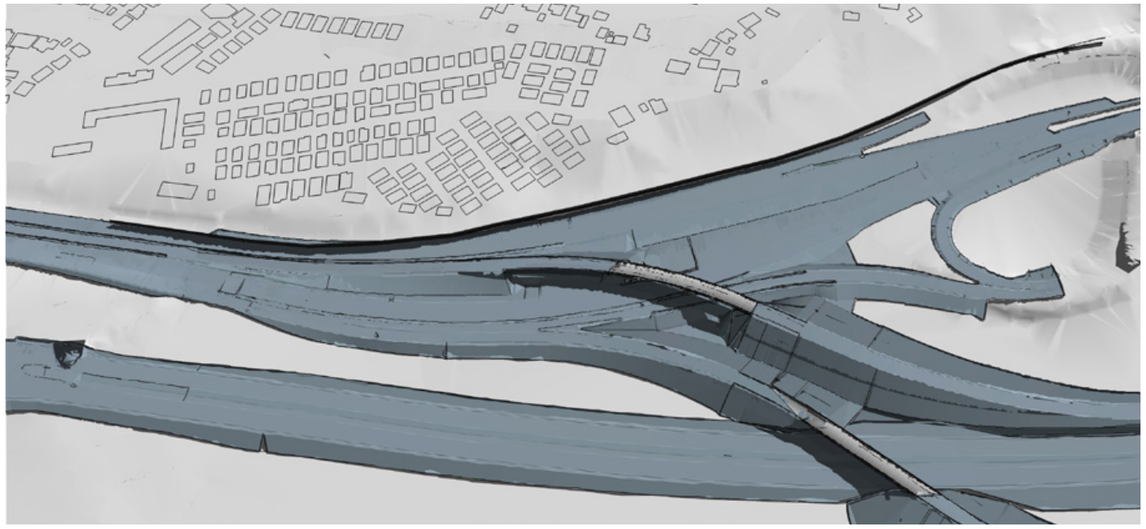


Figure A3–18 Shadow analysis for Tarro on 20 June at 3pm

20 September

Lower noise barrier height



Taller noise barrier height

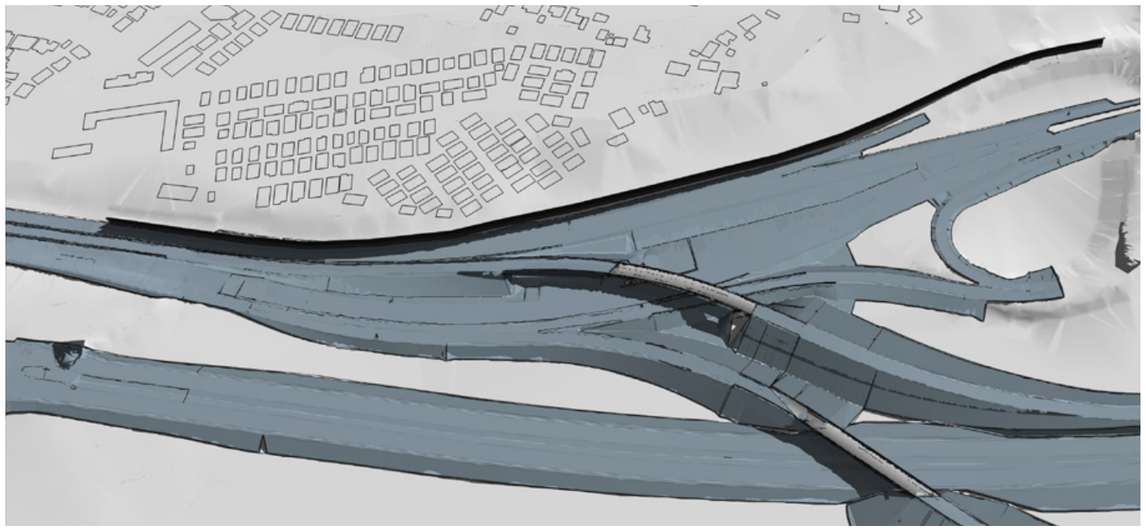


Figure A3–19 Shadow analysis for Tarro on 20 September at 9am

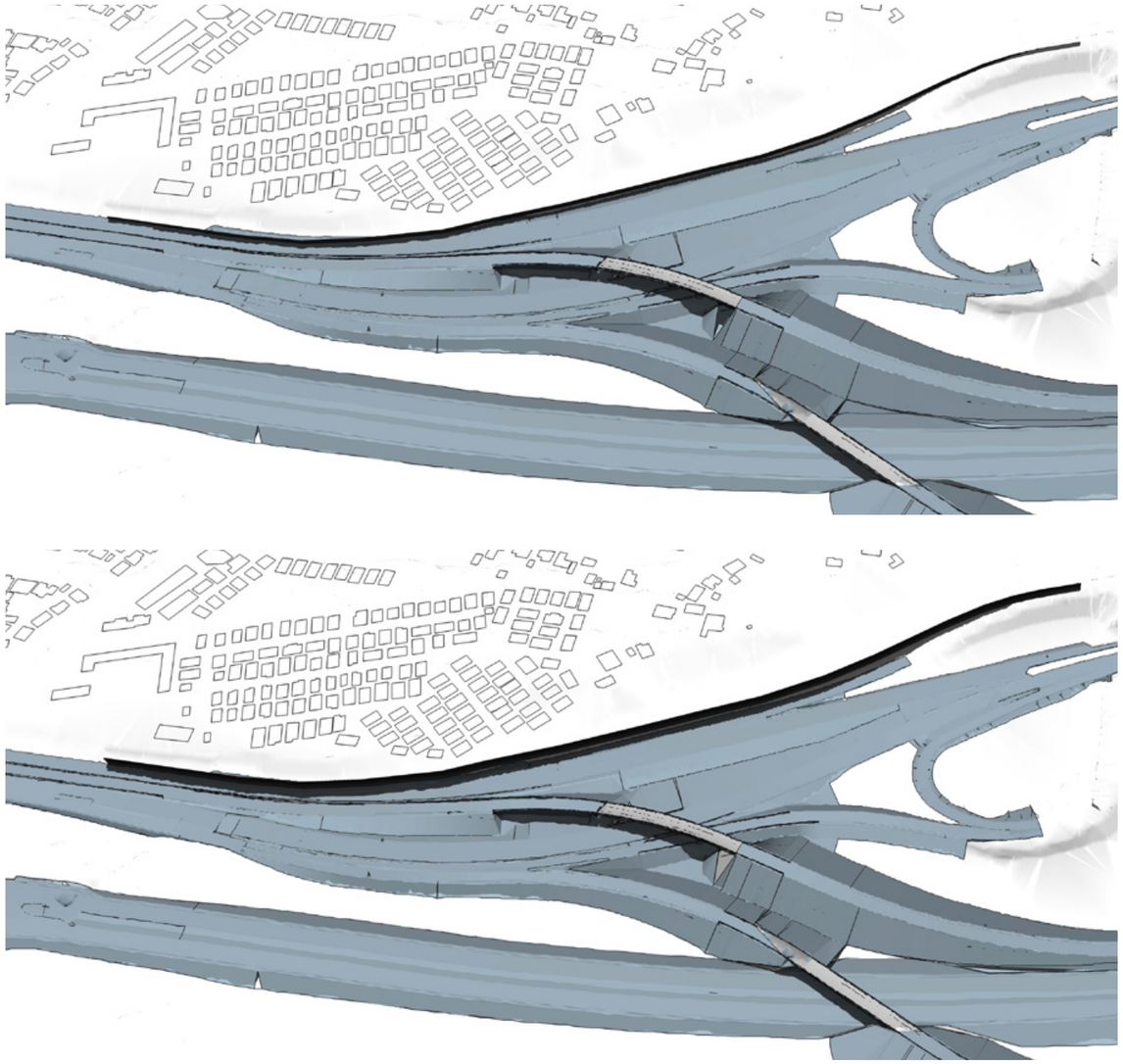


Figure A3–20 Shadow analysis for Tarro on 20 September at 12pm

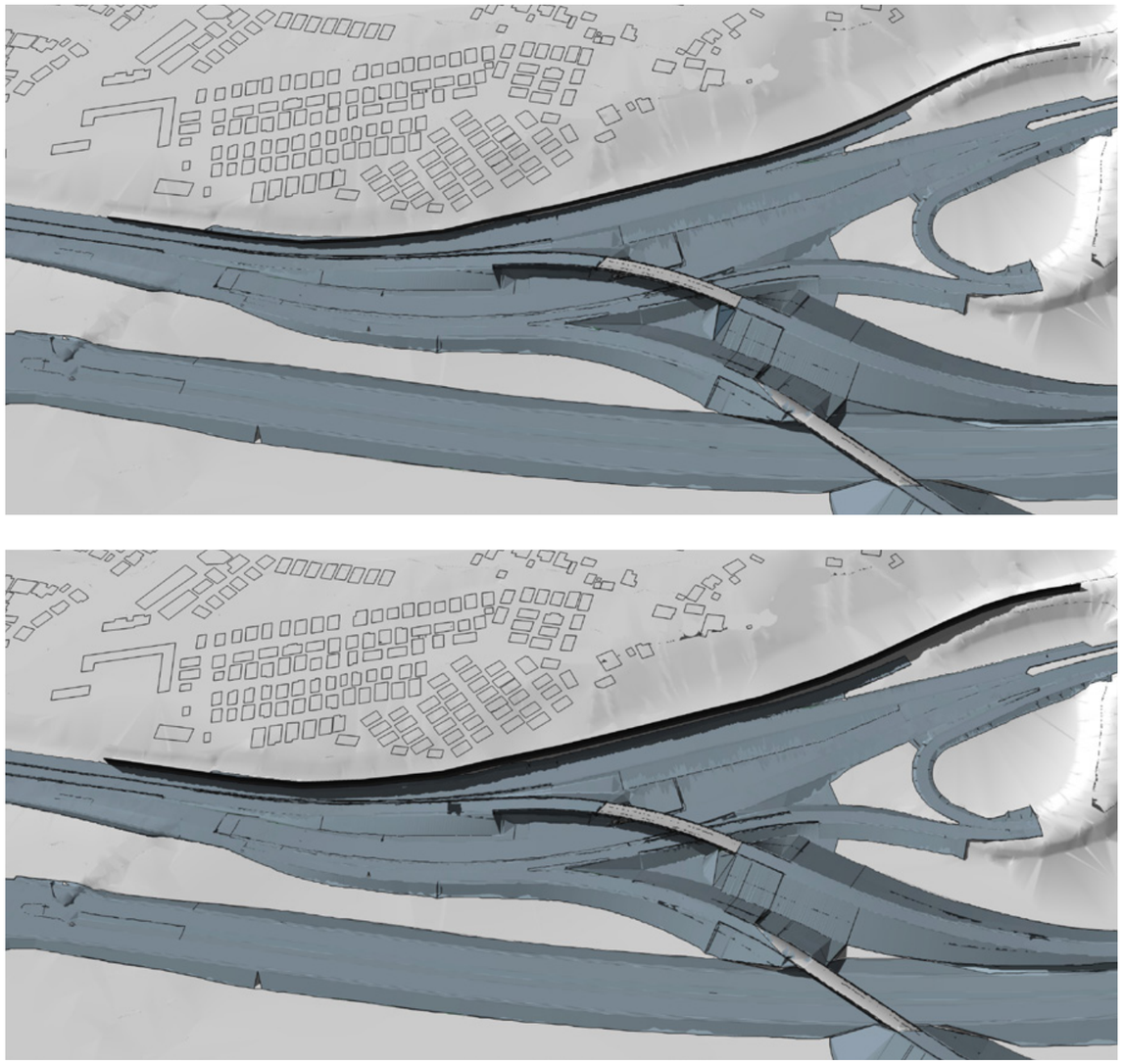
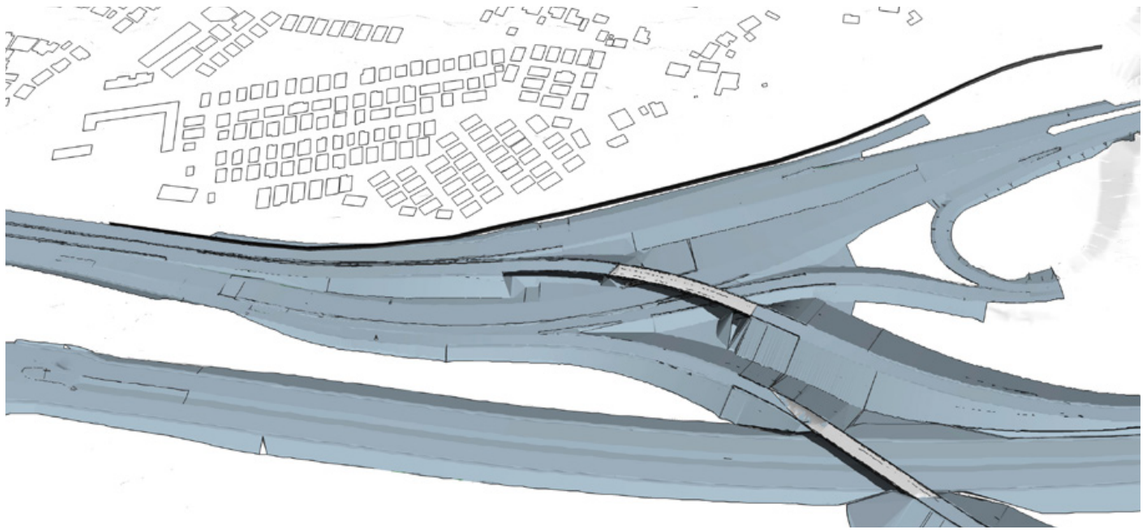


Figure A3–21 Shadow analysis for Tarro on 20 September at 3pm

20 December

Lower noise barrier height



Taller noise barrier height

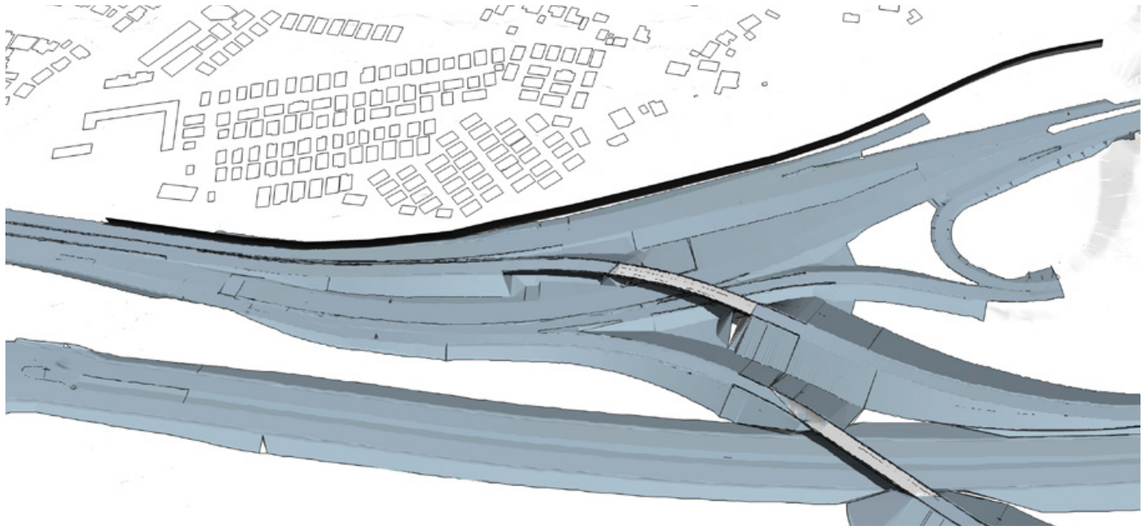


Figure A3–22 Shadow analysis for Tarro on 20 December at 9am

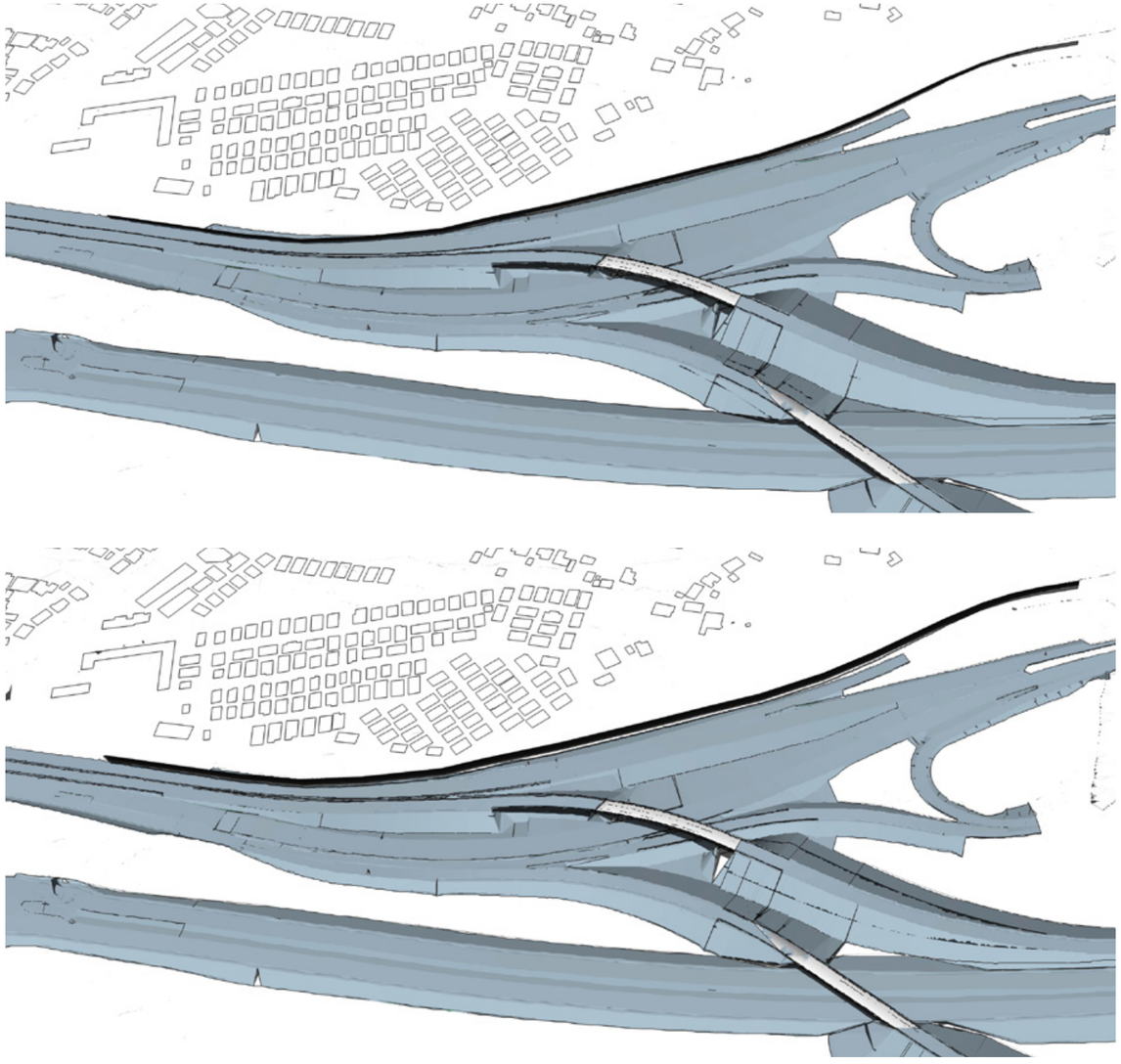


Figure A3–23 Shadow analysis for Tarro on 20 December at 12pm

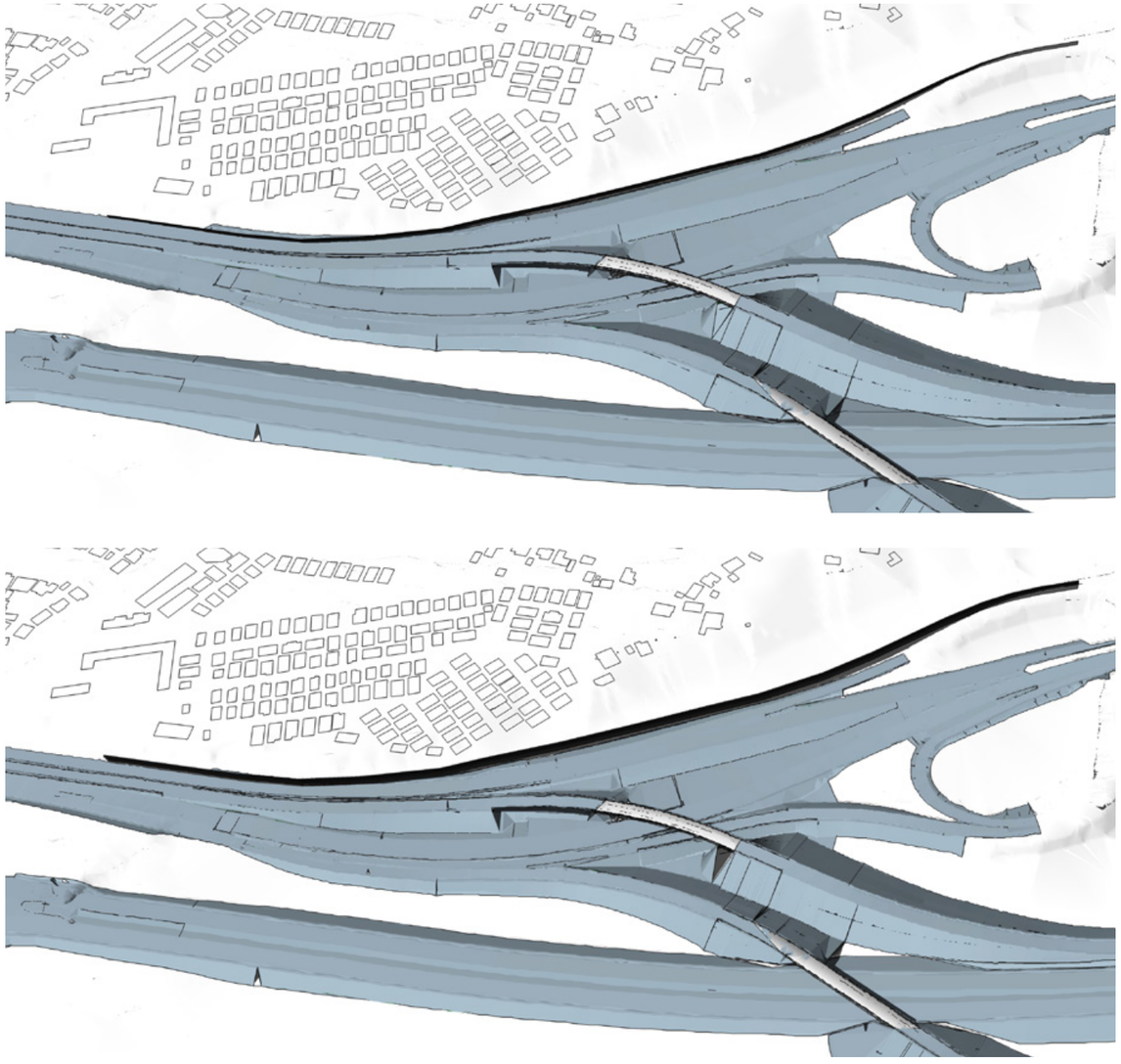


Figure A3–24 Shadow analysis for Tarro on 20 December at 3pm

Shadow diagrams for Focus area 3: Hunter Region Botanic Gardens

20 March

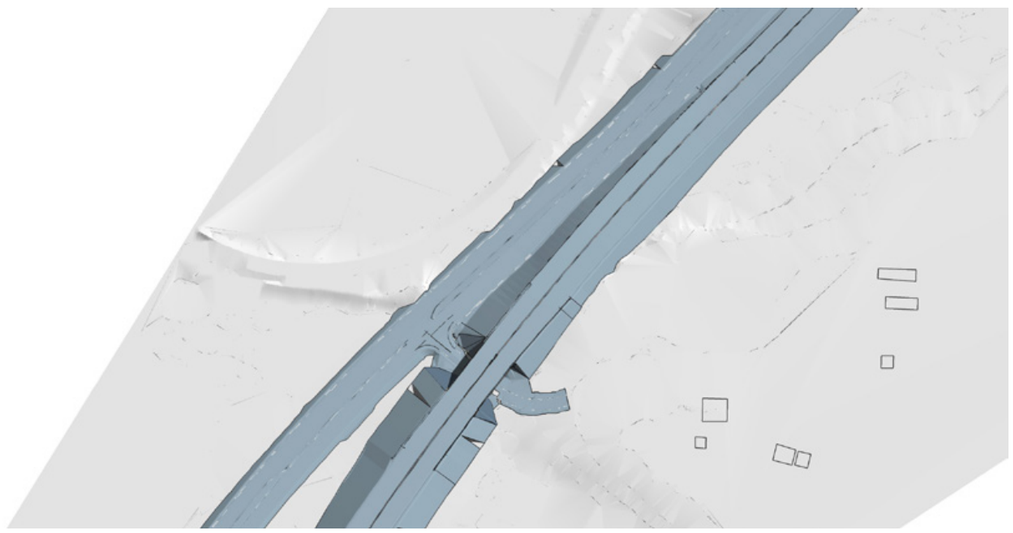


Figure A3–25 Shadow analysis for Hunter Region Botanic Gardens on 20 March at 9am

20 June

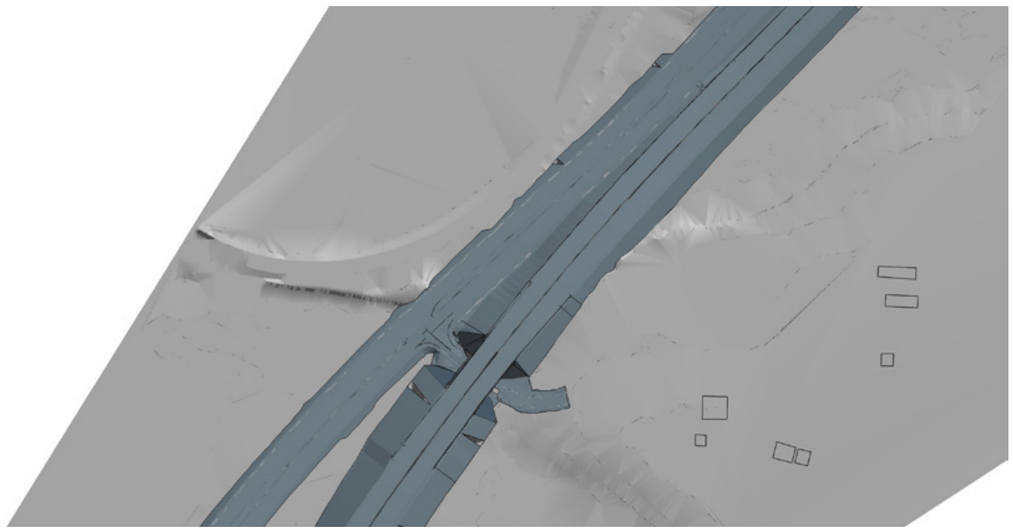


Figure A3–26 Shadow analysis for Hunter Region Botanic Gardens on 20 June at 9am

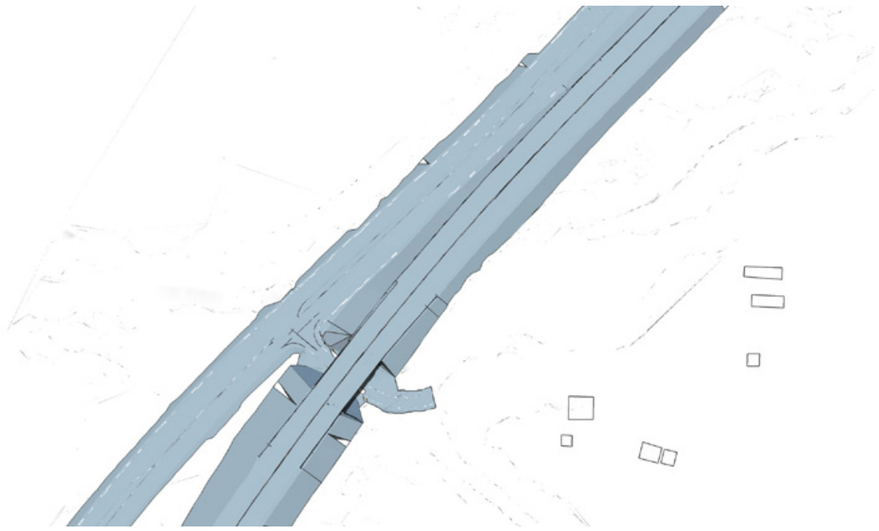


Figure A3–27 Shadow analysis for Hunter Region Botanic Gardens on 20 March at 12pm

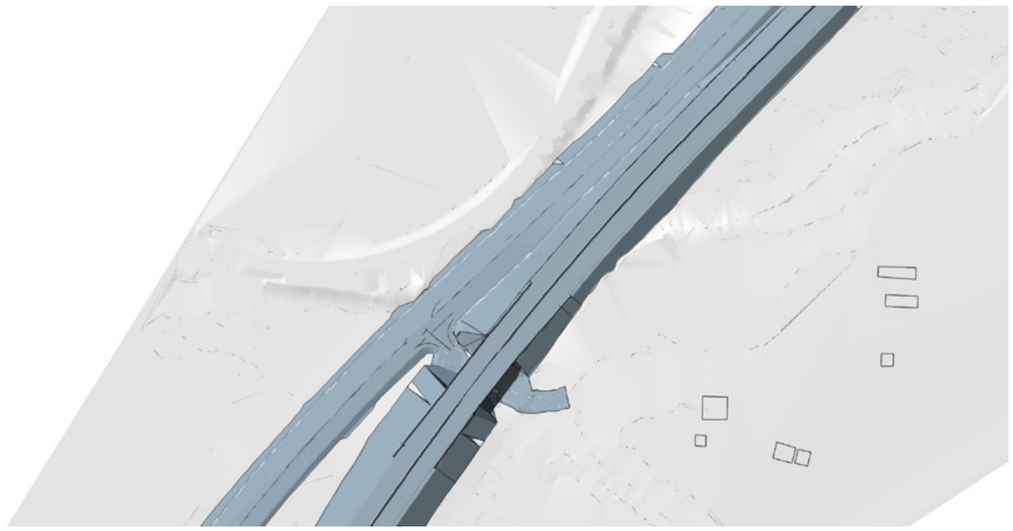


Figure A3–28 Shadow analysis for Hunter Region Botanic Gardens on 20 March at 3pm

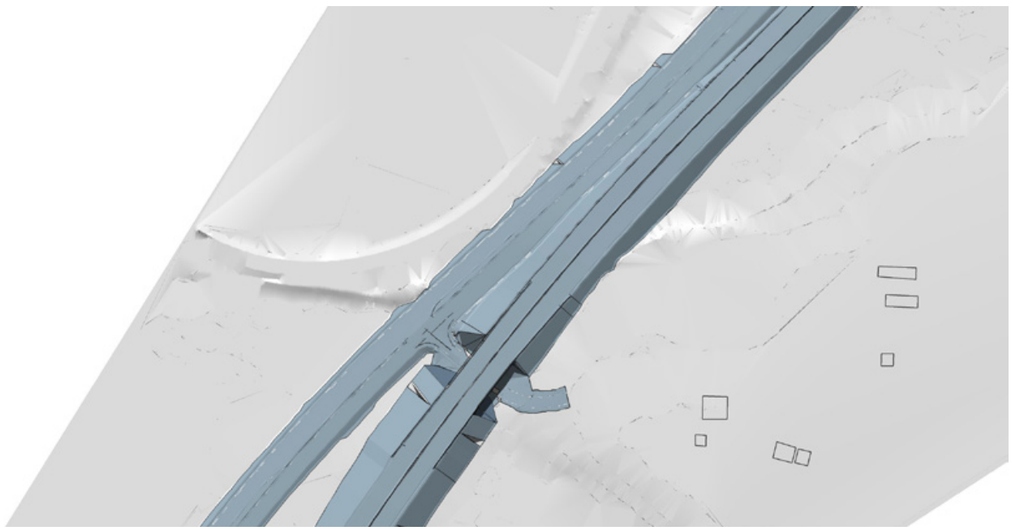


Figure A3–29 Shadow analysis for Hunter Region Botanic Gardens on 20 June at 12pm

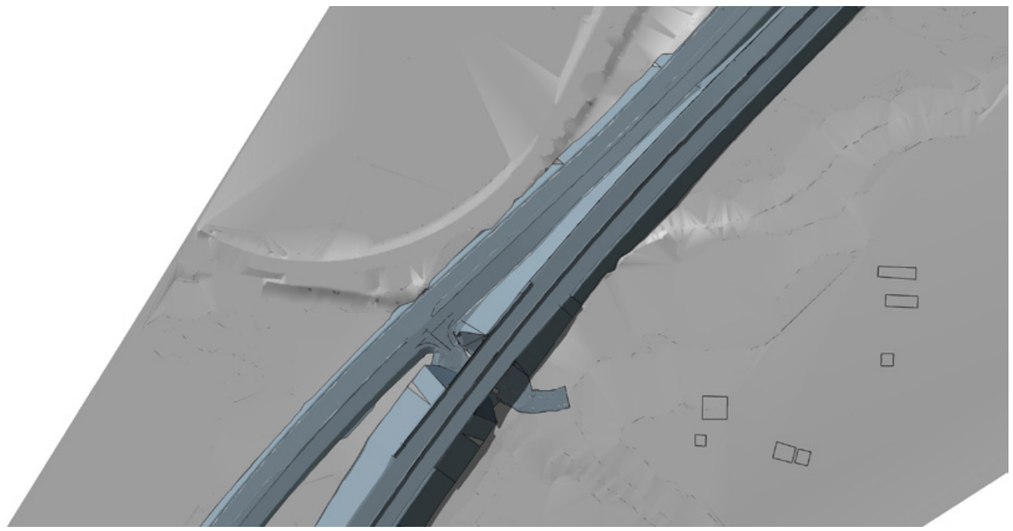


Figure A3–30 Shadow analysis for Hunter Region Botanic Gardens on 20 June at 3pm

20 September

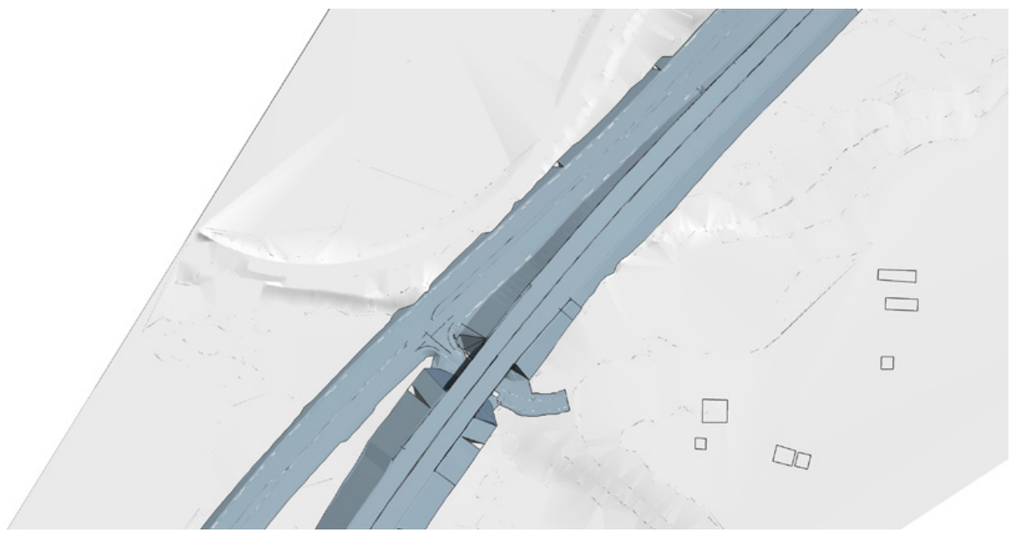


Figure A3–31 Shadow analysis for Hunter Region Botanic Gardens on 20 September at 9am

20 December

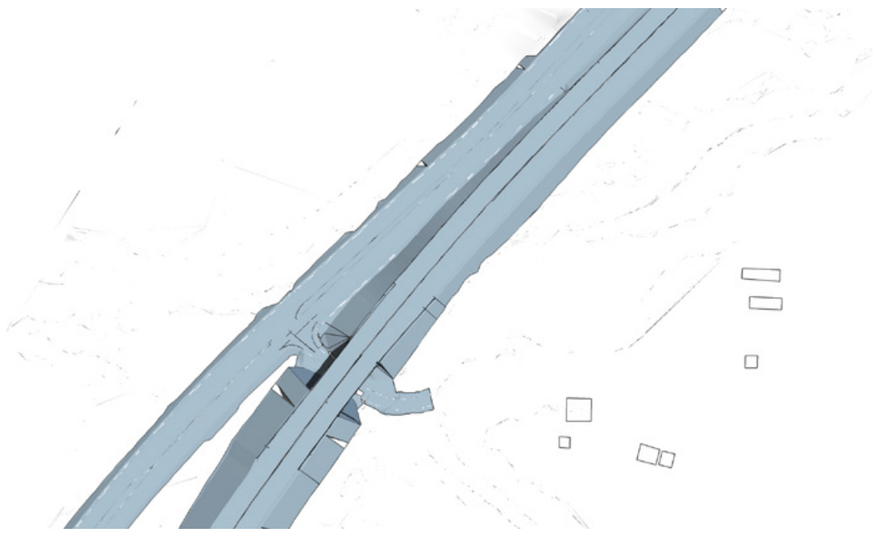


Figure A3–32 Shadow analysis for Hunter Region Botanic Gardens on 20 December at 9am

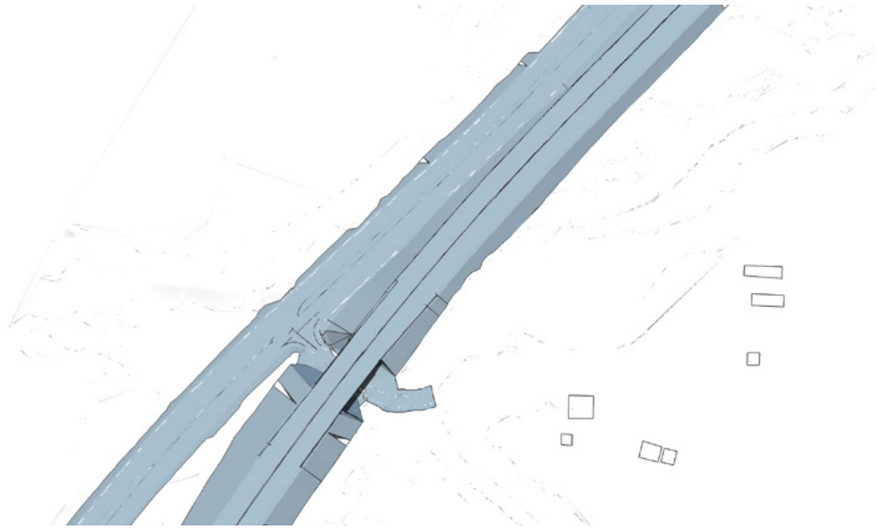


Figure A3–33 Shadow analysis for Hunter Region Botanic Gardens on 20 September at 12pm

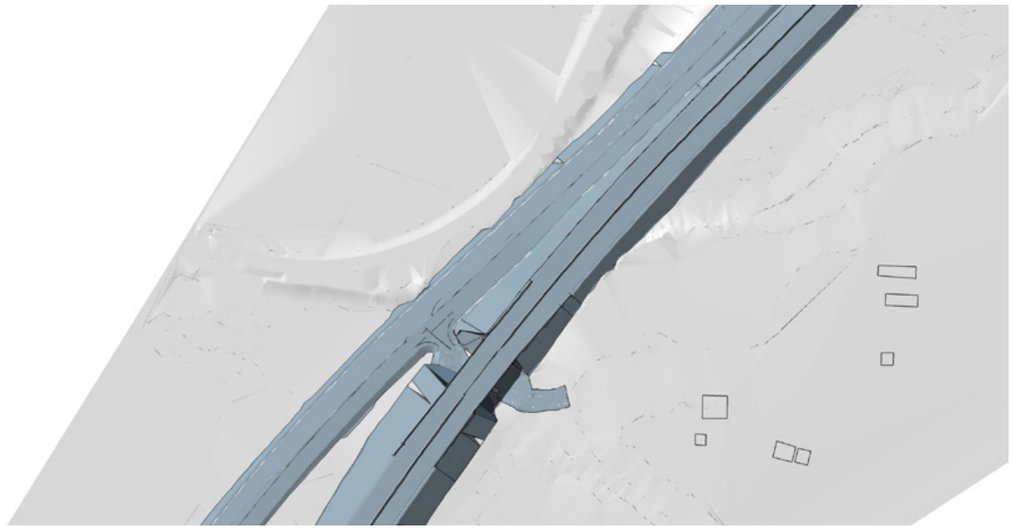


Figure A3–34 Shadow analysis for Hunter Region Botanic Gardens on 20 September at 3pm

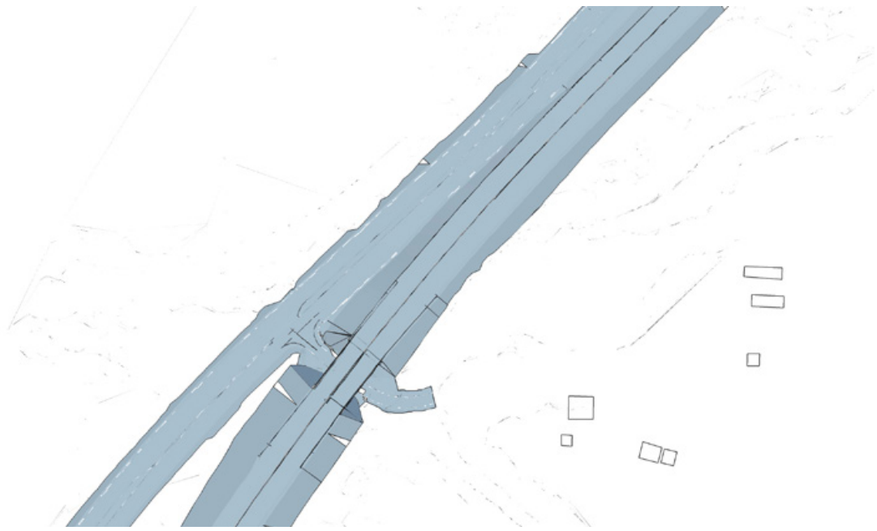


Figure A3–35 Shadow analysis for Hunter Region Botanic Gardens on 20 December at 12pm

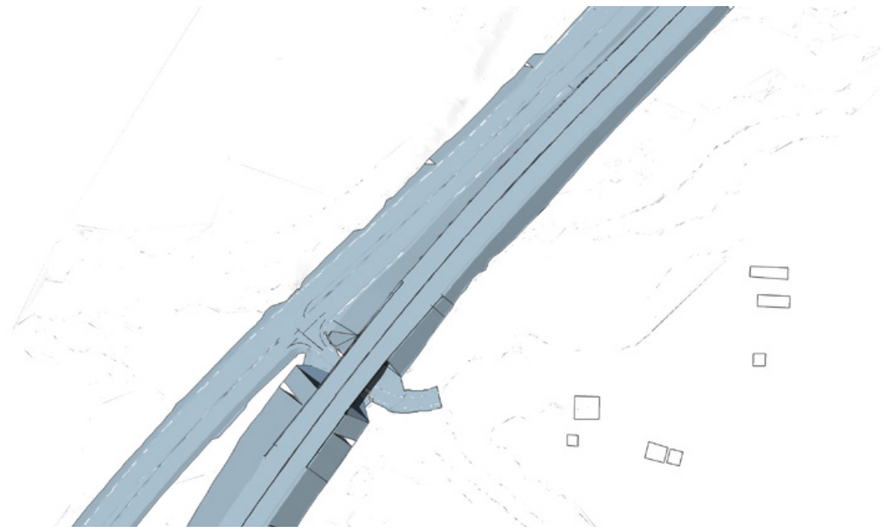
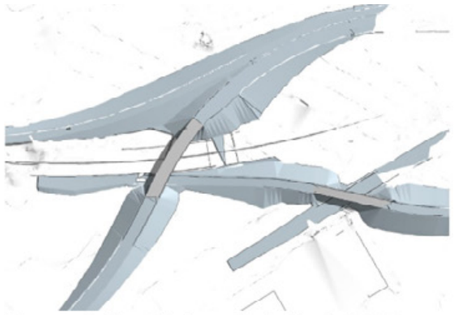


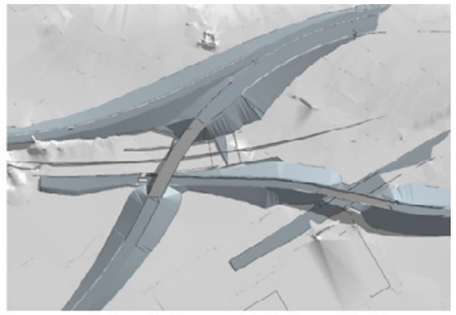
Figure A3–36 Shadow analysis for Hunter Region Botanic Gardens on 20 December at 3pm

Additional shadow diagrams

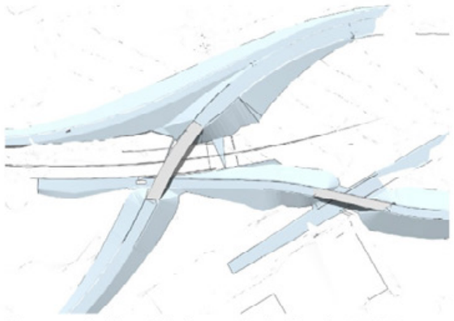
Tomago industrial area



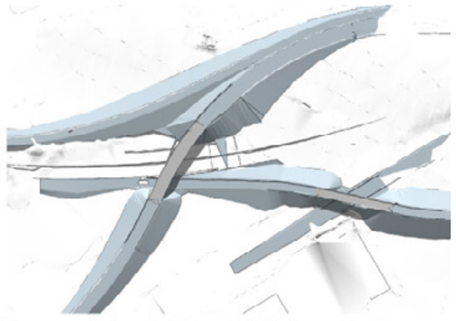
Tomago Industrial Area: 20th March 09:00



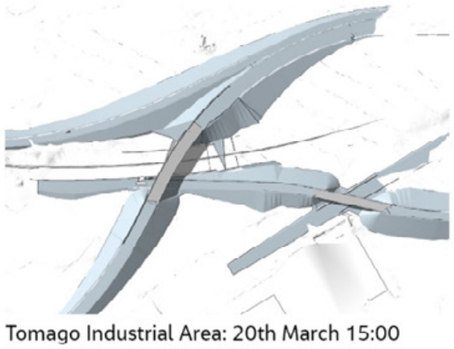
Tomago Industrial Area: 20th June 09:00



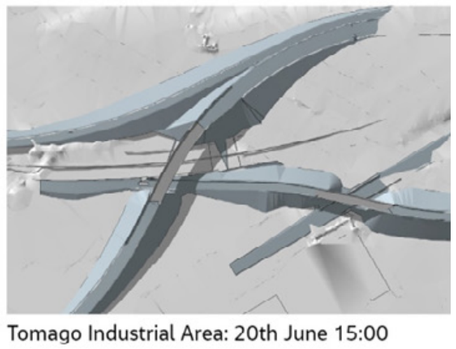
Tomago Industrial Area: 20th March 12:00



Tomago Industrial Area: 20th June 12:00

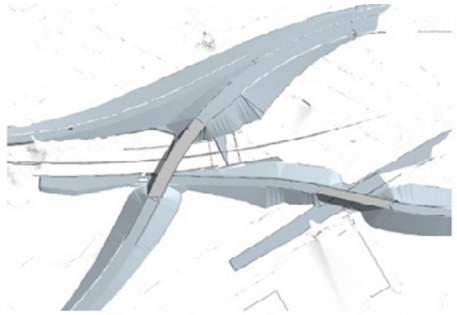


Tomago Industrial Area: 20th March 15:00

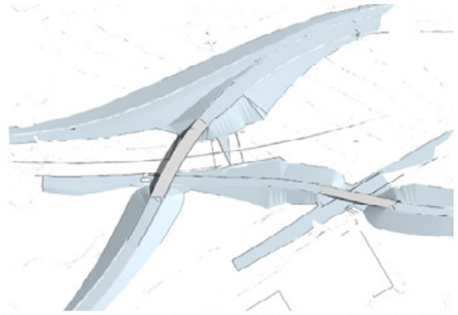


Tomago Industrial Area: 20th June 15:00

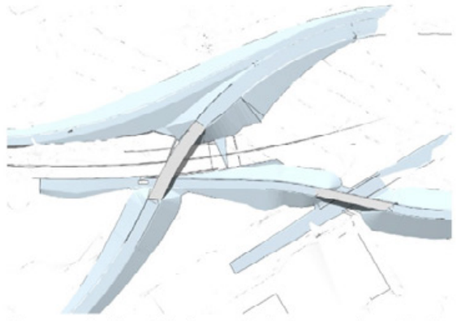
Figure A3–37 Shadow analysis for Tomago industrial area for March and June



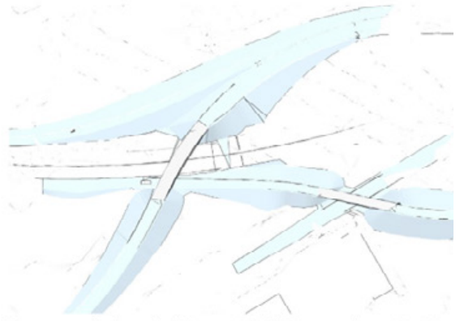
Tomago Industrial Area: 20th September 09:00



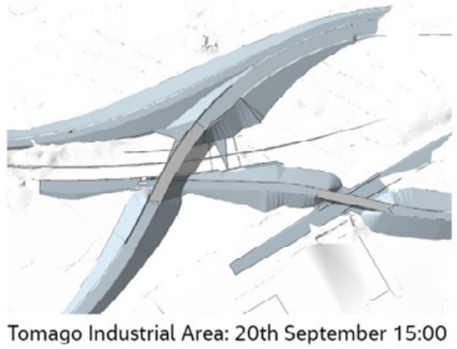
Tomago Industrial Area: 20th December 09:00



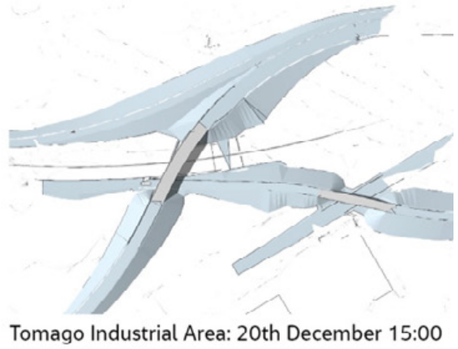
Tomago Industrial Area: 20th September 12:00



Tomago Industrial Area: 20th December 12:00



Tomago Industrial Area: 20th September 15:00



Tomago Industrial Area: 20th December 15:00

Figure A3–38 Shadow analysis for Tomago industrial area for September and December

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