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# **The Northern Road Upgrade Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park**

NSW Environmental Impact Statement /  
Commonwealth Draft Environmental Impact Statement

## **Appendix O – Technical working paper: Urban design, landscape character and visual impact assessment**

June 2017





# **Urban Design and Visual Impact Assessment Technical Paper**

**The Northern Road Upgrade,  
Mersey Road to Glenmore Parkway**

Version 10 - 08 March 2017

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# The Northern Road Upgrade between Mersey Road and Glenmore Parkway

## Urban Design and Visual Impact Assessment Technical Paper

Version 10 - 08 March 2017

Prepared for



Prepared By

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# I. INTRODUCTION

## 1.1 PURPOSE

This Urban Design Technical Paper has been prepared by Spackman Mossop Michaels (SMM) for Roads and Maritime Services (Roads and Maritime). It contains the urban design concept and the Landscape Character and Visual Impact Assessment (LCVIA) for the proposed upgrade of The Northern Road (the project) between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park, in the Liverpool and Penrith Local Government Areas (LGAs).

This paper supports and forms part of the Environmental Impact Statement (EIS) prepared by Jacobs for the project. It addresses the environmental assessment requirements set out by

- Roads and Maritime *Environmental Impact Assessment Practice Note. Guideline for Landscape Character and Visual Impact Assessment. EIA-N04* (EIA-N04)
- The Secretary's Environmental Assessment Requirements (SEARs) issued under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act)
- The Commonwealth EIS Guidelines, as per the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

SMM has worked on this project in conjunction with the Roads and Maritime project development team, the Roads and Maritime Centre for Urban Design, Roads and Maritime specialist advisors and planners, and engineers and technical staff from Jacobs.

In addition to supporting the environmental assessment process, this technical paper seeks to facilitate an integrated urban design and engineering outcome for the project, consistent with Roads and Maritime policy. Integration of the LCVIA in the development of the engineering design highlights potential issues as well as opportunities to minimise or avoid potential impacts during concept development. Should the project be approved, the LCVIA provides guidance for the development and refinement of the concept design to ensure good urban design outcomes.

# INTRODUCTION

## 1.2 STRUCTURE OF THIS TECHNICAL PAPER

Consistent with *EIA-N04*, the structure of this technical paper is as follows:

1. **Introduction**  
Introduction and overview.
2. **Contextual analysis**  
An overview of the study area and surrounding context, including a brief overview of relevant planning documents and existing site conditions including physical and urban design aspects of the area.
3. **Description of the project**  
The description summarises the main features of the project, including the underlying design parameters. Key features of the proposed upgrade are illustrated on an overview plan and typical sections.
4. **Urban design objectives**  
The agreed urban design vision, objectives and principles adopted for the project.
5. **Urban design concept**  
The urban design concept defines the urban design concept for the project. It includes an illustrated urban design strategy, detailed recommendations for road design elements, and landscape design principles. The concept design is illustrated in a series of plans and cross sections. The urban design concept provides the basis for the development of detailed designs, should the project be approved.
6. **Landscape character impact**  
The landscape character impact assessment determines the likely impact on the landscape character as a result of the project, giving regard to both the magnitude of the project and the sensitivity of the landscape to change.
7. **Visual impact**  
The visual impact assessment identifies the area from which the project is likely to be seen, followed by an assessment of the likely impact of the project on a number of select views. The visual impact results from the combination of the magnitude of the project and the sensitivity of the chosen view.
8. **Mitigation strategy**  
The mitigation strategy identifies a series of measures to avoid or reduce the identified visual and landscape character impacts, as well as recommendations towards better realisation of the project urban design objectives. They are provided for consideration and to guide the future design stages. The Mitigation strategy also discusses residual impacts. These are lasting impacts that will not be able to be removed through the application or implementation of mitigation measures.
9. **Conclusion**  
Summary of key findings.

# INTRODUCTION

## 1.3 THE STUDY AREA

The study area comprises an approximately 1.6 kilometre section of The Northern Road between Mersey Road in Bringelly and Glenmore Parkway in Glenmore Park. It includes the diversion of The Northern Road around the site of the Western Sydney Airport and a bypass around the Luddenham town centre - refer **Figure 3**.

## 1.4 BACKGROUND

The Northern Road is located in the west of the Sydney Metropolitan Region, about 45 kilometres from the Sydney CBD. It extends for some 35 kilometres from Camden Valley Way in Narellan to Richmond Road in Penrith. It is a state road and has been identified as a principal arterial road in several infrastructure planning documents including the South Western Sydney Urban Design Strategy (Cox 2015), the South West Growth Centre Road Network Strategy (SMM 2011), and the Growth Centres Road Framework (RTA 2011).

The Northern Road provides an important link road orbiting the extents of the Sydney Metropolitan area. It caters for traffic from existing and planned residential and commercial developments in Sydney's south-west and north-west. Historically, it formed part of a link road from Singleton in the Hunter Valley to Wollongong in the Illawarra, via Windsor, Campbelltown and Appin (refer **Figure 2**).

The upgrade of The Northern Road has been identified in the Western Sydney Infrastructure Plan (WSIP), a 10 year, \$3.6 billion road investment program funded by the Australian and NSW governments, aimed at integrating transport in the region to capitalise on the economic benefits from the Western Sydney Airport at Badgerys Creek - also refer **section 2.2.3**.

To support future growth in the region, Roads and Maritime proposes to widen The Northern Road to provide additional travelling lanes plus a bus lane in each direction. The proposed upgrade involves a new road alignment between Mersey Road and Elizabeth Drive, including a number of new intersections with the existing road network and the Western Sydney Airport. It will divert The Northern Road around the site of the Western Sydney Airport and provide a bypass around the Luddenham town centre.

The upgrade would also provide new street lighting, traffic lights and turning lanes at some intersections, a central depressed drainage median, upgraded drainage infrastructure including flood mitigation, a shared path for pedestrians and cyclists on the western side of the road and a new footpath on the eastern side of the road where appropriate. A more detailed description of the proposed upgrade is provided in **section 3**, together with overview plans. More detailed illustrated plans are provided in **section 5**.

## INTRODUCTION

### 1.5 ASSESSMENT GUIDELINES

The following table outlines the SEARs, the requirements of the Commonwealth EIS guideline and the respective sections of this technical paper that have addressed the requirements. This ensures a clear link between the requirements and how they have been addressed in the design and LCVIA for the proposed upgrade.

#### ***Secretary's Environmental Assessment Requirements (EP&A Act)***

Requirement	Relevant section in this technical paper
Urban Design and Visual Amenity - including:	Section 4: Urban design objectives and Section 5: Urban design
<ul style="list-style-type: none"> <li>A consideration of the urban design and visual amenity implications of the proposal, including supporting infrastructure, during construction and operation</li> </ul>	Section 6: Landscape character impact
<ul style="list-style-type: none"> <li>A consideration of impacts on views and vistas (including impacts on extant views to the eastern escarpment of the Blue Mountains), streetscapes, existing significant vegetation, key sites and buildings</li> </ul>	Section 6: Landscape Character Impact and Section 7: Visual impact
<ul style="list-style-type: none"> <li>Measures to ameliorate visual impacts during construction and operation</li> </ul>	Section 8: Mitigation strategy
<ul style="list-style-type: none"> <li>Measures to manage lighting impacts during construction and operation.</li> </ul>	Section 4: Urban design objectives and Section 6: Landscape character impact

#### ***Commonwealth EIS Guidelines (EPBC Act)***

Requirement	Relevant section in this technical paper
<p>The EIS must include a description of the environment of the proposal site and the surrounding areas that may be affected by the action. It is recommended that this include the following information:</p> <p>A description of the environment in all areas of potential impact, including all components of the environment as defined in Section 528 of the EPBC Act:</p> <ul style="list-style-type: none"> <li>The qualities and characteristics of locations, places and areas.</li> </ul>	Section 2: Contextual analysis and Section 6: Landscape character impact
<p>Impacts to the environment (as defined in section 528) should include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>Lighting impacts on everyday activities and on sensitive environmental receptors (all sensitive receptors within the community and natural environment).</li> </ul>	Section 4: Urban design objectives Section 6: Landscape character impact
<p>An assessment of residual impacts after the proposed avoidance and mitigation measures have been taken into account, including the reasons why avoidance or mitigation of impacts may not be reasonably achieved.</p>	Section 8: Mitigation strategy

# INTRODUCTION

## 1.6 STUDY METHOD

The development of the concept design and the LCVIA is an iterative process aimed at refining the concepts to reduce and mitigate the potential impacts wherever possible.

The method used follows *EIA-N04* and involved the following:

- Develop an understanding of the study area through site visits and field investigations, review of relevant literature and analysis of aerial photographs, spatial data and topographic maps
- Review of the engineering concept design and supporting material
- Review of the SEARs and Commonwealth EIS guidelines
- Contextual analysis of the study area and surroundings including identification of Landscape Character Zones (LCZs)
- Assessment of the likely impact of the proposed upgrade on the identified LCZs
- Identification of the likely visual catchment of the proposed upgrade
- Selection of viewpoints within the visual catchment, representing a range of different land uses and viewers
- Assessment of the likely impact of the proposed upgrade on the selected viewpoints by comparing the sensitivity of the views and the magnitude of the project
- Identification of urban and landscape design opportunities to maximise integration of the proposed upgrade with the natural and built context of surrounding areas, including means to mitigate adverse visual and landscape character impacts for consideration during future design phases.

The following describes the method used to assess the proposed upgrade in more detail.

### 1.6.1 Landscape character impact assessment

A number of LCZs are identified through the contextual analysis. They are generally based on the study area's surrounding land use, vegetation cover and topography to identify areas of distinct characteristics. The purpose of dividing the study area into character zones is to make the assessment process easier to undertake and understand.

Within each LCZ the impact of the proposed upgrade is based on the sensitivity of the zone, and the magnitude of the proposed upgrade in that zone:

- **Sensitivity** refers to how sensitive the existing character of the setting is to the proposed change, or its inherent capacity to absorb change. For example, a pristine natural environment will be more sensitive to change than an industrial area
- **Magnitude** refers to the physical size and scale of the project. For example, a large intersection will 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 provides the rating of the **landscape character impact** (refer to **Figure 1**).

### 1.6.2 Visual impact assessment

The extent of area from where the proposed works would be able to be seen is referred to as the visual catchment or visual envelope. It is largely defined by the landform of the study area. Direction of travel or of the view is another factor influencing visibility of the project. Factors such as built structures or vegetation need to be considered where they limit or obscure views. However, vegetation, whilst often blocking potential views, is not considered as a permanent obstruction as it can be removed or destroyed.

As distance is an important factor in how the works are perceived, very large visual catchments are typically defined by zones of proximity from the proposed works, for example zones of 100 metres, 300 metres and beyond.

Within the LCZs, a number of viewpoints and groups of viewpoints are identified at varying locations and view directions. The visual impact of the proposed upgrade has been assessed by considering both the sensitivity of the view and the magnitude of the proposed works within that view:

- **Sensitivity** refers to the quality of the view and how it will be affected by the proposed works. It is measured by assessing the chosen view's composition, its inherent capacity to absorb change and the type and number of viewers such as road users and local residents
- **Magnitude** refers to the physical character, size and scale of the proposed works and their proximity relative to the viewer. For example, a development situated one kilometre from the viewpoint will have a much reduced visual impact relative to one 100 metres away
- The combination of sensitivity and magnitude provides the rating of the **visual impact** (refer to Figure 1).

		MAGNITUDE			
		High	Moderate	Low	Negligible
SENSITIVITY	High	High impact	High to Moderate	Moderate	Negligible
	Moderate	High to Moderate	Moderate impact	Moderate to Low	Negligible
	Low	Moderate	Moderate to Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Figure 1: Visual and landscape character impact assessment grading matrix (source: EIA-N04)

### **1.6.3 Qualitative assessment**

For the purposes of this technical paper, the study identifies the existing landscape character and the capacity of the study area to absorb the changes associated with the proposed upgrade of The Northern Road. In the process, the likely magnitude and sensitivity of viewers have been described in a qualitative manner:

This has been based on the authors' extensive experience as landscape architects and urban designers specialising in the field of landscape character and visual assessment including assessment of a larger number of projects of a similar nature.

### **1.6.4 Mitigation measures**

Mitigation measures are a series of strategies, principles or treatments recommended to ameliorate the identified landscape character and visual impacts of the proposed upgrade. They include ways to lessen the magnitude or visual effect of the proposed works, and to maximise integration with the setting and surroundings. They may also include treatments near critical view areas to reduce the visual impact.

## 2. CONTEXTUAL ANALYSIS

### 2.1 LOCATION

The study area for this technical paper is the approximately 1.6 kilometre section of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park (refer to **Figures 2 and 3**).

#### 2.1.1 Metropolitan context

The Northern Road is an important arterial link between Camden and Windsor. It is an historic route that dates back to the early settlement of the Hawkesbury and Macarthur areas. It runs north-south through the South West Priority Growth Area (SWPGA). Together with the North West Priority Growth Area (NWPGA) the SWPGA is earmarked to accommodate the majority of Sydney's residential growth over the next 25 years.

Major urban growth will also occur between the two priority growth areas. The Western Sydney Airport will be a major catalyst for growth. Located between Elizabeth Drive and Badgerys Creek, the airport will be the anchor in a major corridor of existing and new employment lands stretching from Bringelly to Minchinbury. The Western Sydney Priority Growth Area (WSPGA) will consist of new employment lands that wrap around the Western Sydney Airport and stretch north and east to join up with employment lands in the Western Sydney Employment Area (WSEA). The Northern Road in the southern part of the study area closely follows the western boundary of the WSPGA - refer **Figure 2** and **Figure 3**.

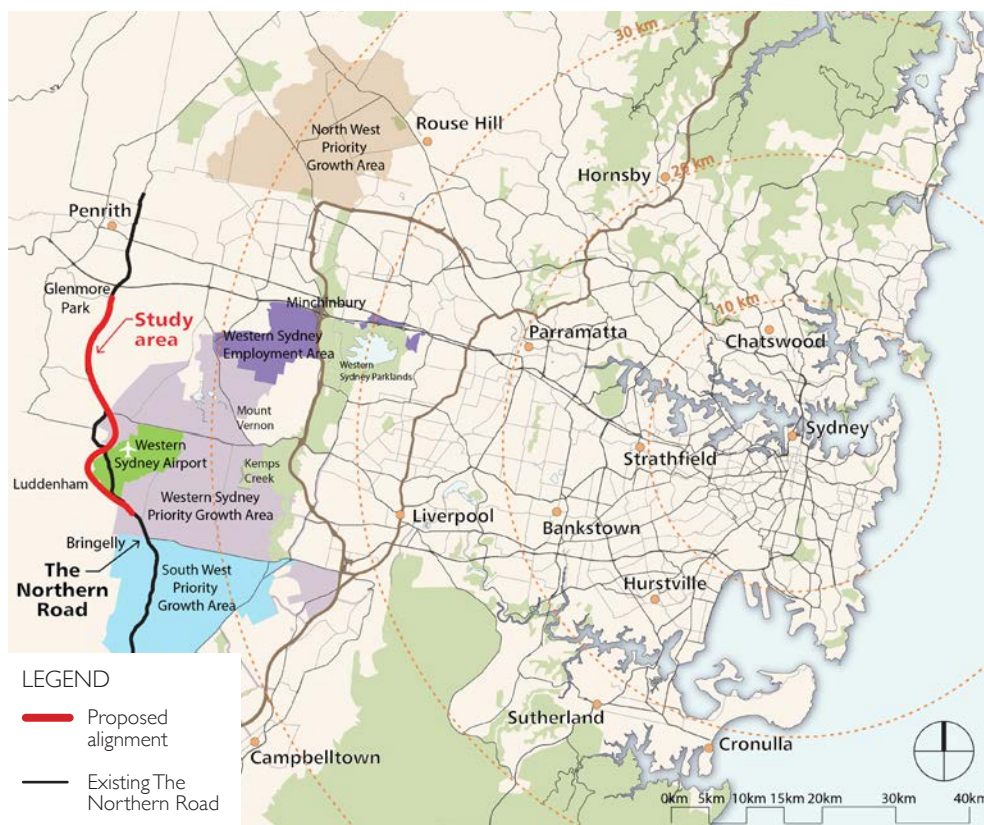


Figure 2: Metropolitan context of The Northern Road and the study area

## CONTEXTUAL ANALYSIS

### 2.1.2 Local context

Located around the periphery of the Western Sydney Airport, and connecting to Penrith, the study area will be an important gateway to the airport, and to employment and residential lands within the WSPGA and the SWPGA respectively.

The Northern Road is also an important urban arterial road skirting the west of the Sydney metropolitan area. It will function as the main north-south connecting route between Camden and Campbelltown, and Penrith and Windsor.

Much of the study area is currently situated within a rural setting. Planning for the Western Sydney Airport, the WSPGA and SWPGA is underway and will result in substantial changes to the area. As a result, the southern extents of the study area will be progressively transformed from rural lands to employment, infrastructure and other urban uses including town centres and residential areas.

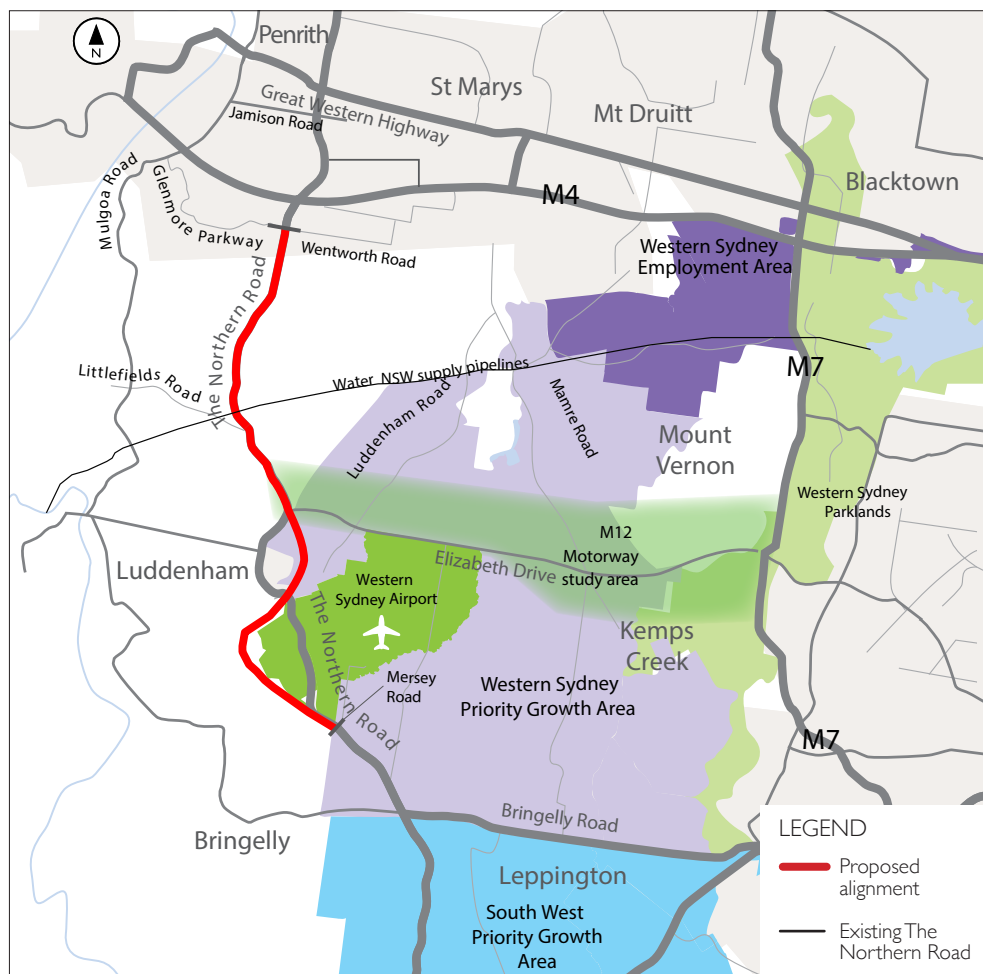


Figure 3: Local context of the study area (source: adapted from: Roads and Maritime Services 2015, p. 3)

## CONTEXTUAL ANALYSIS

### 2.1.3 Places of interest

Particular features and places of interest that provide destinations for the local community in the area surrounding the proposed upgrade include (refer **Figure 4**):

1. Penrith Golf & Recreation Club
2. Penrith Anglican College
3. Orchard Hills Water Filtration Plant
4. Surveyors Creek Nature Reserve
5. Defence Establishment Orchard Hills (DEOH)
6. Orchard Hills Golf Club
7. Mulgoa Nature Reserve
8. Eureka Farm Equipment
9. Stones Kart Sport Shop
10. Complete Roofing
11. Mulgoa village
12. Water NSW supply pipelines
13. The Honey Shed
14. Luddenham Pet Meat and Pet Supplies
15. Luddenham Showground
16. Luddenham town centre
17. Workers Hubertus Country Club
18. Wallacia village and Panthers Wallacia Golf Course
19. Leppington Pastoral Company
20. Royal Australian Air Force Telecommunications Unit
21. Luddenham Raceway Gokart and Paintball Centre
22. Top Shape Live Christmas Trees

## CONTEXTUAL ANALYSIS

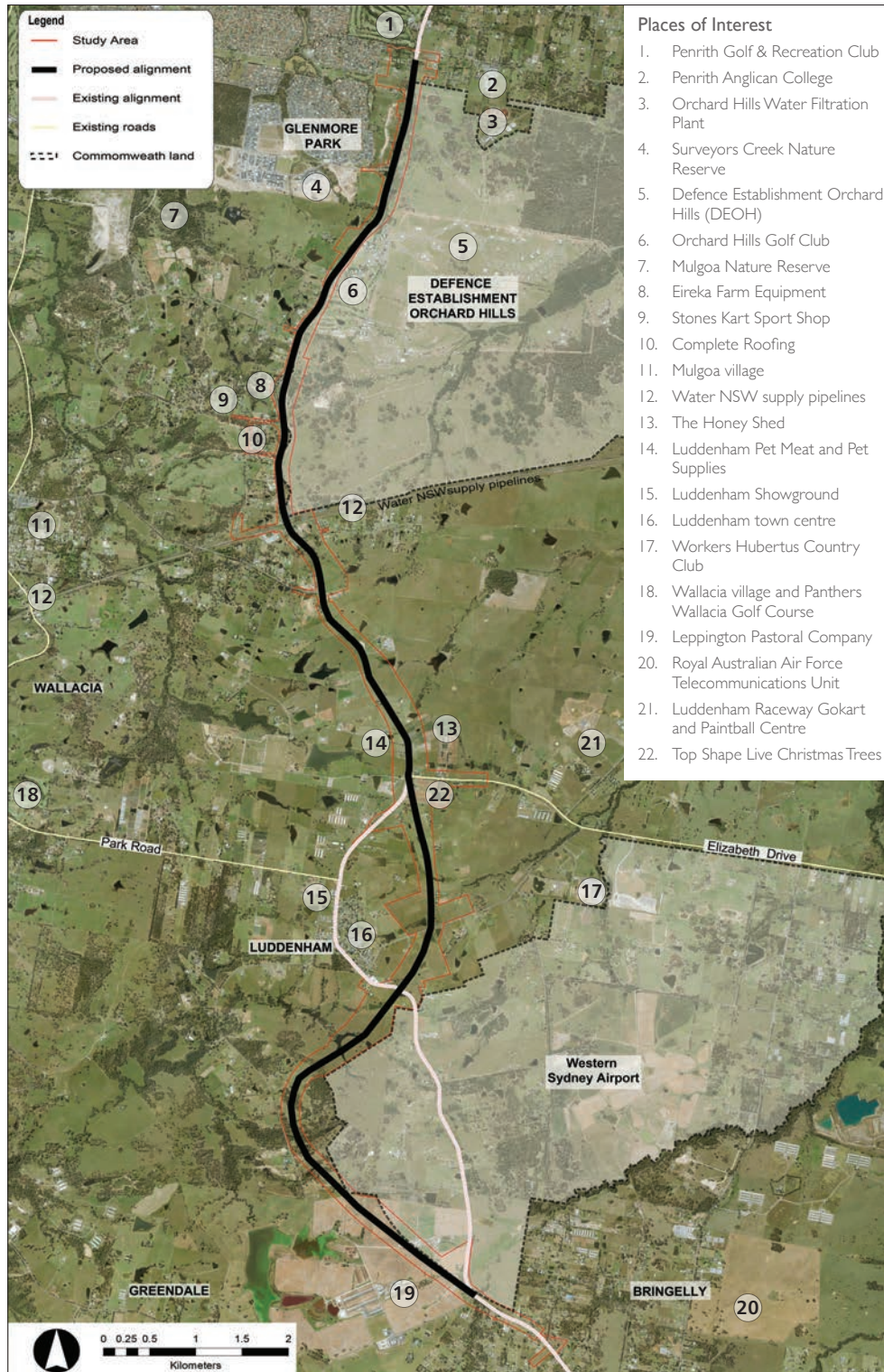


Figure 4: Aerial photograph showing places of interest surrounding the study area

## CONTEXTUAL ANALYSIS

### 2.2 PLANNING CONTEXT

#### 2.2.1 A Plan For Growing Sydney

The Sydney Metropolitan Strategy *A Plan for Growing Sydney* (the Plan) sets the metropolitan planning context. It provides the framework for Sydney's future over the next 20 years, directing growth and land use planning decisions.

It outlines a vision for Sydney to be a strong global city and a great place to live, with a competitive economy, world-class services, transport and housing choice within communities that are strong, healthy and well connected.

The Plan identifies western Sydney as the 'key to Sydney's success'. Given the projected growth over the next 20 years, western Sydney will likely be the driver of future productivity in Sydney and NSW.

Particular opportunities for western Sydney identified by the Plan include (refer **Figure 5**):

- Investment in transport infrastructure, such as the South West Rail Link, a possible extension to the South West Rail Link from Badgerys Creek to the western rail line, the Western Sydney Rail Upgrade Program and the Outer Sydney Orbital
- Rezoning of land in the SWPGA to maintain a steady supply of greenfield sites for urban residential development
- Development of the WSPGA as the single largest new employment space in the Sydney Metropolitan Area, supporting manufacturing and industrial activity, particularly the freight and logistics sectors
- Development of a second airport at Badgerys Creek and associated investment in road and rail related infrastructure as a major stimulus to the western Sydney economy and broadening employment opportunities with up to 60,000 jobs in the long term
- Creation of a transport gateway focused on the Western Sydney Airport at Badgerys Creek
- Improving transport connections between centres including upgrades to The Northern Road, Elizabeth Drive and Bringelly Road.

The upgrade of The Northern Road is therefore a direct result of strategic planning as outlined in the Plan.

#### **Metropolitan Rural Area**

The Metropolitan Rural Area (MRA) is that part of the Sydney Metropolitan Area generally located outside established urban areas - refer **Figure 5**. The MRA provides a rural and bushland backdrop to the metropolitan urban area and holds important environmental, economic and social assets.

Managing the MRA is a key objective of *A Plan for Growing Sydney*, and a critical part of managing Sydney's natural environment and biodiversity as well as of securing local food production (Direction 4.1). This will involve balancing local growth needs with environmental protection, resource management, agriculture, tourism and culture, research activity, military uses and community safety.

Much of the study area is located within or along the edges of the MRA. The intention for these lands to remain rural is of relevance as it will influence the future landscape character of the study area.

## CONTEXTUAL ANALYSIS

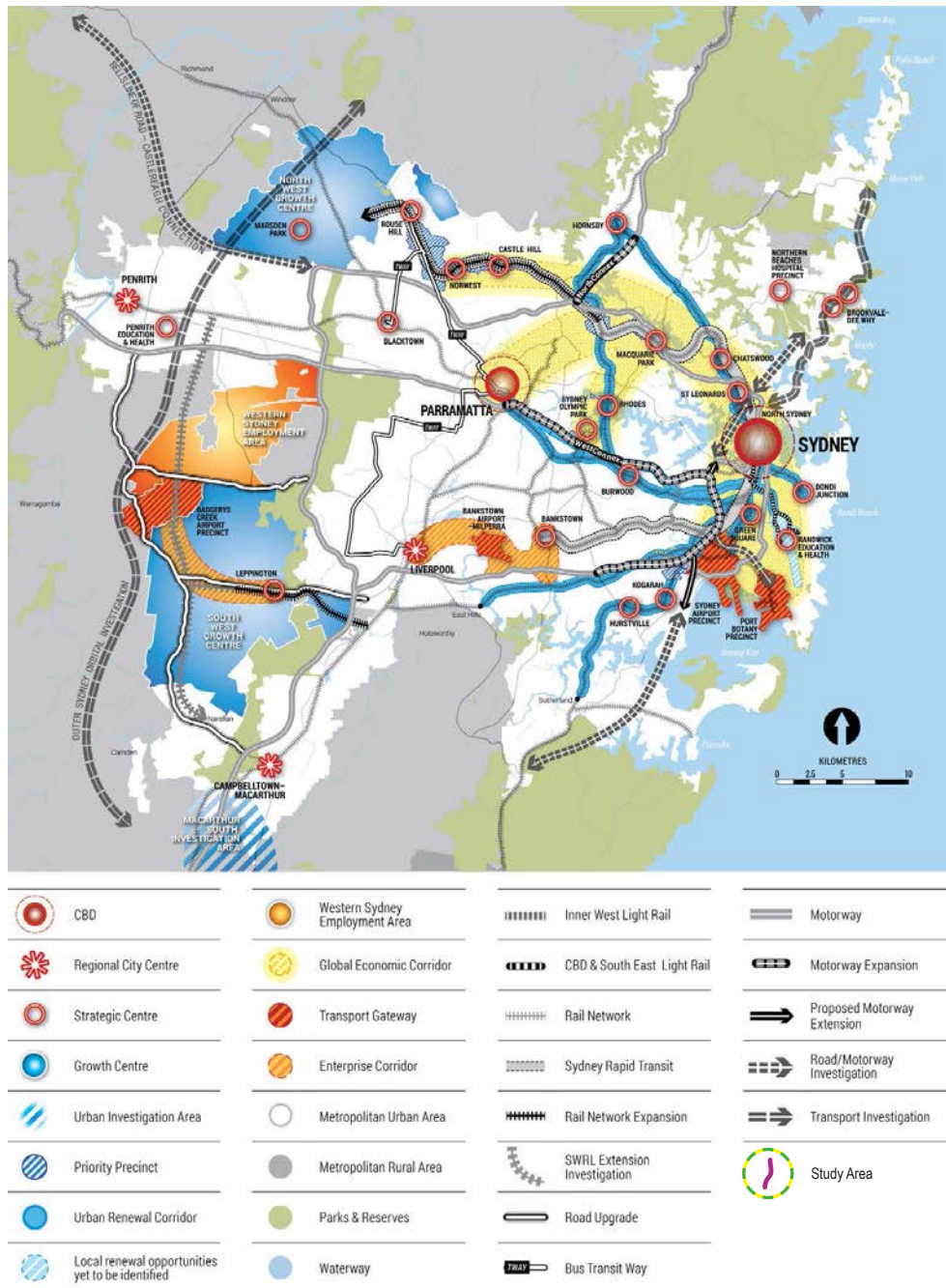


Figure 5: The study area in the context of major urban growth areas and the Metropolitan Rural Area (source: A Plan for Growing Sydney, Figure 4: Connecting Jobs and Homes, DP+E 2014, p. 15)

## CONTEXTUAL ANALYSIS

### 2.2.2 Sydney Green Grid

The *Sydney Green Grid* is a framework for the creation of an interconnected network of open spaces, parks, bushland and waterways, embedded in *A Plan for Growing Sydney*. It aims to connect open space, local centres, workplaces, community destinations, leisure facilities and residential areas through an active transport network of greenspace corridors and enhanced tree canopies, with walkways and cycle ways across the Sydney metropolitan area, to create green connections.

The 'Green Grid' has been identified by the Department of Planning and Environment as a key part of planning and building Sydney for the future. It will provide Sydney's green infrastructure and will be an essential component of the city for maintaining and improving both ecological and human health.

### 2.2.3 Western Sydney Infrastructure Plan

The WSIP is a joint initiative by the Australian and NSW governments aimed at building a stronger and more prosperous western Sydney, transforming the region's economy through major infrastructure upgrades and making western Sydney a better place to live and do business.

Building on *A Plan for Growing Sydney*, the WSIP will invest \$3.6 billion over 10 years to deliver major road infrastructure in western Sydney, to capitalise on the economic benefits from developing the Western Sydney Airport and to support an integrated transport solution for the region.

The WSIP seeks to provide improved road transport capacity ahead of projected traffic demand resulting from planned residential and employment development in the NWPGA, SWPGA and the WSPGA. Relevant proposals include the upgrade of The Northern Road and Bringelly Road, a new Werrington Arterial and a proposed M12 Motorway that will provide direct access from Sydney's motorway network to the Western Sydney Airport - refer **Figure 6**.

## CONTEXTUAL ANALYSIS

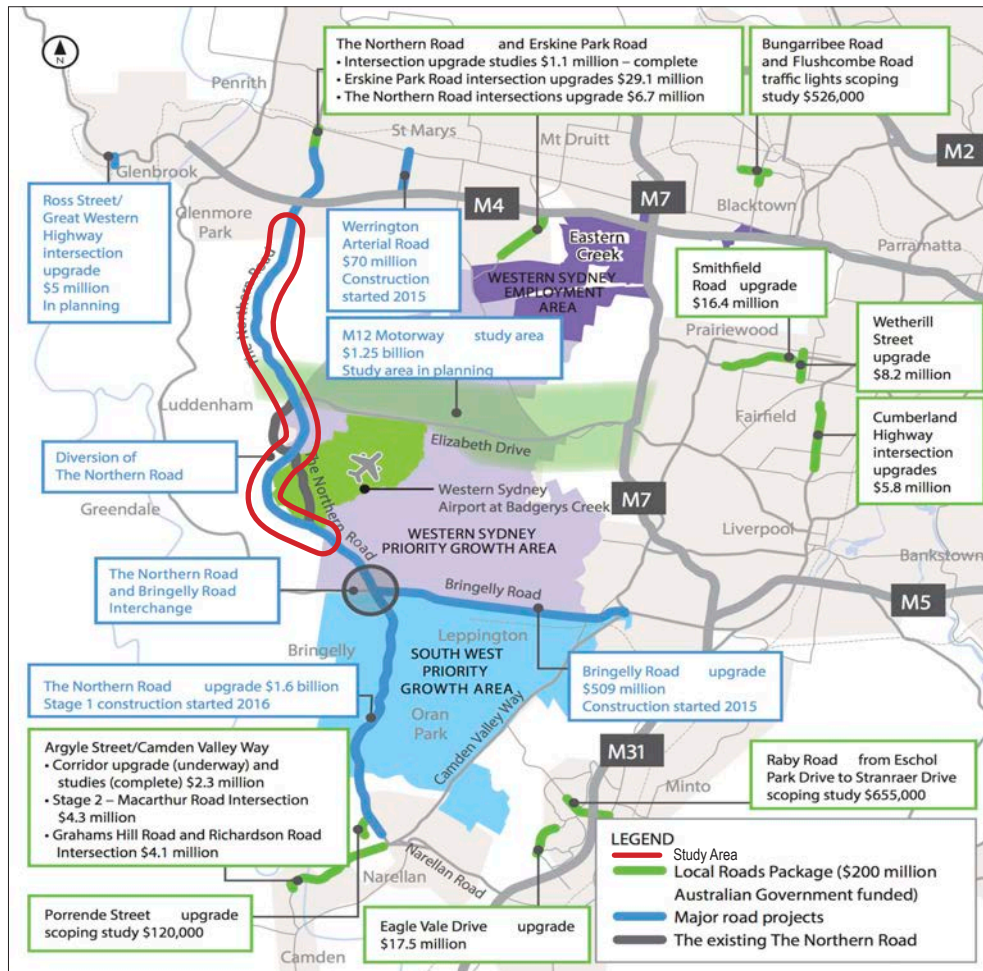


Figure 6: Western Sydney Infrastructure Plan (adapted from: Roads and Maritime Services 2015, p. 3)

## CONTEXTUAL ANALYSIS

### 2.2.4 Local planning instruments

The study area spans the Penrith and Liverpool LGAs. Land use and development in and adjoining the study area is controlled by the Penrith Local Environmental Plan (LEP) 2010 and the Liverpool LEP 2008 respectively.

As can be seen from **Figure 7**, a number of land uses adjoin the study area. They include:

- Rural land use zones (RU) adjoining much of the southern study area south of the Water NSW supply pipelines. They include:
  - RU1 Primary production areas south of Elizabeth Drive and west of The Northern Road in Luddenham, Greendale and Bringelly
  - RU2 Rural landscape areas on both sides of the corridor between the Water NSW supply pipelines and Elizabeth Drive, as well as in Mulgoa opposite the DEOH. It is noted that much of the latter has been identified as an urban release area
  - RU4 Rural small holdings at the edges of Luddenham town centre and in Bringelly
  - RU5 Village, in Luddenham town centre
- Residential zones including
  - R1 General residential and R2 Low density residential areas set back from the road corridor in parts of Glenmore Park, as well as in the Luddenham town centre
  - R5 Large lot residential living in the Luddenham town centre and in Bringelly
- Two small neighbourhood business zones (B1) in Luddenham town centre
- Special purpose zones including
  - SP1: the DEOH and the site of the Western Sydney Airport at Badgerys Creek
  - SP2: the Water NSW supply pipelines
- Environment protection zones (E) including
  - E2 Environmental conservation around the perimeter of the DEOH in Orchard Hills and Luddenham
  - E3 Environmental management areas in the Mulgoa Creek catchment
  - E4 Environmental living areas in parts of Glenmore Park.

### **Scenic and landscape values**

It is noted that much of the study area and adjoining lands in the Penrith LGA have been identified as possessing scenic and landscape values - refer **Figure 8**. Particular objectives for this land are provided by clause 7.5 of Penrith LEP 2010. They include:

- To identify and protect areas that have particular scenic value either from major roads, identified heritage items or other public places, and
- To ensure development in these areas is located and designed to minimise its visual impact.

Translation of scenic and landscape values into statutory and planning instruments indicates that these values are both significant and widely held. The implications for the proposed works, and for the development of the concept design are:

- The landscape of the study area is important and has been singled out for its scenic and landscape values within the Penrith LGA
- Statutory identification of scenic and landscape values suggests a high level of visual sensitivity to change in the landscape

## CONTEXTUAL ANALYSIS

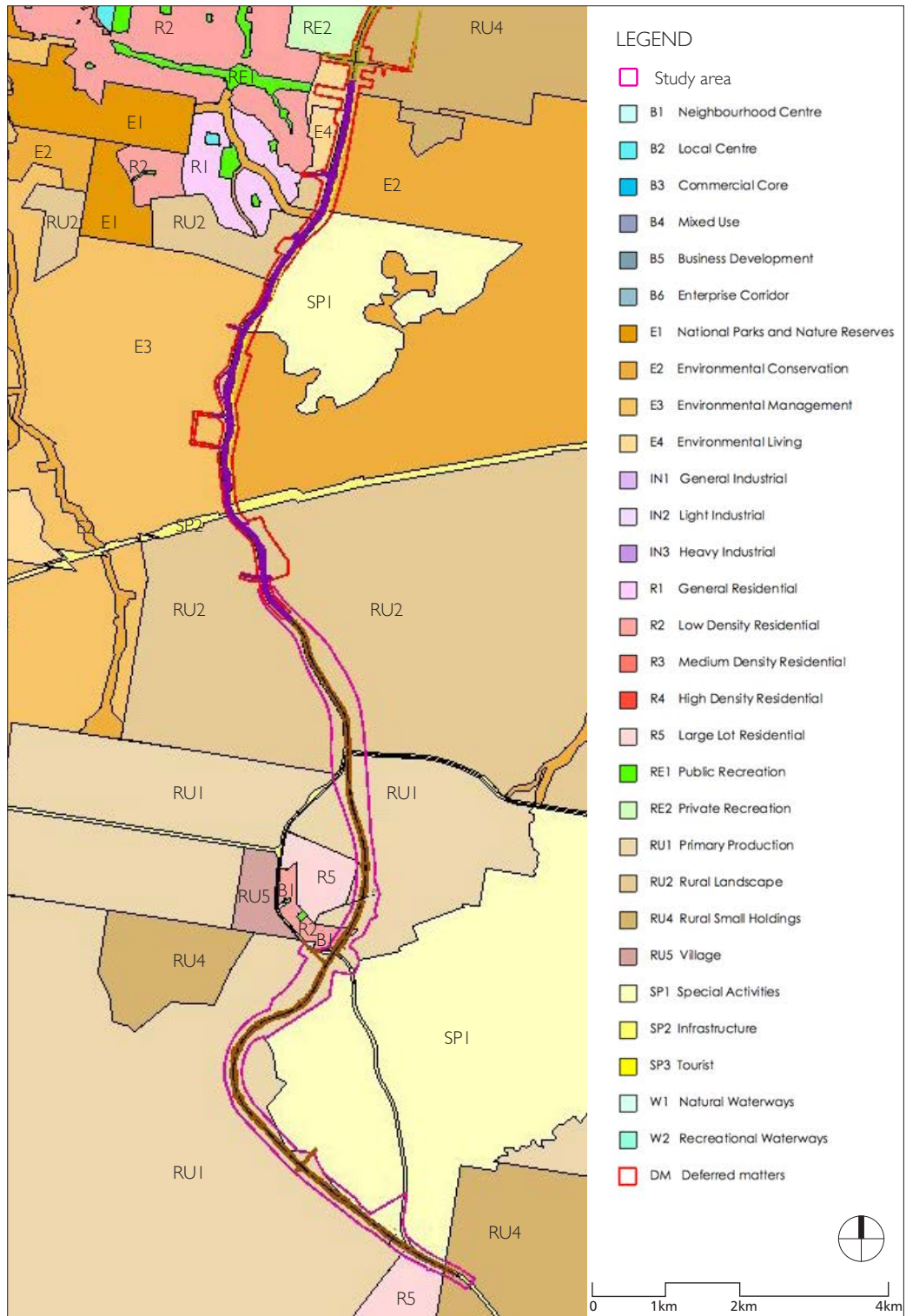


Figure 7: Land use zoning (source: Jacobs)

## CONTEXTUAL ANALYSIS

- Given that these lands are also identified to be part of the MRA in *A Plan for Growing Sydney*, conversion of rural lands to residential or urban land uses are unlikely in the foreseeable future
- There is a statutory requirement to protect scenic landscape values including the need to
  - Carefully consider and manage the potential impacts of the proposed works on scenic and landscape values
  - Complement or enhance scenic landscape values as part of the proposed works.

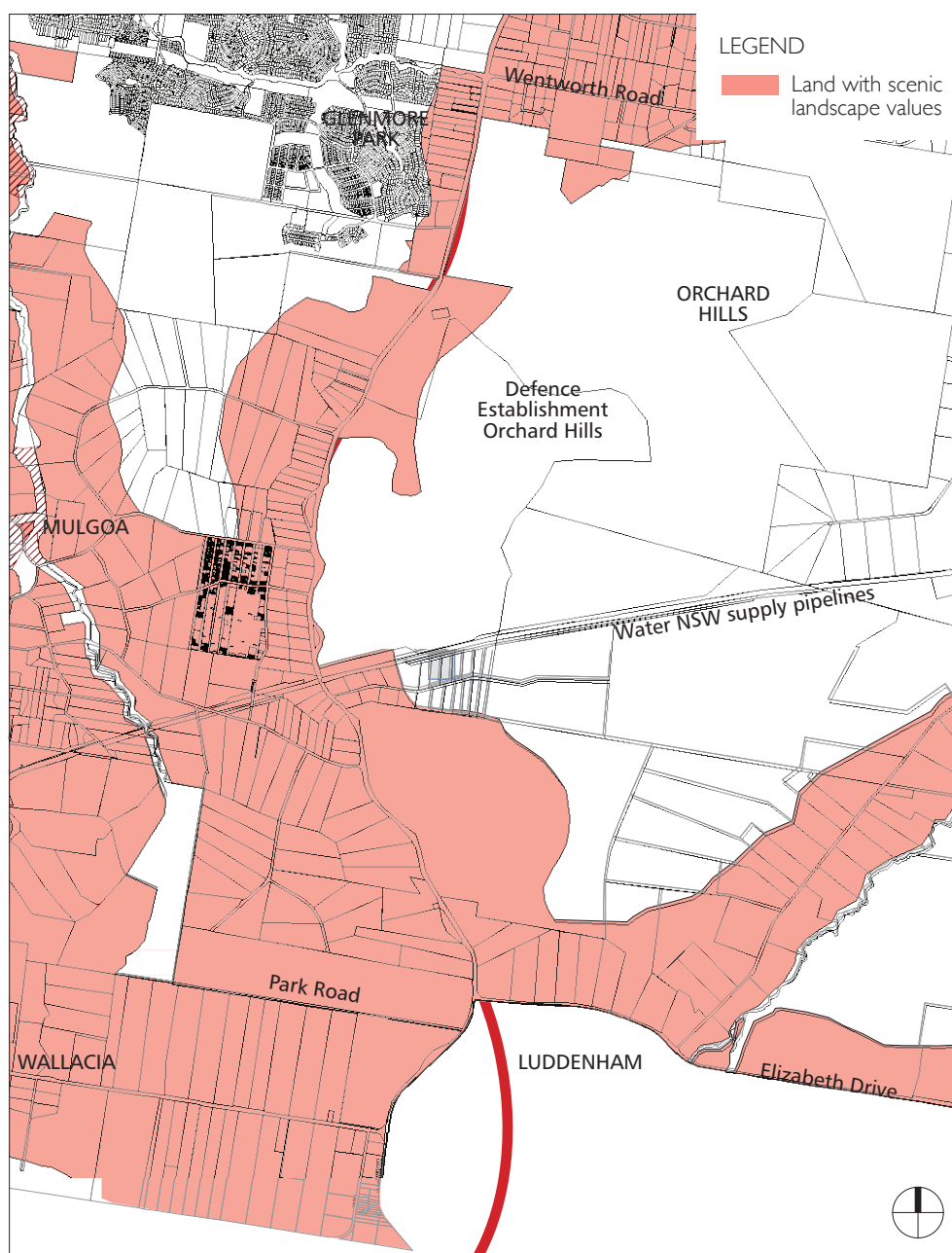


Figure 8: Land with Scenic and Landscape Values - Extract from Sheets 6, 7, 13 and 14, Penrith LEP 2010

## CONTEXTUAL ANALYSIS

### 2.3 URBAN DESIGN GUIDANCE

The following provides a brief overview of relevant documents that guide the urban design concept for the proposed works.

#### 2.3.1 Beyond the Pavement

*Beyond the Pavement. Urban Design Policy Procedures and Design Principles* is the Roads and Maritime urban design policy. It provides guidance on urban design outcomes and expectations, and how to integrate urban design into the infrastructure design process. It identifies urban design principles for Roads and Maritime's projects and provides relevant case studies.

Through *Beyond the Pavement* Roads and Maritime commits to providing excellent outcomes for the people of NSW, governed by 9 overarching urban design principles that include both physical outcomes and performance based principles.



#### 2.3.2 South West Growth Centre Road Network Strategy

The *South West Growth Centre Road Network Strategy* was prepared in 2011 to guide the road network planning for south-western Sydney, with a focus on the area loosely defined by the F5 Freeway, Elizabeth Drive and The Northern Road.

The Strategy built on and further developed earlier work such as the *Growth Centres Road Framework*, to integrate land use and transport by guiding the future planning and design of both the road network and adjoining land uses. It has since been superseded by the *Draft South Western Sydney Urban Design Strategy* that considers a larger study area extending to the M4 Motorway.



#### 2.3.3 South Western Sydney Urban Design Strategy

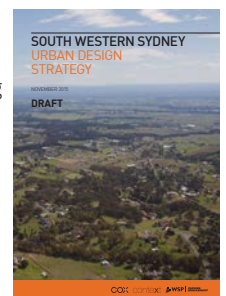
The *Draft South Western Sydney Urban Design Strategy* (SWSUDS) was published in November 2015, in response to the WSIP. Building on the *South West Growth Centre Road Network Strategy* it aims to realise a clear character and identity for the region bound by the M4, M7 and the Hume Highway by providing urban design direction for the development of the road network.

The SWSUDS is built on the premise that the road network holds the potential to shape and define the character of an area. A fundamental landscape element in western Sydney is its Cumberland Plain ecology. Its retention and integration into the road network hierarchy is seen as the defining character element of south-western Sydney.

Based on other Roads and Maritime policies including *Beyond the Pavement*, the SWSUDS outlines urban design and road planning principles and recommendations to achieve urban design integration and the desired landscape and urban design outcomes.

The SWSUDS further defines the road hierarchy for the region and provides design guidelines for different types of roads and intersections. This is refined by a 'corridor approach' for major routes that identifies unique issues and values for each road corridor. It considers the corridors' existing character in the context of likely future development to identify an appropriate response.

The SWSUDS is a key document for consideration in the assessment of the potential landscape character impacts of the proposed works, as well as in the development of mitigation measures and the urban design concept.



## CONTEXTUAL ANALYSIS

### 2.4 EXISTING SITE CONDITIONS

#### 2.4.1 Landform & views

The landscape of the study area is typical of the Cumberland Plain and defined by its situation along a well defined ridge that constitutes the watershed between the South Creek and Nepean River catchments.

For the most part of the study area the existing alignment of The Northern Road closely follows this ridge as it gradually descends in elevation, from a high point south of Luddenham towards Glenmore Park.

In terms of the views available to the motorist, there are three distinct sections within the study area - refer **Figure 9**. They are:

- The southern section between Mersey Road and the transmission line easement, near 1,972 The Northern Road
- The central section between the transmission line easement and the Water NSW supply pipelines
- The northern section between the Water NSW supply pipelines and Glenmore Parkway.

In the southern section there are generally mid distance views over rolling paddocks. Due to tree cover and topography, there are limited long distance views, although there are occasional glimpses of the Blue Mountains to the west, including from the existing The Northern Road alignment.

The central section is the most open section of the study area. The Blue Mountains are an almost constant feature in the west. North and south of the Luddenham town centre motorists enjoy panoramic views from the road corridor; ranging from the Blue Mountains in the west to the prominent ridge line that defines the Western Sydney Parklands to the east. The exception is Luddenham town centre where built structures limit views from the road corridor.

The northern section of the study area between the Water NSW supply pipelines and Glenmore Parkway in contrast is much more enclosed. There are only occasional brief glimpses of the Blue Mountains. Views to the east are contained by a ridge line running in close proximity to the road corridor; limiting views from the road corridor to short-distance views into immediately adjoining lands.

#### 2.4.2 Hydrology and fish habitat

There are a number of creeks and tributaries surrounding the study area, all part of the wider Hawkesbury-Nepean Catchment - refer **Figure 9**. Within the study area a number of creeks and farm dams are found. They are often associated with vegetation remnants.

Farm dams make an important contribution to the landscape character and the experience of the drive along The Northern Road, including its visual values. Creeks have also been identified as regional recreational links integral to the realisation of the Sydney Green Grid.

Creeks in the area have been assessed for their importance as fish habitat and for fish passage. No watercourse crossings have been mapped as Key Fish Habitat by Department of Primary Industries (DPI) Water (2007). However five waterways crossing the study area are considered Type 1 – Key Fish Habitats, based on the *DPI Policy and Guidelines for Fish Habitat Conservation and Management (2013)*. They contain a combination of native aquatic plants and/or woody snags.

## CONTEXTUAL ANALYSIS

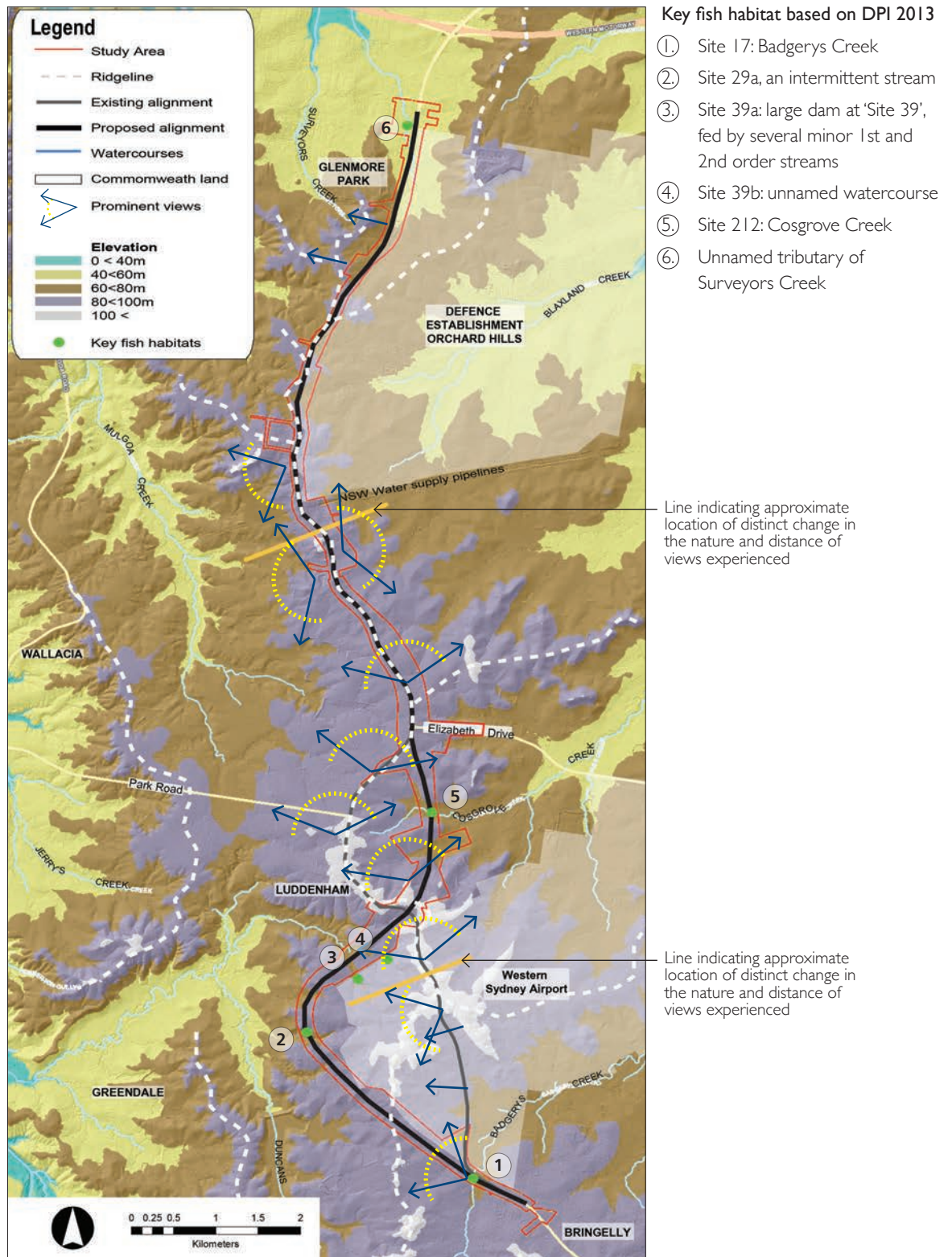


Figure 9: Topography, views, water courses and fish habitat

## CONTEXTUAL ANALYSIS

There are also intermittently flowing waterways identified as Class 2 – Moderate Key Fish Habitat due to the presence of limited in stream aquatic vegetation.

The key waterways crossed by the project are - refer **Figure 9**:

- Badgerys Creek (site 17)
- An intermittent stream at 'Site 29a'
- The large dam at 'Site 39', fed by several minor 1st and 2nd order streams with minimal channel definition, only flowing when the upstream dams overflow (site 39a and 39b)
- Cosgrove Creek (site 212)
- Unnamed tributary of Surveyors Creek

The Nepean River is the downstream receiving environment to the project area; however, the project itself is located close to the catchment divide, just west of the eastern boundary. The Nepean River is significant both environmentally and economically and provides for a range of domestic and irrigation uses. No threatened or protected fish species are expected to occur within the study area due to the limited water and aquatic habitat present.

For more information refer the *Biodiversity Assessment Report* (Appendix I of the EIS).

### 2.4.3 Vegetation

#### **Native vegetation cover**

The native vegetation of the study area is an important feature in defining the landscape of the area. Together with the topography it influences the character of the landscape, as well as the views and vistas.

Remnant native vegetation is found throughout the study area and in adjoining areas. It generally occurs in scattered clumps of trees and as individual specimen along the edges of the road corridor; or in private properties adjoining the road corridor. A number of private properties retain larger stands of remnant vegetation. Larger stands are also typically associated with creeks.

The analysis of the vegetation cover undertaken by the SWSUDS clearly highlights the changing character and density of vegetation cover in the area surrounding the proposed works. As can be seen on **Figure 10**, the heaviest vegetation cover exists around the southern end of the study area, as well as in the section north of the Water NSW supply pipelines.

In contrast, areas between Badgerys and Duncans Creek retain limited vegetation. The landscape around Willowdene Avenue in Luddenham, around the Luddenham town centre and along Mulgoa Creek is more varied, consisting of a mix of open and vegetated areas.

#### **Native vegetation communities**

Native vegetation generally consists of Cumberland Plain Woodland. It is highly modified as a result of past and current land uses, including agricultural uses which have resulted in substantial clearing of the original vegetation cover.

There are a number of ecologically vulnerable remnants within the study area - refer **Figure 11**. They include:

- Cumberland Plain Woodland and Shale Gravel Transition Forest - protected under the EPBC Act

## CONTEXTUAL ANALYSIS



Figure 10: Extent of native vegetation cover (adapted from Figure 2.17 from Cox 2015, p. 23)

## CONTEXTUAL ANALYSIS

- Cumberland Plain Woodland, listed as an Endangered Ecological Community (EEC) under Schedule 3 of the *Threatened Species Conservation Act 1995* (TSC Act) and including the following communities:
  - Forest Red Gum - Rough Barked Apple Grassy Woodland on alluvial flats of the Cumberland Plain
  - Grey Box - Forest Red Gum Grassy Woodlands on flats of the Cumberland Plain'
  - Grey Box - Forest Red Gum Grassy Woodlands on shale of the southern Cumberland Plain'
- River-Flat Eucalypt Forest on Coastal Floodplains of the Sydney Basin Bioregion, listed as an EEC under Schedule 3 of the TSC Act.

For more detailed information on the local ecology refer to the *Biodiversity Assessment Report* (Appendix I of the EIS).

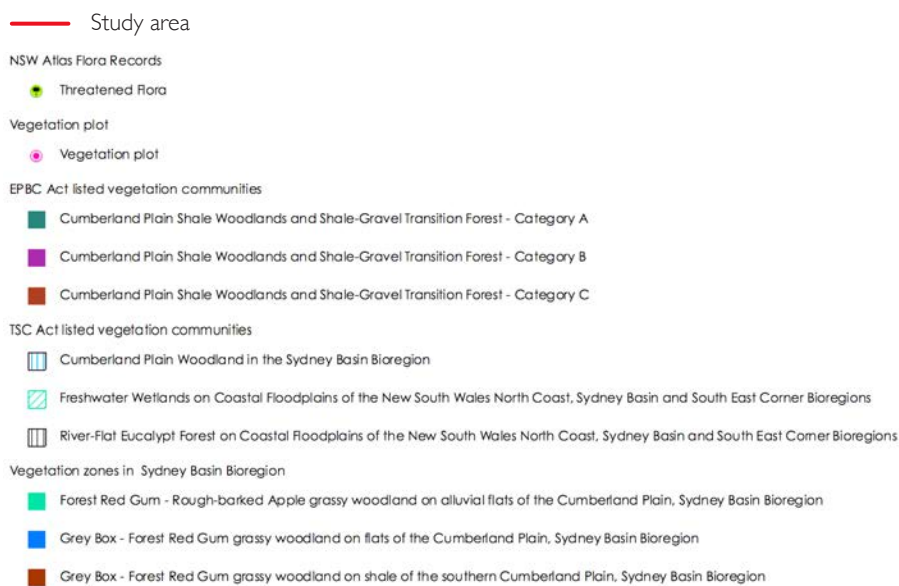
### Cultural plantings

The area is mainly characterised by its remnants of native vegetation which has been cleared extensively for rural uses. The predominant use is for pasture, creating expansive open areas.

Cultural plantings are typically associated with residential gardens and front yards of rural dwellings. The area is also used for orchards and tree farms including an historic orchard on Gates Road (refer section **2.4.5 Heritage**) and a number of Christmas tree farms, including near Elizabeth Drive and Eaton Road.

Overall, there is little prominent cultural planting.

### LEGEND - Figure 11



## CONTEXTUAL ANALYSIS



Figure 11: Aerial photograph showing distribution of ecologically vulnerable remnant vegetation (source: Jacobs)

## CONTEXTUAL ANALYSIS

### 2.4.4 Land use and settlement pattern

The study area is located at the periphery of the Sydney metropolitan area and currently remains rural. It is characterised by a mix of paddocks and open areas interspersed by stands of remnant vegetation of varying sizes, as well as rural residences and structures associated with rural production such as machinery or animal sheds.

Luddenham is a distinct rural town and the local service centre in the study area, featuring basic shops and services as well as schools, churches and a number of historic buildings. The relatively tight clustering of buildings in a small town centre clearly distinguishes it from the remainder of the study area. It also differs from Bringelly south of the study area which does not have a defined urban centre.

The DEOH, while representing a different land use, nevertheless is consistent in character with surrounding agricultural land uses, containing a similar mix of open and vegetated areas.

The Orchard Hills Golf Club is unique in character and provides a contrast to surrounding areas, through its formal arrangement of manicured lawns and straight lines of trees lining the fairways.

#### ***Planned changes to land use and development patterns***

It is noted that development of the Western Sydney Airport at Badgerys Creek, the WSPGA and the SWPGA will result in substantial changes to the existing land use and settlement pattern. It will progressively transform the character of the landscape surrounding the study area from rural to urban. The extent of area likely to be transformed by employment lands and other urban uses is shown in **Figure 12**.

## CONTEXTUAL ANALYSIS

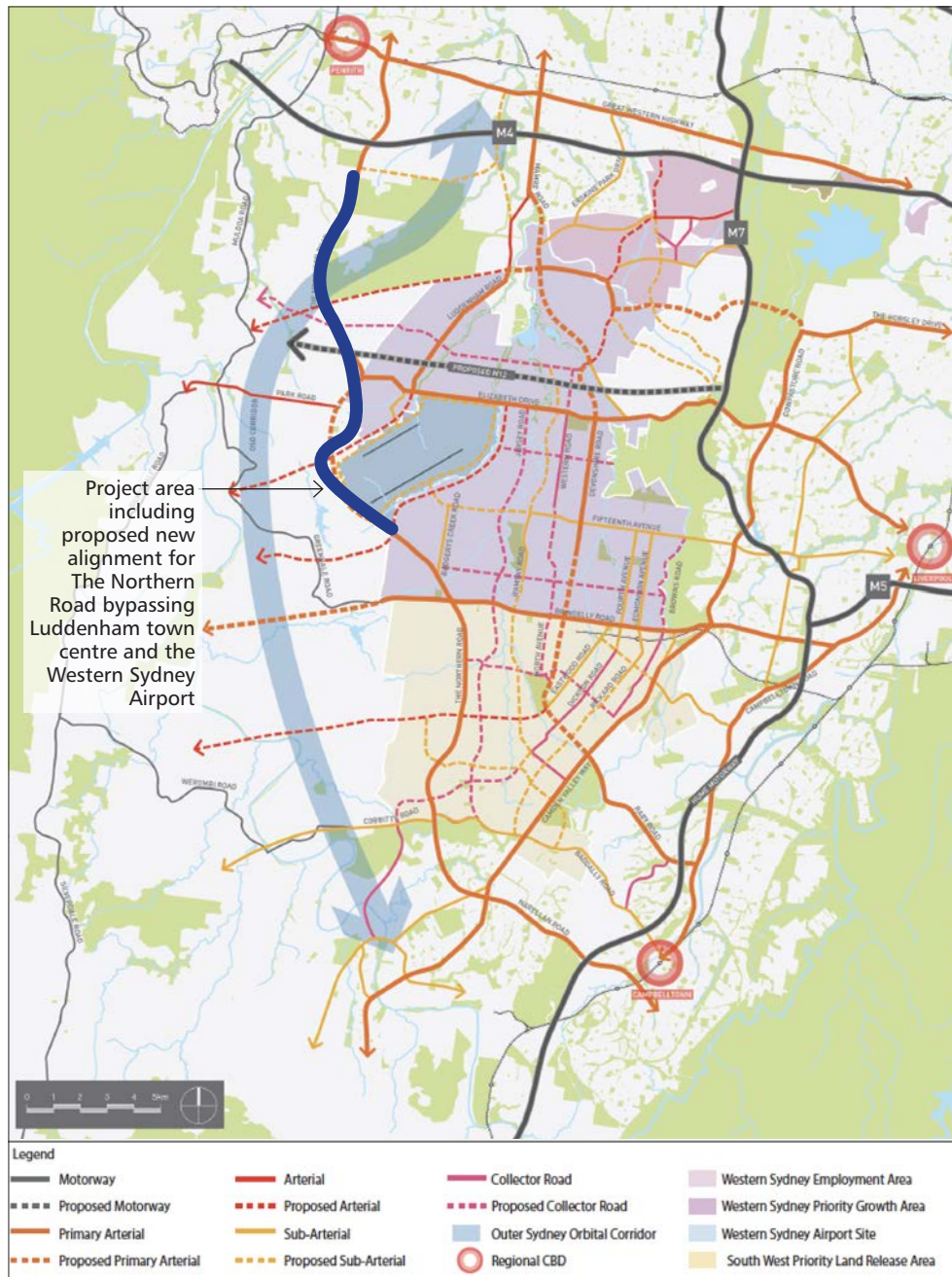


Figure 12: Proposed future urban areas and road network (adapted from Figure 2.40 from Cox 2015, p. 43)

## CONTEXTUAL ANALYSIS

### 2.4.5 Heritage

The *Non-Aboriginal Heritage Working Paper* for the project (Appendix N of the EIS) identified ten potential heritage items within the study area - refer **Figure 13**.

Of these, four were identified as having heritage significance, as follows:

- Orchard Hills Cumberland Plain Woodland (Chaffey Brothers Irrigation Scheme Canal) – listed on the Commonwealth Heritage List (CHL)
- Water NSW supply pipelines
- Miss Lawson's Guesthouse Site
- Lawson's Inn site – listed on the Liverpool Local Environmental Plan (LLEP).

A number of Aboriginal heritage sites have also been identified within and surrounding the study area as outlined in the *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS) - refer **Figure 13**.

For more information refer to the *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS) and the *Non-Aboriginal Heritage Working Paper* (Appendix N of the EIS).

## CONTEXTUAL ANALYSIS

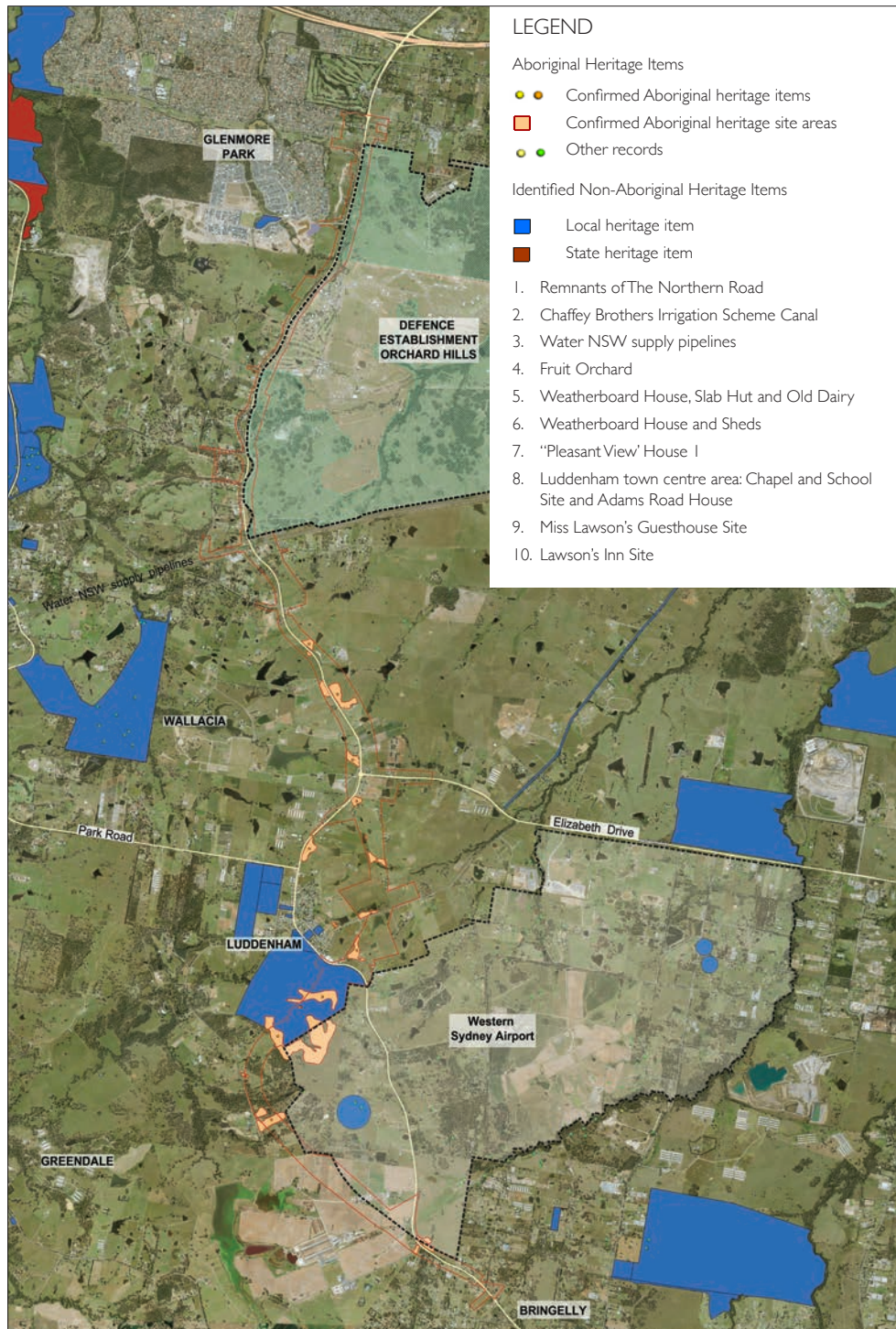


Figure 1.3: Aboriginal and Non-Aboriginal heritage items (source: Jacobs)

## CONTEXTUAL ANALYSIS

### 2.4.6 Utilities

The following utilities have been identified along or near the study area - refer **Figure 14**:

- **Electricity**  
A substation near the Water NSW supply pipelines.  
High and low voltage transmission and distribution lines, including TransGrid 330kV transmission lines that cross the road corridor
  - Near the northern extent of the study area, about 350 metres south of Glenmore Parkway
  - At the southern extent about 70 metres directly south of Vicar Park Lane
- **Water**  
Water NSW and Sydney Water mains including the Water NSW supply pipelines
- **Gas**  
A Jemena gas main is located near Bradley Street, Orchard Hills
- **Telecommunications**  
Including optic fibre and coaxial cables and several mobile towers
- **Sewer**  
No sewer mains have been identified.

### ***Relocation of utilities and services***

A number of utilities and services may be impacted by the project. This may include the need for realignment. The extent of impacts cannot be confirmed until the detailed design.

Strategies to address impacts may include protection or relocation of the utility, or adjustments to the project design to avoid any impacts. Either the construction contractor or the relevant utility provider would undertake utility adjustments.

## CONTEXTUAL ANALYSIS



Figure 14: Above-ground utility services (source: Jacobs)

## CONTEXTUAL ANALYSIS

### 2.4.7 Movement network and public transport

#### Road network

The Northern Road is an important urban arterial road. Skirting the west of the Sydney metropolitan area it links the Camden and Campbelltown areas with Penrith and Windsor. It will become increasingly important with progressive development of the SWPGA and NWPGA, as well as the WSPGA and the Western Sydney Airport.

At the local level The Northern Road provides access to rural holdings along its length, as well as the Luddenham town centre and the DEOH. It is complemented by a series of lower order roads that provide access to residential subdivisions and rural properties off The Northern Road. They include Glenmore Parkway, Wentworth Road, Chain-O-Ponds Road, Grover Crescent, Kings Hill Road, Gates Road, Littlefields Road, Eaton Road, Adams Road and Mersey Road - refer **Figure 15**.

Park Road and Elizabeth Road are state roads, providing links to Wallacia and Kemps Creek respectively.

In addition, there's a network of local roads within Luddenham town centre. Willowdene Road provides access between Luddenham town centre and rural properties to the south.

A number of changes to the road network are planned for the area, to support future growth. They are shown in **Figure 16**.

#### Public transport

Route 789 operates between Penrith and Luddenham, predominantly along The Northern Road. This is a peak hour only service and only operates twice a day on weekdays. No services are provided on weekends.

Within the study area there are currently fourteen bus stops associated with this route, located as follows and shown on **Figure 15**:

- |  |   |
|--|---|
| <p><b>A. Adams Road:</b></p> <ol style="list-style-type: none"> <li>1. Northbound stop located on Adams Road (stop ID: 2745186)</li> </ol> <p><b>B. North of Elizabeth Drive at The Northern Road:</b></p> <ol style="list-style-type: none"> <li>2. Southbound stop (stop ID: 2745120)</li> <li>3. Northbound stop (stop ID: 2745123)</li> </ol> <p><b>C. 2,787 The Northern Road:</b></p> <ol style="list-style-type: none"> <li>4. Southbound stop (stop ID: 2745119)</li> <li>5. Northbound stop located at 2,787 The Northern Road (stop ID: 2745124)</li> </ol> <p><b>D. The Northern Road north of Gates Road:</b></p> <ol style="list-style-type: none"> <li>6. Southbound stop located at (stop ID: 2745118)</li> </ol> | <p><b>E. The Northern Road south of Longview Road:</b></p> <ol style="list-style-type: none"> <li>7. Southbound stop at (stop ID: 274818)</li> <li>8. Northbound stop (stop ID: 2745125)</li> </ol> <p><b>F. The Northern Road south of Chain-O-Ponds Road:</b></p> <ol style="list-style-type: none"> <li>9. Northbound stop (stop ID: 2745126)</li> <li>10. Southbound stop (stop ID: 274817)</li> </ol> <p><b>G. Defence Establishment at Orchard Hills:</b></p> <ol style="list-style-type: none"> <li>11. Southbound stop (stop ID: 274816)</li> <li>12. Northbound stop (stop ID: 2745127)</li> </ol> <p><b>H. The Northern Road</b></p> <ol style="list-style-type: none"> <li>13. Southbound stop located at Truck Stop (stop ID: 274815)</li> <li>14. Northbound stop (stop ID: 2745128).</li> </ol> |
|--|---|

## CONTEXTUAL ANALYSIS

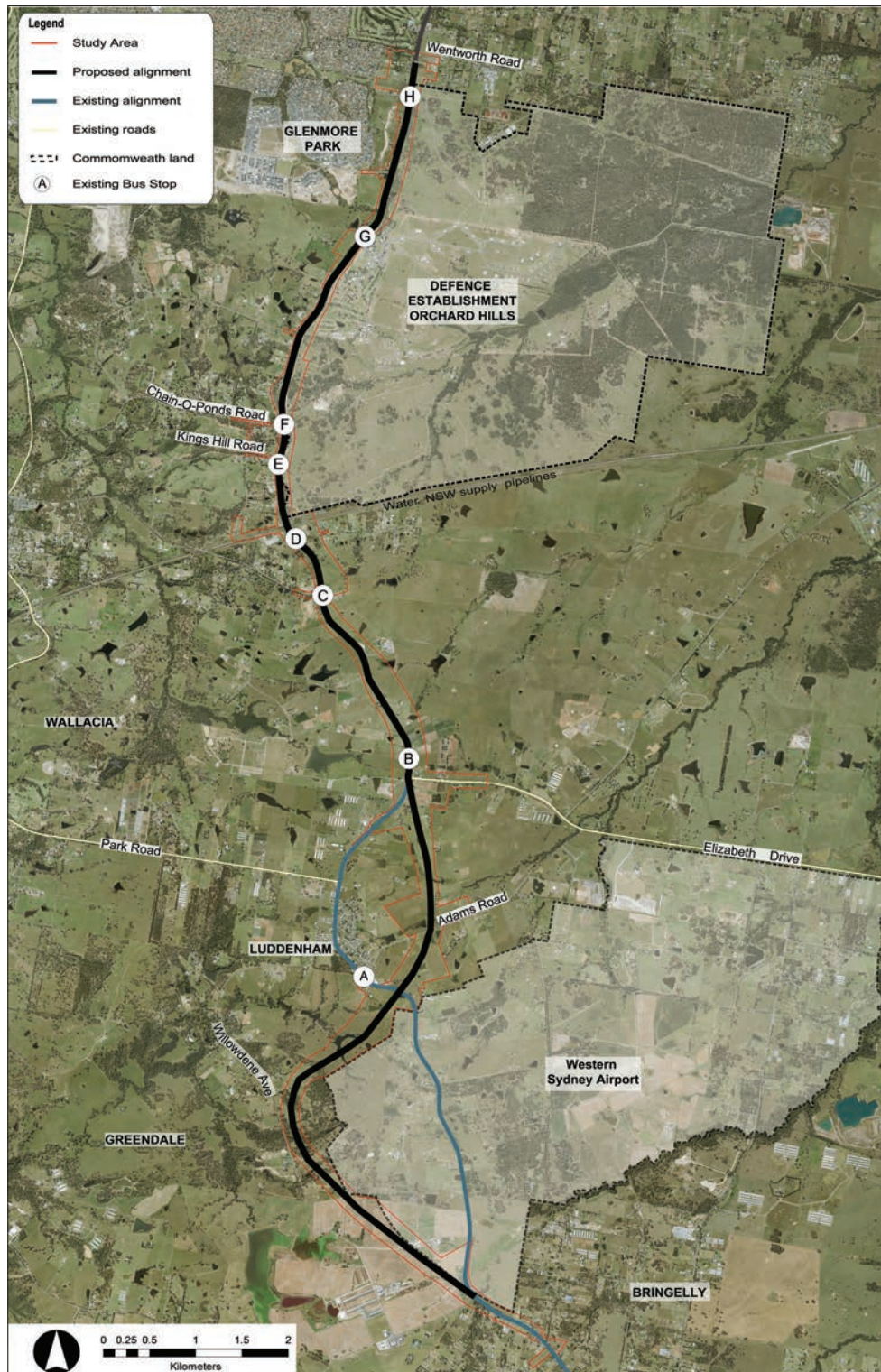


Figure 15: Existing bus stop locations

## CONTEXTUAL ANALYSIS

### ***Future public transport - buses***

The SWSUDS identified a number of road corridors for the provision of bus priority infrastructure, to provide a strategic bus network that is separate from the busiest traffic routes - refer **Figure 16**.

The proposed strategic bus network is generally focused on providing internal through connections within existing and future employment areas including the WSPGA. It also provides links to future residential growth areas south of Bringelly Road.

### ***Future public transport - rail***

The NSW Government has investigated preserving an additional public transport corridor in Sydney's South West to provide a north-south rail connection through the SWPGA and WSPGA including the Western Sydney Airport. However, public transport would only partially provide a resilient connection to the Western Sydney Airport site and would be used to support existing road users and freight tasks.

Even with the provision of increased public transport there would still be a growth in traffic demand that would need to be accommodated.

## CONTEXTUAL ANALYSIS

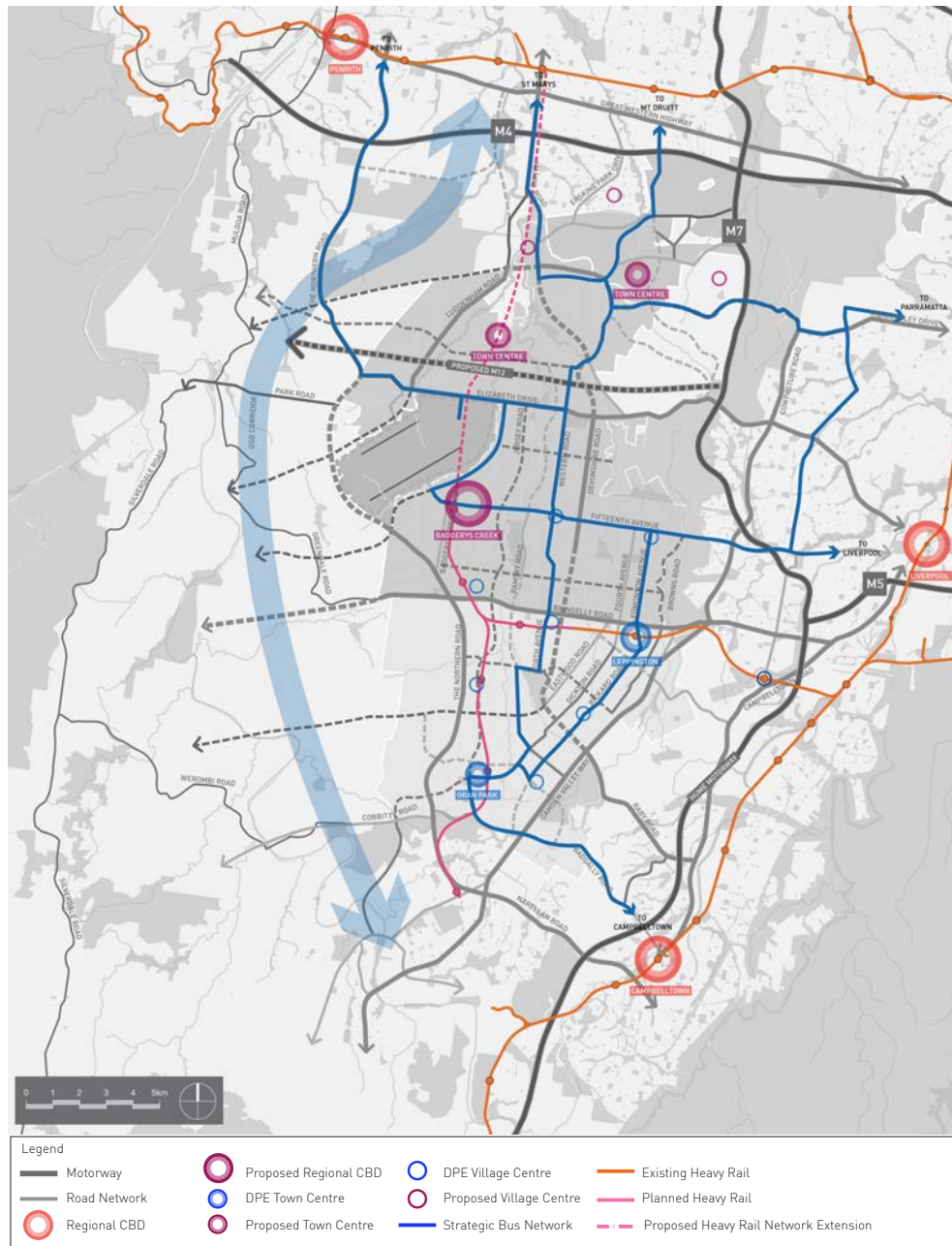


Figure 16: Proposed future urban areas and road network (Figure 2.43 from Cox 2015, p. 47)

## CONTEXTUAL ANALYSIS

### 2.4.8 Landscape character zones

The landform and vegetation, views and vistas, settlement pattern and built structures within and adjoining the study area combine to define the landscape character of the study area.

Within the study area, a number of different LCZs can be defined based on the interplay of existing natural and built features. The LCZs are (refer **Figure 17**):

1. Bringelly - between Mersey Road and the transmission line easement
2. Duncans Creek - the Duncans Creek catchment around Willowdene Avenue
3. Luddenham Plateau - between Eaton Road and Littlefields Road
4. Cosgrove Creek - the valley surrounding Adams Road
5. Mulgoa-Orchard Hills - north of Littlefields Road.

The following provides a detailed description of each LCZ.

#### **LCZ 1 - Bringelly**

The Bringelly LCZ is situated in the upper catchment of Badgerys and Duncans Creeks and includes much of the land within the Leppington Pastoral Company. The landscape is generally broad with gently sloping ridges creating an open and expansive rural landscape setting, interspersed with remnant vegetation, farm dams and buildings. Denser vegetation along Badgerys Creek provides a frame at the southern end of this LCZ.

Currently the landscape itself is the visually most prominent element. Much of the motorist's experience relies on this 'borrowed' rural landscape outside the road corridor.

North of the TransGrid easement along the existing The Northern Road alignment, the major north-south ridge crosses the corridor. This high point represents the transition from the Bringelly LCZ to the Luddenham Plateau. From here, the major ridge runs first south-west and then south, approximately half way between the existing and proposed alignments of The Northern Road.

Long-distance views within the Bringelly LCZ are limited as a result. There are occasional glimpses of the Blue Mountains in the west with the majority of views extending into the mid distance across open pastures.

The existing character of The Northern Road in the Bringelly LCZ is consistent with its rural setting. It consists of a two lane road (one lane for each direction) with a curving horizontal and rolling vertical alignment that creates a distinct "country road" character.

It is noted that the character of this LCZ will change substantially as the Western Sydney Airport will be developed.

## CONTEXTUAL ANALYSIS

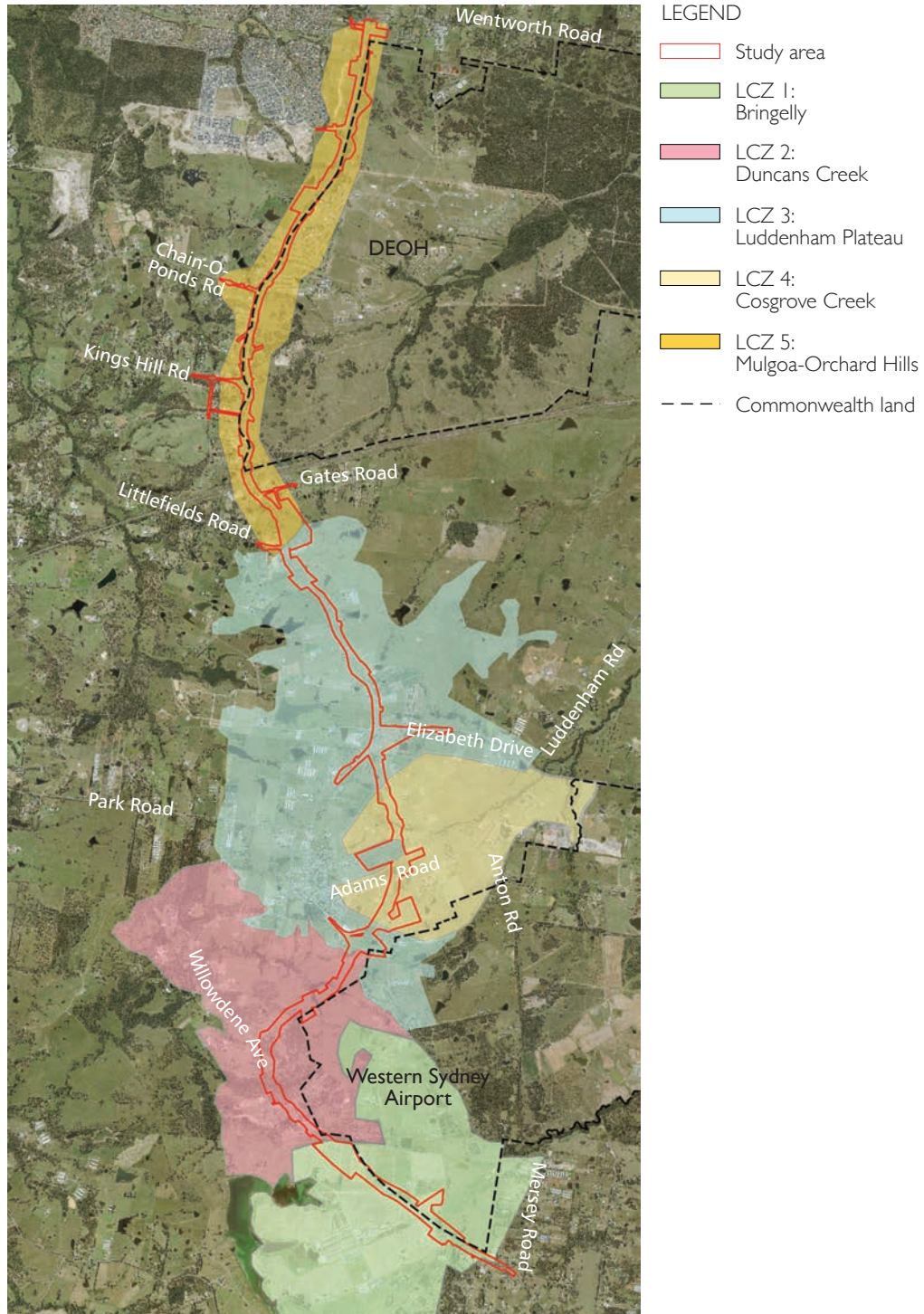


Figure 17: Landscape Character Zones surrounding the study area

## CONTEXTUAL ANALYSIS

### **LCZ 2 - Duncans Creek**

The Duncans Creek LCZ is located west of the main ridge line. It is centred around the Duncans Creek catchment and generally includes areas surrounding Willowdene Avenue.

The Duncans Creek LCZ is visually diverse. It includes a mix of open pastures and extensive stands of Cumberland Plain Woodland both around dams and along creek lines. Land uses include rural residential living, and a combination of small and large farms including horse studs.

Contrasting with the open and more gently sloping landscape around The Northern Road's existing alignment and areas further east, the Duncans Creek LCZ contains a number of steep and narrow valleys that cross Willowdene Avenue and retain extensive stands of native vegetation. As a result of the complex pattern of steep topography and remnant vegetation, the area is visually self-contained and views are generally limited to short-distance views.

Willowdene Avenue is the major public road providing access to the Duncans Creek LCZ. It is a generally narrow two-lane country road that gently curves to follow the natural undulations of the landscape without major cut or fill embankments.

The parts of the Duncans Creek LCZ east of the proposed new road alignment are located within the site of the Western Sydney Airport. This area will change substantially as the airport is developed.

There are currently no published plans that indicate that the part of the LCZ west of the proposed new road alignment will change in the foreseeable future. The proposed new road alignment is therefore likely to form the boundary between two distinct future land uses and their respective landscape character.

### **LCZ 3 - Luddenham Plateau**

The Luddenham Plateau LCZ is characterised by its location along a broad ridge from where the landscape drops away to the east and west, creating the character of a high plateau characterised by open sky and expansive views in all directions. This landscape setting provides for panoramic views into the surrounding landscape, ranging from the Blue Mountains in the west to Cecil Hills and the Western Sydney Parklands in the east.

The LCZ has been extensively cleared, and retains only scattered remnants. The majority of land is used for a variety of agricultural purposes with the exception of the Luddenham town centre, located towards the southern end of the LCZ. Luddenham is a small rural settlement that is distinct from surrounding areas by its relatively tight clustering of buildings.

Luddenham town centre is the local centre servicing surrounding rural areas. It features community services and institutions including a post office, churches and schools, the local showground and parks, as well as a number of shops including cafes, service stations and a supermarket. They are surrounded by a small conglomeration of residential dwellings on suburban blocks.

Vegetation within the town consists of a mix of native vegetation remnants and cultural plantings associated with residential properties including exotic trees and shrubs and manicured lawns.

While buildings and trees limit views to a degree, there are some expansive views from Luddenham town centre towards the east and west, including along a number of streets, from properties around the perimeter of the town and from parks or across vacant lots.

## CONTEXTUAL ANALYSIS

The Northern Road within the Luddenham Plateau LCZ generally follows the ridge line. As a result motorists enjoy extensive panoramic and long-distance views. In particular the Blue Mountains provide an almost constant backdrop to the west, with the exception of Luddenham town centre where views are partially interrupted by buildings and vegetation.

Views create highly memorable moments along the route and much of the motorists' experience is defined by the 'borrowed' landscape outside the road corridor. Long-distance views to the Blue Mountains and the Western Sydney Parklands are also important because they connect the corridor to its larger landscape setting and create a unique sense of place.

The character of The Northern Road within the LCZ is consistent with the rural setting. It is comprised of a two lane road (one lane for each direction) with a gently curving horizontal and vertical alignment.

It is noted that the character of the parts of the LCZ east of the proposed new road alignment will change substantially as the Western Sydney Airport will be developed. Similarly to the Duncans Creek LCZ, there are no current plans that indicate major changes to land uses around Luddenham town centre and along The Northern Road north of Elizabeth Drive.

### **LCZ 4 - Cosgrove Creek**

Cosgrove Creek LCZ is located between Eaton Road and Elizabeth Drive and includes land along Cosgrove Creek and its tributaries. The land in this area has been extensively cleared and retains only scattered remnants, mostly along Cosgrove Creek and its tributaries. The majority of the land is used for rural uses including rural residential living and small farms.

As for the Duncans Creek LCZ, the character of Cosgrove Creek is unique in comparison to the majority of the gently undulating landscape surrounding much of the study area. It is characterised by a series of small but sharply defined and relatively steep valleys that are in sharp contrast to the broad landscape of the Luddenham Plateau.

Adams Road is at the heart of the LCZ and follows the main valley floor along Cosgrove Creek. It provides an important link between the Luddenham town centre and the north-eastern parts of Luddenham around Luddenham Road. Within the Cosgrove Creek LCZ Adams Road is a two-lane country road framed by relatively steep hills to the south and a series of farm dams stepping down along the valley on its northern side.

Due to the topography, views from within the Cosgrove Creek LCZ are generally limited to short- to mid-distance views contained by surrounding ridge lines. However, the area is exposed to views into it from surrounding elevated areas, in particular from the higher ridges of the Luddenham Plateau such as along The Northern Road and Eaton Road.

It is noted that Cosgrove Creek is located within the WSPGA. As a result, the landscape character of this zone will likely change substantially over the coming decades, as the area is progressively developed for employment lands.

## CONTEXTUAL ANALYSIS

### **LCZ 5 - Mulgoa - Orchard Hills**

The character of the landscape changes at Littlefields Road as the main north-south ridge narrows and the topography surrounding the road corridor becomes more varied, steeper and more sharply defined. Land use consists of smaller rural holdings, rural residential living as well as the DEOH. The Mulgoa-Orchard Hills LCZ retains considerably more remnant native vegetation than is the case for the LCZs to the south.

The Mulgoa-Orchard Hills LCZ is characterised by being visually largely self-contained, as topography and vegetation cover combine to close off the panoramic views characteristic of the Luddenham Plateau. There are mid-distance views to the east framed by the rolling ridges and remnant woodlands within the DEOH. The major north-south ridge for the most part is located just west of the road corridor and is relatively steep, limiting views towards the west to areas immediately adjoining the road corridor. As the road rises and falls between a series of high points, there are occasional brief glimpses towards the Blue Mountains.

The Northern Road is consistent with the rural setting. It consists of a two lane road (one lane for each direction) with a gently curving horizontal and vertical alignment.

The character of this LCZ is unlikely to change in the foreseeable future as there are no known plans for land use changes. While residential estates are being developed in areas such as Glenmore Park, they are located west of the main ridge line and are not visible from The Northern Road corridor.

## CONTEXTUAL ANALYSIS

### 2.5 SUMMARY OF KEY FINDINGS

The following summarises the key findings and values from the analysis in terms of the opportunities they represent for the urban and landscape design:

1. **Distinct land uses**

The section of The Northern Road proposed to be upgraded will be defined to a large extent by adjoining land uses.

*Opportunity:*

Design the corridor to reinforce and reflect this distinction, as follows:

- Rural landscape in the north comprising of rural, rural residential and Defence uses
- A combination of rural, airport and employment lands in the south

2. **Interface location of the re-aligned corridor section**

In the southern part of the study area, The Northern Road will be located at the interface between rural and urban (future airport and employment lands).

*Opportunity:*

Design the corridor to enhance the interface and reinforce the rural character of areas to the west.

3. **Areas of scenic and landscape values:**

Large parts of the study area and surrounding lands in the Penrith LGA are recognised as possessing important scenic and landscape values that are captured by environmental planning instruments.

*Opportunity:*

Protect scenic and landscape values, by minimising the scale of the infrastructure where possible and by reinforcing the existing landscape and scenic character.

4. **Panoramic views**

The area around the Luddenham town centre is located on a high plateau that affords panoramic views in all directions, extending east to Western Sydney Parklands and west to the Blue Mountains. The Blue Mountains provide a constant blue ribbon framing the western outlook. These views are integral to the sense of place of the area, provide a sense of geographic location for motorists and contribute substantially to the scenic value and tourism potential of the drive along The Northern Road.

*Opportunity:*

Retain panoramic views for both motorists and viewers from surrounding areas, to maintain the sense of place as well as a visually exciting drive.

5. **Remnant Cumberland Plain Woodland**

The area retains areas of endangered Cumberland Plain Woodland, in particular around the perimeter of the Western Sydney Airport site and north of the Water NSW supply pipelines.

*Opportunity:*

Protect and enhance remnant vegetation. Carefully balance softworks for the proposed upgrade with the operational requirements of the Western Sydney Airport and the desire to maintain distinct views.

## CONTEXTUAL ANALYSIS

### 6. Creeks and farm dams

There are a number of creeks in the area, as well as a large number of farm dams. Both are frequently associated with vegetation remnants and make an important contribution to the landscape and visual character and the experience of the drive, including its scenic values. Creeks have also been identified as holding potential to provide regional recreational links, integral to the realisation of the *Sydney Green Grid* (refer **section 2.2.2**).

*Opportunity:*

Celebrate creek crossings and design them to enhance their potential as ecological links, as well as potential future regional pedestrian cycling links as identified in the *Sydney Green Grid*.

## 3. DESCRIPTION OF THE PROJECT

### 3.1 OVERVIEW

#### 3.1.1 Key features

Roads and Maritime is seeking approval to upgrade 16km of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park (the project). The project generally comprises the following key features:

- A six-lane divided road between Mersey Road, Bringelly and Bradley Street, Glenmore Park (two general traffic lanes and a kerbside bus lane in each direction separated by a wide central median) with a wide central median allowing for provision of an additional travel lane in each direction in the future, if required
- An eight-lane divided road between Bradley Street, Glenmore Park to about 100 m south of Glenmore Parkway, Glenmore Park (three general traffic lanes and a kerbside bus lane in each direction separated by a median)
- About eight kilometres of new road between Mersey Road, Bringelly and just south of the existing Elizabeth Drive, Luddenham, to realign the section of The Northern Road that currently bisects the Western Sydney Airport site and to provide a bypass to access the Luddenham town centre
- About eight kilometres of upgraded and widened road between the existing Elizabeth Drive, Luddenham and about 100m south of Glenmore Parkway, Glenmore Park
- Closure of the existing The Northern Road through the Western Sydney Airport site
- Tie-in works with the following projects:
  - The Northern Road Upgrade, between Peter Brock Drive, Oran Park and Mersey Road, Bringelly (to the south)
  - The Northern Road Upgrade, between Glenmore Parkway, Glenmore Park and Jamison Road, South Penrith (to the north)
- New intersections including:
  - Traffic light intersection connecting the existing The Northern Road at the southern boundary of the Western Sydney Airport, incorporating a dedicated u-turn facility on the western side
  - Traffic light intersection for service vehicle access to the Western Sydney Airport, incorporating 160m of new road connection to the airport boundary
  - Traffic light intersection connecting the realigned The Northern Road with the existing The Northern Road (west of the new alignment) south of Luddenham
  - An un-signalised (give way controlled) intersection connecting the realigned The Northern Road with Eaton Road (east of the new alignment, left in, left out only)
  - A four-way traffic light intersection formed from the realigned Elizabeth Drive, the realigned The Northern Road and the existing The Northern Road, north of Luddenham
  - A traffic light intersection at the Defence Establishment gates, Orchard Hills, incorporating a u-turn facility.
- New traffic light signals at four existing intersections:
  - Littlefields Road, Luddenham
  - Kings Hill Road, Mulgoa
  - Chain-O-Ponds Road, Mulgoa
  - Bradley Street, Glenmore Park incorporating a u-turn facility.

## PROJECT DESCRIPTION

- Modified intersection arrangements at:
  - Dwyer Road, Bringelly (left in, left out only)
  - Existing Elizabeth Drive, Luddenham (left out only)
  - Gates Road, Luddenham (left in only)
  - Longview Road, Luddenham (left in, left out only)
  - Grover Crescent south, Mulgoa (left in only)
  - Grover Crescent north, Mulgoa (left out only).
- Dedicated u-turn facilities at:
  - The existing The Northern Road at Luddenham, southwest of Elizabeth Drive
  - Chain-O-Ponds Road, Mulgoa
  - The existing Elizabeth Drive, Luddenham around 800m east of The Northern Road.
- A bridge over Adams Road, Luddenham
- Local road changes and upgrades, including:
  - Closure of Vicar Park Lane east of the realigned The Northern Road, Luddenham
  - Eaton Road cul-de-sac west of the realigned The Northern Road, Luddenham
  - Eaton Road cul-de-sac east of the realigned The Northern Road, Luddenham
  - Elizabeth Drive cul-de-sac about 300m east of The Northern Road with a connection to the realigned Elizabeth Drive, Luddenham
  - Extension of Littlefields Road east of The Northern Road, Mulgoa
  - New roundabout on the Littlefields Road extension, Mulgoa
  - A new service road between the Littlefields Road roundabout and Gates Road, including an un-signalised intersection (give way controlled) at Gates Road, Luddenham
  - Extension of Vineyard Road, Mulgoa between Longview Road and Kings Hill Road
  - A new roundabout on the Vineyard Road extension at Kings Hill Road, Mulgoa.
- A new shared path on the western side of The Northern Road and pedestrian paths on the eastern side of The Northern Road
- Drainage infrastructure upgrades
- Operational ancillary facilities including:
  - Heavy vehicle inspection bays for both northbound and southbound traffic, adjacent to Grover Crescent, Mulgoa and Longview Road, Mulgoa respectively
  - An incident response facility located on the south-western corner of the proposed four-way traffic light intersection at Elizabeth Drive, Luddenham.
- New traffic management facilities including Variable Message Signs (VMS)
- Roadside furniture and street lighting
- Utility services relocations
- Changes to property access along The Northern Road (generally left in, left out only)
- Establishment and use of temporary ancillary facilities and access tracks during construction
- Property adjustments as required.

## PROJECT DESCRIPTION

### 3.1.2 Road design standards

The road geometry and earthworks has been designed using the following engineering standards listed in order of precedence:

- Roads and Maritime and RTA Publications (including 'RTA Road Design Guide')
- Austroads Publications
- Australian Standards
- Other Reference Documents and Standards.

The engineering design parameters for the road works component are summarised in the following sections.

#### *The Northern Road design criteria*

Design parameter	Value adopted in design
Design speed	90 km/h
Minimum general traffic lane width	3.5 m
Minimum bus lane width	4.0 m
Minimum auxiliary lane width	3.3 m
Minimum grade	0.5 %
Maximum grade	6 %
Cut batter slope	Generally 1 in 4 but some areas of local steepening to 1 in 2 where required
Fill batter slope	Generally 1 in 4 but some areas of local steepening to 1 in 2 where required
Bench width	4 m cut; 4.5 m fill
Design Vehicle	B-double

#### *Local road design criteria*

Design parameter	Value adopted in the design
Posted speed limit	Adams Road – Not Signposted Eaton Road – 60 km/h Vicar Park Lane – Not Signposted Dwyer Road – Not Signposted Airport Access – 60 km/h The Northern Road (Existing) – 60 km/h Elizabeth Drive - 80 km/h Littlefields Road – 80 km/h Gates Road – 60 km/h Longview Road – Not Signposted Vineyard Road – Not Signposted Kings Hill Road – 70 km/h Grover Crescent – 60 km/h Chain-O-Ponds Road – 70 km/h Bradley Street – 80 km/h
Design speed	Design speed generally the same as the posted speed

## PROJECT DESCRIPTION

Design parameter	Value adopted in the design
Minimum grade	1 %
Maximum grade	6 %
Cut batter slope	Generally 1 in 4 but some areas of local steepening to 1 in 2
Fill batter slope	Generally 1 in 4 but some areas of local steepening to 1 in 2
Bench width	4 m cut; 4.5 m fill
Design Vehicle	Dwyer Road: 19 m Semi trailer Airport Access: B-Double Eaton Road: 19 m Semi trailer The Northern Road (Existing): B-Double Adams Road: 19 m Semi trailer (List others north of Adams Road)

### 3.1.3 Road design drawings

The plans in **Figures 18, 19 and 20** on the following pages show the key design features of the proposed road design concept for the proposed upgrade. Typical road design cross sections are provided in **Figures 21 to 23**.

### 3.1.4 Water Quality and drainage design

A number of operational water quality swales are proposed across the project to capture suspended solids and reduce nutrients, including eleven swales which have been optimised to provide additional water quality treatment upstream of the five identified sensitive receiving waterways for the project (i.e. Key Fish habitat - refer **section 2.4.2**).

Optimisation measures include increased base width and rock check dams that would slow down runoff, allowing it to temporarily pond. For further detail refer the *Soils, water and contamination assessment* (Appendix L of the EIS).

#### **Aquatic impacts**

The project would require the traversing of minor waterways and farm dams. The construction and operation of the project has the potential to impact aquatic ecosystems due to changes in water quality, habitat loss and instream barriers. Inappropriate design or type of water crossing can impede or prevent fish from travelling within their natural range and barriers to fish passage can prevent breeding or re-population of waterways through restricting access to spawning grounds. For more information refer to the *Biodiversity Assessment Report* (Appendix I of the EIS).

Water crossing structures have been designed to minimise the impacts of altering the natural flow regimes of the rivers and streams within the region. The design took into consideration all waterways within the study area. Detailed design of these culverts would ensure that barriers to fish are not created, and that they are designed as fish friendly crossings, to ensure that barriers to fish are not created and impacts to the existing hydrology are minimised. For further detail refer the *Soils, water and contamination assessment* (Appendix L of the EIS) and the *Flooding and Hydrology Technical Working Paper* (Appendix K of the EIS).

## PROJECT DESCRIPTION

The urban design concept has responded to this approach by maximising native vegetation along existing creek lines and to connect existing bushland remnants where possible within the construction footprint, to enhance the ecology and drainage systems of the area - refer **section 4** and **section 5**.

### 3.2 A NOTE ON LANDSCAPE CHARACTER AND VISUAL IMPACTS

As a result of the road design parameters and the physical manifestation of that design, it can be expected that there will be an impact on the existing landscape character and views.

All works associated with the proposed works are assessed as part of the LCVIA including permanent and temporary works.

Temporary impacts are short term, direct and indirect impacts during the construction phase of the proposed works. Examples include establishment and use of construction site compounds and general daily construction activities, including material storage and stockpile sites.

Construction site compounds would comprise offices and material laydown areas and would be fenced and generally covered in hardstand. Offices would generally be prefabricated and material storage areas would include purpose built temporary structures as required. Construction site establishment would involve the placement of temporary concrete safety barriers and fencing to create a safe work zone.

Temporary works and structures have the potential to have lasting impacts. An example would be where mature vegetation required to be cleared to allow establishment of a construction compound. The visual and landscape character impacts from the loss of established vegetation would persist following removal of the compound. Wherever possible, compound site locations have been limited to areas that would not require vegetation clearing beyond that already required for the project.

The landscape character and visual impacts of the proposed works are described in **section 6** and **section 7** of this technical paper.

## PROJECT DESCRIPTION

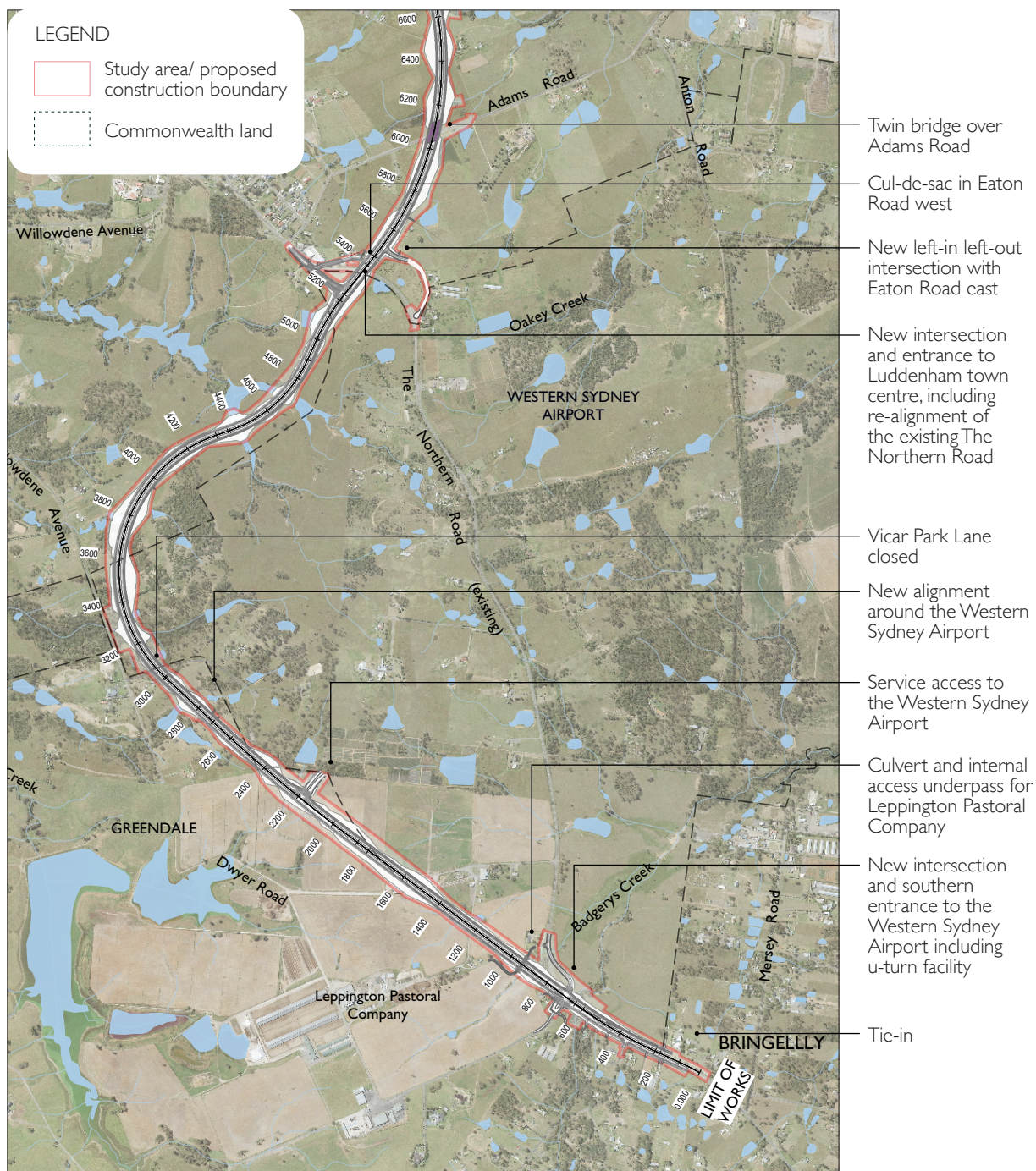


Figure 18: The proposed works - Mersey Road to Adams Road

## PROJECT DESCRIPTION

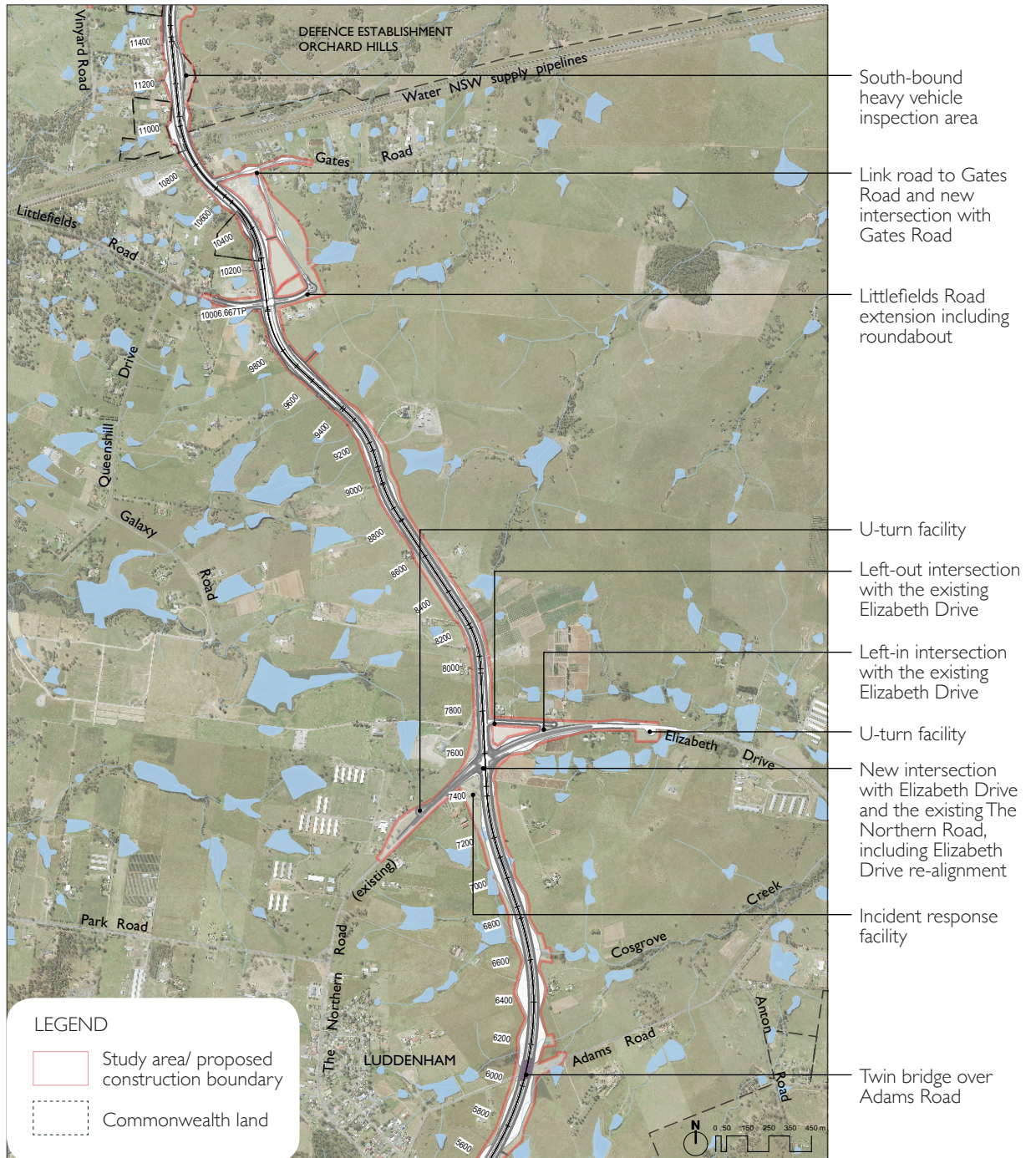


Figure 19: The proposed works - Adams Road to Water NSW supply pipelines

## PROJECT DESCRIPTION

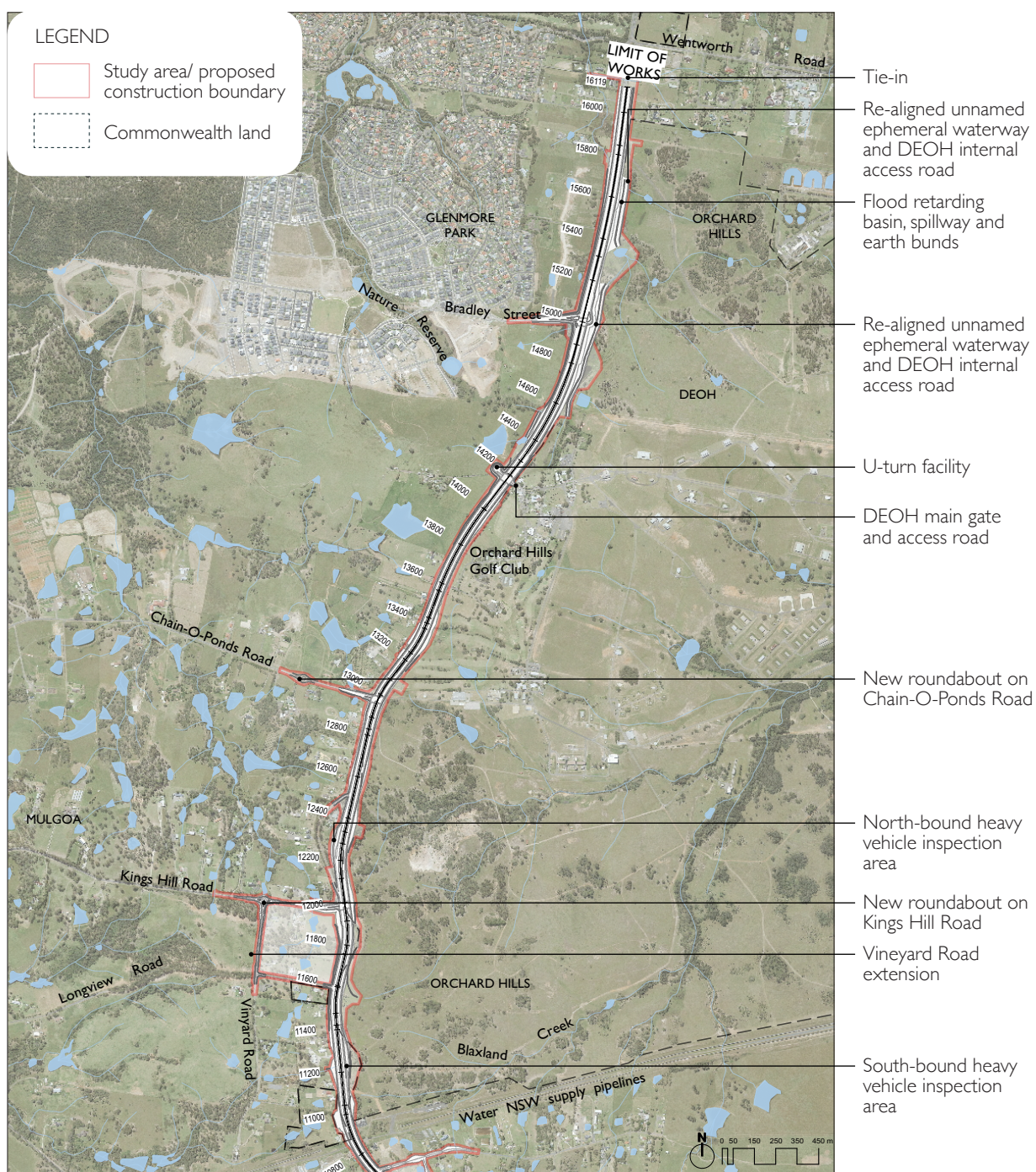


Figure 20: The proposed works - Water NSW supply pipelines to Glenmore Parkway

## PROJECT DESCRIPTION

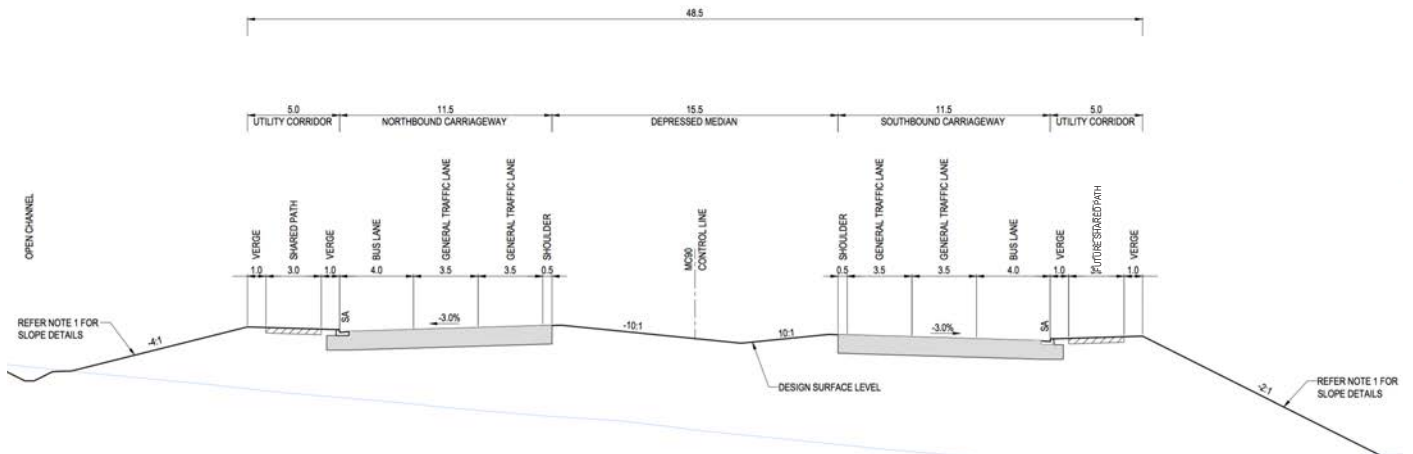
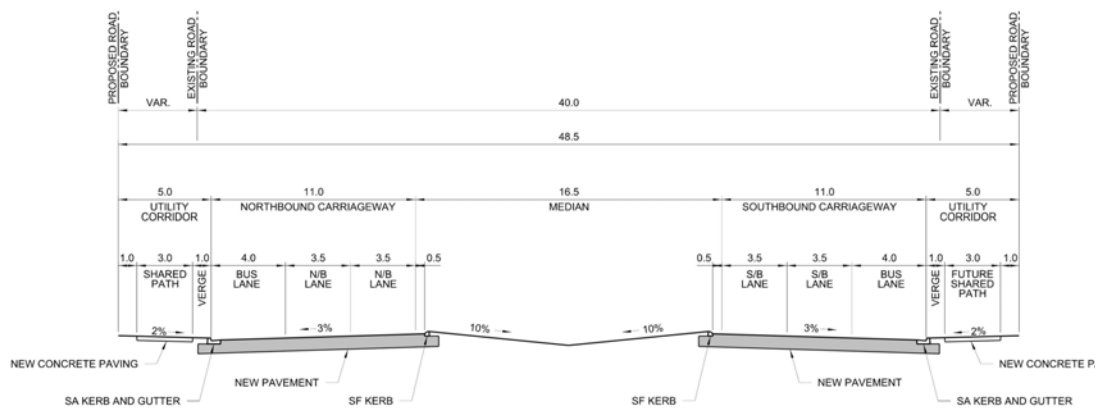


Figure 21: The proposed works - typical cross section between Mersey Road and Adams Road (source: Jacobs 2016)



The proposed works - typical cross section between Littlefields Road and Bradley Street (source: Jacobs 2016)

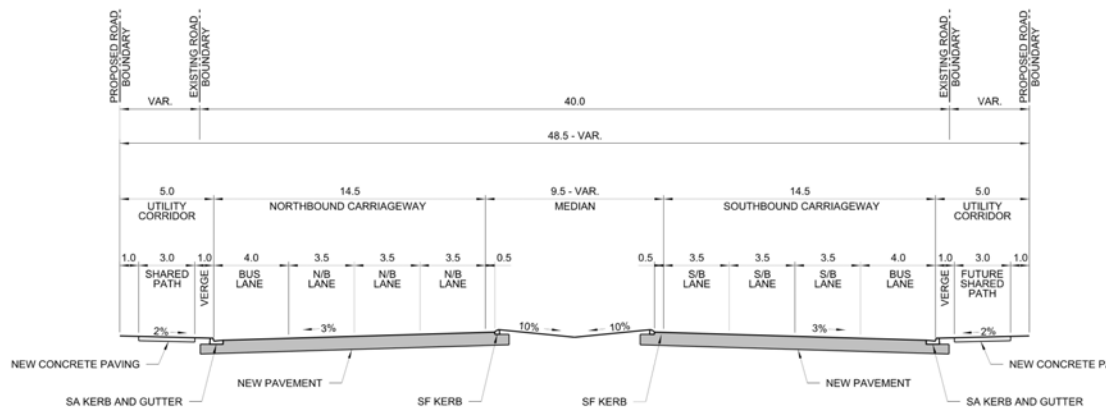


Figure 22: The proposed works - typical cross section between Bradley Street and Glenmore Parkway (source: Jacobs 2016)

## PROJECT DESCRIPTION

*This page has been left intentionally blank.*

## 4. URBAN DESIGN OBJECTIVES

In any road upgrade, the experience of the road user and viewer is improved through careful consideration of all road design elements. They include cut and fill batters, walling, drainage structures, bridges, fences and barriers, planting and landscaped surfaces.

To guide the design of these elements urban design objectives are provided.

The objectives define the most important outcomes to be achieved as a result of the project, taking into account both the road corridor and its relationship with surrounding areas. Urban design objectives would be implemented in accordance with the performance themes of safety, cost effectiveness and sustainability as outlined in *Beyond the Pavement*.

### 4.1 URBAN DESIGN VISION FOR THE NORTHERN ROAD

The following vision statement articulates the desired outcome for The Northern Road within the study area.

*The Northern Road will provide safe and efficient travel for motorists, public transport and active transport, both within, to and across the corridor. The planning and design of the road corridor will respond to the adjoining landscape and built context. Acknowledging likely future land use changes, the design for the proposed upgrade will enhance the contrast between future urban areas and areas retaining their rural land use. The latter include areas in Mulgoa and Orchard Hills known to possess significant scenic and landscape values. At the same time the proposed upgrade will provide an attractive experience on the approach to the Western Sydney Airport from the north and south that will assist in promoting a positive image for locals and visitors alike.*

It is noted that the future character and quality of the experience of the road will be determined not only by the planning and design of future upgrades of the road, itself but substantially by the planning, design and development of land adjoining the corridor including the Western Sydney Airport. In that sense the vision relies on a commitment by the Commonwealth, State and Local Government agencies to address the issues raised in this technical paper; and to implement the urban design objectives, principles and strategies set out in this section.

## URBAN DESIGN OBJECTIVES

### 4.2 URBAN DESIGN OBJECTIVES AND PRINCIPLES

The urban design objectives and principles for the project have been developed based on:

- **The Brief**  
The brief for the project seeks to develop and present an integrated engineering and urban design outcome that:
  - Fits sensitively into the built, natural and community environments through which they pass, is well designed and contributes to the character and functioning of the area
  - Contributes to the accessibility and connectivity of people within regions and communities
  - Contributes to the overall quality of the public domain for the community and all road users.
- **The South Western Sydney Urban Design Strategy**  
The SWSUDS provides guidance in respect of the desired outcomes for the road network of the area.
- **The Northern Road Corridor Plan of Management (CPoM) Narellan to Bringelly**  
The *Northern Road CPoM* provided design objectives and principles for the sections of The Northern Road south of Bringelly Road. Consistent with the corridor approach to the design of the road network promoted by the SWSUDS, these objectives and principles are of relevance to achieve a consistent corridor outcome.
- **The Northern Road upgrade between Glenmore Parkway and Jamison Road**  
Consistent with the corridor approach to the design of the road network promoted by the SWSUDS, the design objectives and principles identified for the upgrade of The Northern Road north of Glenmore Parkway are of relevance to achieve a consistent corridor outcome.
- **Beyond the Pavement**  
*Beyond the Pavement* is the overarching Roads and Maritime policy guiding urban design on all its projects. It outlines nine design principles to achieve an integrated engineering and urban design outcome for all Roads and Maritime projects.

The following four overarching urban design objectives have been adopted:

1. Protect and enhance existing views, character and cultural values of the corridor
2. Provide a flowing road alignment that is responsive to, and integrated with the natural and built landscape
3. Facilitate the provision of good urban design outcomes for areas adjoining the road
4. Develop a simple and unified palette of elements and details that are attractive and easily maintained.

The following pages provide the more detailed urban design principles for each of the four objectives.

## URBAN DESIGN OBJECTIVES

### **Objective 1: *Protect and enhance existing views, character and cultural values of the corridor.***

#### VIEWS AND VISTAS

- Provide an interesting driver experience by drawing on existing vistas and views to create contrast between open and enclosed sections of the route
- Maximise opportunities to enhance the driver experience through views into the surrounding landscape to foster a sense of place and local connection. In particular, maximise and enhance opportunities for views of the Blue Mountains and the Prospect Ridge
- Retain existing views beyond the road corridor, especially views to the Blue Mountains and panoramic views from the Luddenham Plateau, to establish a sense of place for the journey along The Northern Road.

#### LANDSCAPE CHARACTER

- Retain and reinforce the diverse character of the route, including the distinction between the rural north and west and future residential employment lands in the east and south, taking advantage of rural lands to provide an attractive gateway to and from the WSPGA and the Western Sydney Airport.
- Maintain, reinforce and integrate the diversity of landscape types and characters into the design of the road corridor, including the distinction between woodlands, open pastures and small rural holdings as well as future employment and airport lands
- Maintain and enhance the landscape experience of the drive
- Screen future industrial areas from the corridor to maintain the landscape experience and scenic values of the route and use vegetation to frame views of the rural landscape
- Enhance intersections as key landscape nodes that build on the current landscape character and provide an attractive landscape along the route
- Integrate and enhance - and where required reinstate - existing indigenous vegetation communities, to enhance the sense of place, maximise integration with the existing landscape setting, restore ecological values and assist in biodiversity protection and recovery
- Strengthen riparian corridors and creeks through regenerative planting and design creek crossing to enable future pedestrian/ cycle links along creeks and across the corridor, to assist with the establishment of an interconnected network of open space consistent with the Sydney Green Grid.

#### CULTURAL VALUES

- Recognise and protect the character of the Luddenham town centre
- Retain and protect existing heritage and scenic values of the area
- At entrances to the Luddenham town centre, provide feature planting that is consistent with the character of the town.

## URBAN DESIGN OBJECTIVES

**Objective 2:** *Provide a flowing road alignment that is responsive to, and integrated with the natural and built landscape.*

### LANDSCAPE AND VEGETATION

- Prioritise the replanting of EEC where these have been removed or where the *Biodiversity Assessment Report* (Appendix I of the EIS) identifies the need to enhance corridors
- Reduce median widths to create wider areas for new trees and other vegetation along the edges of the corridor while maintaining opportunities for vegetation in the median
- Enhance the scenic and landscape values of Orchard Hills with new trees to complement existing woodlands
- Devise a landscape strategy that is consistent with the landscape character adjoining the road corridor, including existing uses and settlement patterns, and proposed future land uses
- Control the placement of utilities in the corridor. Locate utilities in a way that maximises vegetation opportunities, particularly at the interface with the Orchard Hills Scenic Landscape Area
- Use safety barriers to maximise areas available for new trees in medians, between carriageways and along utility corridors.

### HYDROLOGY

- Protect creeks and creek banks by maximising tree retention and reinstatement at creek crossings
- Develop designs for creek and road crossings having consideration for the local hydrology and ecology of the area. In particular, ensure physical continuity of natural streams and maintain ecological links across the road corridor to protect and conserve the existing ecology and habitat
- Regenerate native vegetation around creek crossings to provide a landscape buffer and enhance creeks as ecological corridors
- Design stormwater management and water quality controls to protect receiving waterways and contribute to a positive landscape and visual outcome. Integrate natural materials to provide for habitat.

### LANDSCAPE FIT

- Minimise the corridor footprint and the extent of cuttings and embankments on the outsides of the corridor by independently grading the carriageways, using the median to mitigate level changes
- Design major formations like embankments and mounding to mirror the natural topography of the landscape as much as possible and to create a seamless fit with the existing setting. Design embankments to maintain the sense of an open and expansive landscape with uninterrupted views for both motorists and people in surrounding areas
- Minimise the footprint and scale of the road, intersections, overhead structures and associated fill embankments to reflect the gently undulating rural setting.

### STRUCTURES

- Where required, design structures including retaining walls and embankments to reflect and integrate with the adjoining largely rural setting and to maintain the open landscape character
- Design drainage structures as landscape elements to enhance and complement the rural landscape interface and incorporate water sensitive urban design (WSUD) to treat stormwater before entering creeks or permanent water bodies.

## URBAN DESIGN OBJECTIVES

### **Objective 3: *Facilitate the provision of good urban design outcomes for areas adjoining the road.***

#### COMMUNITIES

- Protect the amenity of surrounding communities, in particular the rural town of Luddenham, rural residential areas and farms
- Design intersections to provide attractive and inviting entrances to Luddenham
- Minimise lighting and signage as much as possible to reflect the predominantly rural character of the area to the west of the corridor. Ensure all lighting and signage is unobtrusive in the landscape, including at night.

#### ACCESS TO PUBLIC TRANSPORT AND OPPORTUNITIES FOR ACTIVE TRANSPORT

- Retain and maximise the accessibility and connectivity of adjoining existing and future communities for all users including motorists, public transport users, cyclists and pedestrians. Maximise the safety, convenience and ease of access through direct routes and connections
- Ensure ease of access to bus stops, including from the local street network and across the road corridor from both existing and future destinations such as residential centres and employment areas
- Provide a high level of amenity at bus stops including protection from sun, wind and rain, as well as lighting for orientation and safety
- Maximise opportunities for active transport connections. In particular, provide opportunities for pedestrian and bicycle access from The Northern Road to public transport and future employment areas including the WSPGA and the Western Sydney Airport, to encourage greater active transport use.

#### ACCESS

- Maintain short- and medium-term access to lands within the Western Sydney Airport during construction
- Provide for access to all properties from and across the corridor, including access between farm lands bisected by the new alignment
- Maximise the visibility of paths and shared paths from adjoining areas for good surveillance, sight lines and ease of orientation
- Provide lighting to shared paths and footpaths, consistent with statutory requirements, to ensure paths are safe and attractive for use during the evening and night-time.

### **Objective 4: *Develop a simple and unified palette of elements and details that are attractive and easily maintained.***

- Use robust, high quality and durable materials that minimise opportunities for vandalism
- Provide simple finishes that remain subservient to the landscape
- Design bridges as structures to appear as simple and elegant structures of contemporary form and scale that complement the surrounding environment
- Design the soffit of bridges with a visually attractive form, particularly in areas that will be highly visible to motorists and the general public
- Generally limit road lighting to major intersections to reduce glare and retain the character of existing rural areas along the corridor.

## URBAN DESIGN OBJECTIVES

### 4.2.1 Urban design principles for road design elements

Standard road elements may include road furniture (safety barriers, pedestrian and shared path fencing, bus stops, street lighting, signage), retaining walls, shared paths and bridges. Principles have been developed to guide the design development of standard road design elements, as described in the following section.

#### ***Pedestrian and shared paths***

- Provide a planted verge of at least 0.8 metres for native grasses between the back of kerb and the path, to provide physical separation from the carriageway. Where the width of the planted verge would be narrower than 0.8 metres, replace the verge with additional paving to provide a wider (shared) path
- Maximise the visibility of paths and shared paths from adjoining areas for good passive surveillance, sight lines and ease of orientation
- Concrete to be broom finished. Use a mid grey colour to reduce glare. Use exposed aggregate thresholds with adequate tonal variation to alert cyclists to potential points of conflict such as upcoming intersections or bus stops
- Make provision for connections to future residential and employment areas in the SWPGA, WSPGA and the Western Sydney Airport.

#### ***Fencing***

- Maintain a scale and rhythmic use of fencing elements consistent with surrounding land uses, for example, where the road adjoins rural properties, use visually open fences similar to existing fence styles
- Provide a cyclist safety rail on bridges and other areas as required - refer **Figure 24**.
- On bridges, provide transparent safety barriers and anti-throw screens to maximise opportunities for views - refer **Figure 24 and 25**.

#### ***Bus stops***

- Provide sufficient area to accommodate bus stop infrastructure including bus shelters, signs and shared paths
- Ensure ease of access to bus stops, including from the local street network and across the road corridor
- Provide a high level of amenity at bus stops including protection from sun, wind and rain
- Ensure bus stop areas are well lit for orientation and safety
- Provide transparent sides on bus shelters for maximum passive surveillance and views of the road corridor and of approaching buses
- Provide textured ground surface finishes to differentiate the bus shelter zone, for example exposed aggregate concrete. Provide enough space for the shared path to continue through the bus stop zone.

#### ***Lighting fixtures***

- Provide street lighting or adjustments to existing street lighting as required
- Provide street lighting along the full length of the project to light the carriageway and shared path
- Design or adjust existing and proposed street lighting in the vicinity of the Western Sydney Airport site to ensure lighting intensity, configuration and colour meets the relevant guidelines, including but not limited to:

## URBAN DESIGN OBJECTIVES

- The *National Airports Safeguarding Framework Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports*
- *Regulation 94 of the Civil Aviation Regulations 1988*
- As much as possible design road lighting to reduce glare and retain the character of existing rural areas along the corridor while creating a safe place and meeting statutory requirements
- Use planting to minimise the potential for direct glare, chronic or periodic increased illumination, and temporary unexpected fluctuations in lighting (including lights from a passing vehicles) to adversely affect wildlife
- Where possible, use vegetation to provide visual buffers reducing the potential for glare and headlight disturbance to residents adjoining the corridor
- Light fixtures and fittings are to be of the standard adopted for other areas of the SWPGA and WSPGA.

### **Bridges**

- Provide simple and elegant structures designed in accordance with the *Roads and Maritime Bridge Aesthetics Guidelines*
- Ensure a consistent geometry of all bridge elements.
- Minimise disturbance to creek beds and riparian zones including farm dams and remnant vegetation
- Use viaducts and spill-through abutments instead of reinforced retaining structures to support bridges to maximise openness and natural light levels beneath bridges, and to avoid a 'tunnel' effect - refer **Figure 25**
- Provide a separate bridge deck for each carriageway to maximise light access below the Adams Road bridge
- Provide cyclist safety barriers on bridge to separate shared paths from carriageways - refer **Figure 24**
- Ensure that a neat and simple transition is provided between the bridge rail and the road safety barrier - refer **Figure 24**
- Provide transparent throw screens and ensure that the throw-screen is well integrated with the bridge structure - refer **Figure 24** and **Figure 25**.

### **Drainage infrastructure**

- Maximise "green" infrastructure over hard engineering solutions, including drainage structures and swales, to maintain and protect the rural landscape character and outlook
- Produce positive urban design outcomes and minimise impacts on the natural environment through WSUD treatments to stormwater before entering major creeks. Ensure that treatment systems and any proposed stormwater controls are consistent with the landscape and visual values of the area, provide a landscape buffer and enhance creeks as ecological corridors.
- Where hard engineering structures or surfaces can't be avoided, maximise the use of natural rock over concrete for improved visual integration with the adjoining rural landscape
- For creeks identified as important fish habitat design fish friendly crossings and provide light wells to culverts to maximise light access and to maximise the potential for creeks to continue to function as ecological links through covered sections.

Note: no permanent water quality or sedimentation basins are proposed.

## URBAN DESIGN OBJECTIVES



Figure 23: Examples of neat and simple integrated safety barriers between the carriageway and the shared path. Transparent throw screens provide for views into surrounding areas (source: <http://www.noise-barriers.org/img/clear-sound-barrier.jpg>)



Figure 24: This bridge designed for the Hume Highway Duplication provides an example of visually transparent wire mesh throw screens, as well as of how the sense of openness under the bridge can be increased through the use spill-through abutments that avoid a 'tunnel feel'. It further illustrates an example of a simple and bold pier design (source: <http://www.rms.nsw.gov.au/projects/planning-principles/centre-for-urban-design/achievements/images/hume-highway-duplication-2.jpg>)

## 5. URBAN DESIGN CONCEPT

### 5.1 OVERVIEW

The urban and landscape design concept has been developed based on the project objectives and principles, to achieve an integrated concept design for the project. It describes the relationship between the proposed road work, structures including bridges and the adjoining areas, based on the current engineering concept design.

The urban and landscape design concept identifies a series of works recommended for implementation within the identified construction footprint of the proposed upgrade, in conjunction with the construction of the engineering works. It seeks to provide a balance between the hard and soft elements of the project to deliver a project that makes a positive contribution to its setting.

The urban design concept consists of several components:

1. An urban design strategy outlining the overall approach to the design
2. Recommendations for road design elements including embankments, structures such as bridges and walls, hydrological features and roadside elements and furniture
3. A landscape planting concept including recommended species
4. Urban design concept plans at 1:5,000 describing main treatments and outcomes
5. A series of cross sections illustrating the outcomes and treatments in the third dimension, including interfaces with adjoining areas and the local road network
6. An elevation of the proposed Adams Road bridge to illustrate the relationship with the project and the local road network.

#### 5.1.1 Basis for future work

The urban design concept provides the basis for the environmental assessment of the project, including the landscape character and visual impact assessments in **sections 6 and 7** of this paper.

Together with the mitigation measures proposed in **section 8**, the concept design provides guidance towards the future detailed design and construction documentation. The mitigation measures are a series of opportunities to maximise integration of the project into the study area.

The detailed design and documentation of this work, both inside and outside the project area, would be the subject of comprehensive consultation with a range of stakeholders including State Government agencies, Penrith City Council, Liverpool City Council and the local community.

#### 5.1.2 Background documents

In order to achieve a high standard in urban design, this report considers a comprehensive list of design guideline documents set out by Roads and Maritime. This report has been carried out with reference to the following published Roads and Maritime documents:

- Beyond the Pavement
- Bridge aesthetics
- Landscape guideline
- Shotcrete design guidelines
- Water sensitivity urban design guideline
- Biodiversity guidelines

# URBAN DESIGN CONCEPT

## 5.2 URBAN DESIGN STRATEGY

The urban design strategy for the project is a large-scale diagram that translates the urban design principles and objectives into an overall urban design approach. It provides the basis for the development of the urban design concept plans and sections.

There are two important components to the urban design strategy:

1. Vegetation and views - refer **Figure 26**
2. Access and connections - refer **Figure 27**.

More detail is provided in the respective sections below.

### 5.2.1 Vegetation and views

Based on the findings of the contextual analysis, the study area can be divided into three broad urban design treatment zones. The treatment zones have been derived based on the identified LCZs and in consideration of the planned future land use changes in the areas surrounding the proposed upgrade.

The treatment zones are:

1. Badgerys Creek
2. Luddenham High Plateau
3. Orchard Hills

The treatment zones are illustrated in **Figure 26**. They broadly correspond to the LCZs through which the alignment of the upgraded The Northern Road passes and takes into account the planned land use changes both existing character and proposed.

Consistent with the urban design principles for vegetation and protection of prominent views, the urban design strategy seeks to provide for a balanced approach. The following are the design principles for each treatment zone.

#### **Badgerys Creek**

The design considerations within the Badgerys Creek treatment zone are:

1. Complement the existing character of a mix of open pasture and stands of Cumberland Plain Woodland vegetation
2. Reinforce creeks as ecological corridors as well as potential future open space links and networks
3. Stabilise cuttings with Cumberland Plain Woodland and endemic vegetation as appropriate
4. Provide for views to the Blue Mountains
5. Use vegetation to screen the Western Sydney Airport and designated future employment lands, subject to Obstacle Limitation Surface (OLS) and other airport operational and safety requirements
6. Design intersections as landscape features
7. Use vegetation to provide visual buffers to protect the outlook to the east for residents in Luddenham.

## URBAN DESIGN CONCEPT

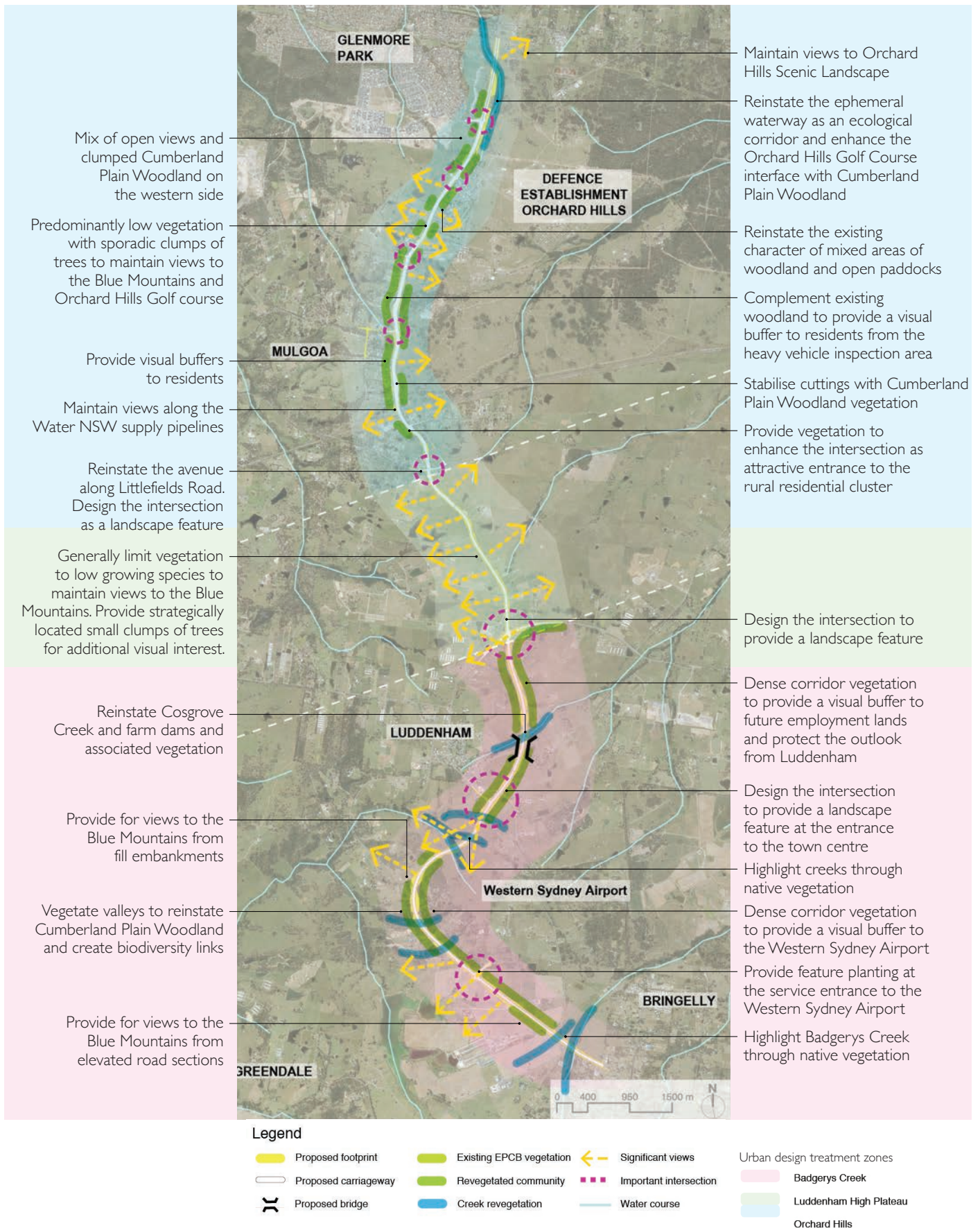


Figure 25: Urban design strategy for vegetation and views showing broad urban design treatment zones

## URBAN DESIGN CONCEPT

### **Luddenham High Plateau**

The design considerations within the Luddenham High Plateau treatment zone are:

1. Provide predominantly low vegetation to maintain distinctive long-distance views to both the east and the west
2. Provide sporadic small tree clumps to complement the existing character of paddocks with remnant trees. Strategically locate trees to maintain residents' views towards the Blue Mountains.

### **Orchard Hills**

The design considerations within the Orchard Hills treatment zone are:

1. Complement the existing character of a mix of open pasture and stands of Cumberland Plain Woodland vegetation
2. Reinforce creeks as ecological corridors as well as potential future open space links and networks
3. Stabilise cuttings with Cumberland Plain Woodland and endemic vegetation as appropriate
4. Provide for views to the Blue Mountains
5. Use Cumberland Woodland vegetation to provide a screen for residents fronting The Northern Road
6. Design intersections as landscape features to provide a positive arrival experience for rural residential clusters accessed from the route.

### **5.2.2 Access and connections**

The dividing median within the proposed alignment introduces a change to the allowable movements from properties onto The Northern Road. Changes to access arrangements for the majority of properties that currently have access directly onto The Northern Road and some properties that have access along roads that connect to The Northern Road would occur as a result of the project.

Additionally, the proposed alignment around the Western Sydney Airport and the Luddenham town centre deviates from the existing road corridor to run through rural properties. This would result in new segments of land that require access to the proposed alignment.

Proposed alternative access routes and arrangements are outlined in the *Traffic and Transport Assessment* (Appendix G of the EIS) prepared for the project.

Roads and Maritime would work with its construction contractor (once selected) to ensure that access to properties can be maintained throughout construction or alternate arrangements would be negotiated with relevant property owners.

The access and connections diagram highlights particular opportunities to achieve improved access and connections between the project and surrounding areas. In particular, there are a number of opportunities to enhance provision for active transport to realise positive community outcomes. The strategy is illustrated in **Figure 27**.

## URBAN DESIGN CONCEPT

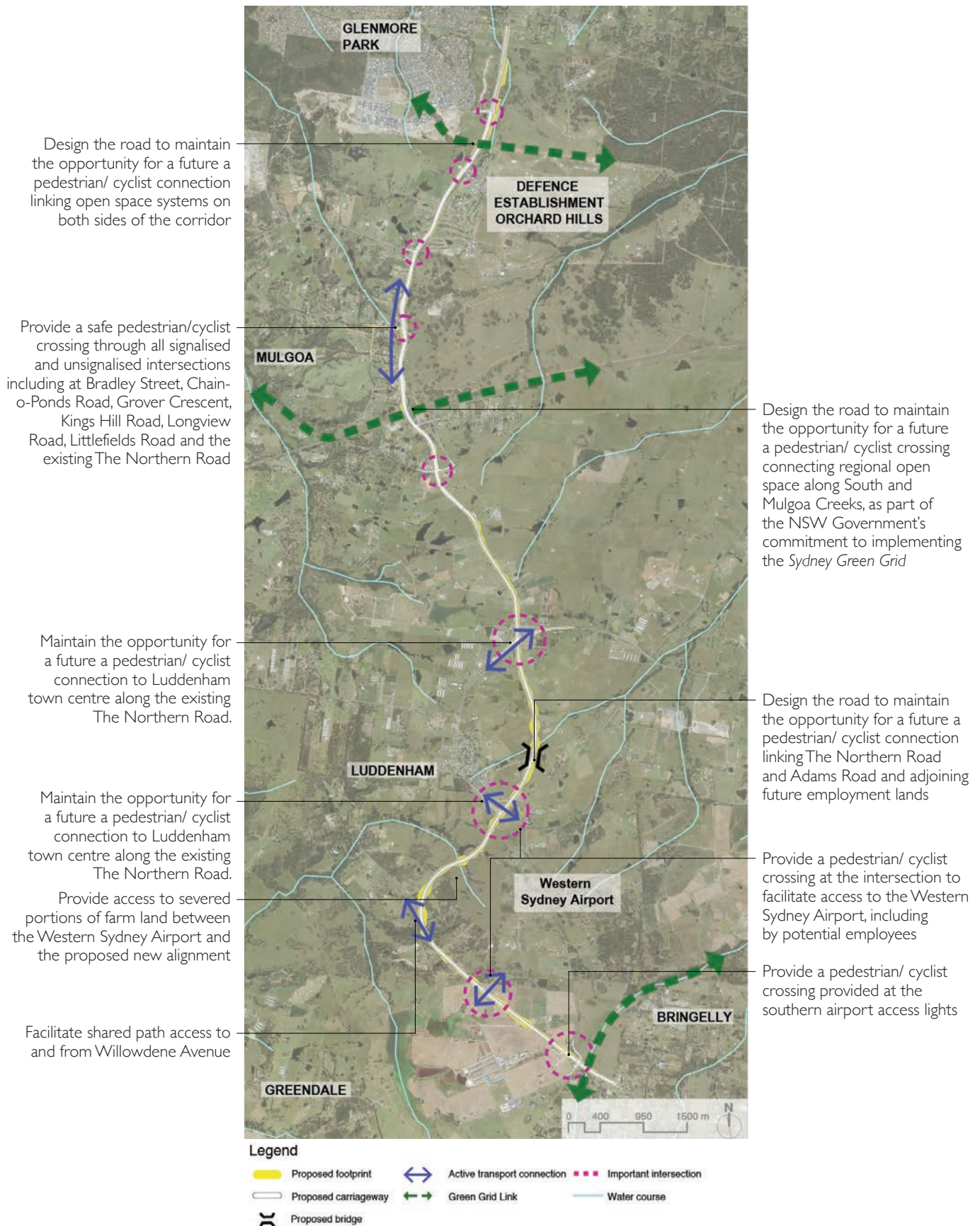


Figure 26: Urban design strategy for access and connections

## URBAN DESIGN CONCEPT

### 5.3 ROAD DESIGN ELEMENTS

The urban design plays an important role in influencing engineering aspects of the project. The following section describes the urban design approach for major road design elements. They include the following:

- **Structures**  
Structures include major engineering elements such as bridges or other structures that may be necessary to achieve the project within its surroundings
- **Earthwork formations**  
Earthwork formations include cuttings and embankments that are required to achieve the design parameters of the project within its surroundings
- **Hydrological features**  
Hydrological features include water management, flood mitigation and drainage systems that are required to ensure safe operation of the proposed work, as well as integration with natural hydrological systems. They would also include water quality infrastructure such as vegetated swales or rock check dams
- **Roadside elements**  
The range of furniture and ancillary structures within the road corridor such as safety barriers and signs, deemed necessary for the operation of the road or management of the impact on adjoining users.

#### **Design approach**

The general approach to the design of road elements is to satisfy the functional requirements for the safe and efficient operation of the road while also being appropriate to their location. In all cases, the design and implementation of the road design elements would need to satisfy the requirements of Austroads and Roads and Maritime design guidelines and practice notes.

It is also important that, in their detailed resolution, the visual expression of the road elements is true to their function as items of contemporary road infrastructure. Respect for the character of the local area will be achieved through sensitive consideration of the location, placement and scale of the new elements.

#### **5.3.1 Bridges**

One bridge is proposed as part of the project. It is located east of the Luddenham town centre, where the proposed upgrade would bridge over Adams Road.

#### **Design approach**

In line with the Roads and Maritime *Bridge aesthetics* guidelines, design the bridge as a simple and elegant structure to:

- Complement the rural setting
- Maximise views of the landscape from both above and underneath.

Further, the design of the bridge takes into account the need for future upgrades to Adams Road, to fulfil its role as an arterial road and major link through the WSPGA and to employment lands in the WSEA beyond.

## URBAN DESIGN CONCEPT

### Description

The bridge would consist of twin bridges with a separate deck for each carriageway. The bridges would be about 65 metres long and consist of two separate spans supported by an 1800 deep plank bridge, a central pier and spill-through abutments - refer drawings.

### 5.3.2 Shared paths

The project would introduce a number of improvements for pedestrians and cyclists along The Northern Road including shared paths and footways to provide cycle and pedestrian connectivity. The urban design approach is to:

- Design shared paths and footways to maximise opportunities for future connection to the pedestrian and cycle networks in the WSPGA, SWPGA and the Western Sydney Airport
- Provide formal crossings at all signalised intersections to improve safety for pedestrians and cyclists to cross roads that would otherwise be uncontrolled
- Design shared paths to provide continuity of cycle links through un-signalised intersections in a safe and direct manner.

### 5.3.3 Earthwork formations

#### Cuttings

A number of large cuttings would be required along the proposed upgrade, in order to achieve the required longitudinal gradients through steeper parts of the landscape such as around Duncans Creek and in the Cosgrove Creek valley. They include cuttings in excess of ten metres deep.

The design of the cuttings has generally adopted a 4H:1V grade. This provides for a low maintenance cut batter slope that can be easily and successfully revegetated. Rounding of the top edges of the batters to transition from batter slopes to more natural gradients will help to integrate the formation with the surrounding landscape.

Revegetation is the preferred treatment for cuttings to restore Cumberland Plain Woodland along the route, as well as provide for a mix of vegetated and open route sections with views. The landscape design seeks to restore the existing bushland after completion of the roadwork, provided this is viable based on the soil conditions.

Revegetation would be a mixture of indigenous shrubs and grasses as well as canopy trees to complement surrounding bushland, except in areas where utility infrastructure or OLS requirements for the Western Sydney Airport prohibit tree planting - also refer **section 5.4.3**.

In the event that sound rock may be uncovered, retention of the rock as an exposed finish would be the preferred strategy. Exposed rock cuttings can heighten the travel experience and provide the road user with a geological appreciation of the region through which they are passing. The 'rawness' and robustness of the material adds colour and texture to the visual landscape, providing a contrast with the smooth and regular form of the materials often associated with roads.

#### Shotcrete

Generally the use of shotcrete in cuttings is not currently anticipated and is to be avoided.

Where unexpected conditions are uncovered during excavation that may lead to shotcrete being considered for the proposed upgrade, application of shotcrete would need to be carried out in accordance with the Roads and Maritime *Shotcrete Guidelines*.

## URBAN DESIGN CONCEPT

### **Embankments**

Embankments are potentially highly visible formations, especially within the exposed landscape of the Luddenham Plateau, and the steeper valleys around Duncans and Cosgrove Creeks. There are a number of very large embankments along the project, exceeding ten metres in height. They have the potential to stand out as highly unnatural land forms.

To minimise this effect, embankments need to be sensitively designed to maximise integration with the surrounding landscape and its scenic values. This includes appropriate landscape strategies to minimise visual contrast with the surrounding landscape character.

The design of embankments has generally adopted a 4H:1V grade. While this would be easily stabilised and vegetated, it does result in a fairly broad footprint for the project.

The visual impact of the embankments in the Badgerys Creek and Orchard Hills treatment zones will be somewhat reduced by the proposed landscape planting strategy. Vegetation will assist with visual screening of batters and embankment transitions to natural ground. In addition, and where possible it would be desirable to flatten out the toe of embankments to achieve maximum integration with the surrounding landform. This will maximise integration of the project with its setting in the event that revegetation should prove unsuccessful or slow.

### **5.3.4 Hydrological features**

The proposed upgrade would require the traversing of minor waterways and farm dams. Its construction and operation has the potential to impact aquatic ecosystems due to changes in water quality, habitat loss and instream barriers.

The urban design approach to the design of hydrological features would be to maximise green infrastructure, soft landscape and WSUD solutions to optimise outcomes at sensitive receiving environments, ensure a sustainable outcome and a good fit with the surrounding context, including adjoining rural areas within the MRA.

Water crossing structures and other components of the drainage system should be sensitively designed to provide a landscape solution that minimises the landscape character and visual impacts and takes into consideration all waterways within the area. Waterway crossings and biodiversity mitigation measures would include:

- Design bridges and culverts as fish friendly crossings and ensure that barriers to fish are not created and impacts to the existing hydrology are minimised
- Replacement or reinstatement of habitat in accordance with Roads and Maritime *Biodiversity Guidelines* including *Guide 5: Re-use of woody debris and bushrock* and *Guide 10: Aquatic habitats and riparian zones*
- Relocation of all large woody debris or snags instream.

The *Biodiversity Assessment Report* (Appendix I of the EIS) provides further specific measures from a biodiversity point of view.

### **5.3.5 Safety barriers**

Safety barriers along the road side generally would consist of wire-rope safety barriers with a transition to w-beam and three-beam barriers on bridge parapets.

## URBAN DESIGN CONCEPT

### 5.3.6 Headlight glare attenuation

Headlight glare requires mitigation in certain circumstances to reduce glare to oncoming traffic. Where possible based on available space and safe stopping sight distance requirements, low shrub planting would be provided in depressed medians along the road, with the exception of areas identified as having distinct views that are to be retained.

#### Fencing

Fencing on the upgrade is likely to consist of road corridor boundary fencing, and potentially some fauna fencing. To minimise fencing requirements a combined boundary/fauna fence could be employed in some locations. The design of the fence would be finalised in the detailed design stage and would be subject to approval by relevant authorities.

Due to the increase in road width, it is also likely that some fencing may need to be replaced or relocated. These fences would primarily be associated with strips of adjoining property that would be acquired. Fencing should be designed to match existing property fencing, which are predominantly basic and inconspicuous rural wire fences that are visually transparent and subservient to the landscape setting.

### 5.3.7 Bus shelters

Bus shelters should be a contemporary design to the approval of local Councils and bus operators. Bus stops should generally be provided to suit existing bus routes, as well as known future routes.

Additional bus stops may be required to meet the needs of the future residential and working population in the WSPGA and SWPGA. A bus strategy will be developed by Transport for New South Wales (TfNSW). This will likely involve consultation with stakeholders such as local councils, bus operators and the community and would determine the need and appropriate locations for additional bus stop locations. Where available, this information would be integrated in future detail design stages.

### 5.3.8 Variable message signs

Variable message signs (VMS) display traffic related advice to motorists, such as traffic delays, severe weather conditions, maintenance operations, incident reporting and incident management. They comprise a steel pole and electronic sign board structure that requires a substantial engineering design component - refer **Figure 28**.

Placement and design of any VMS will be guided by the Roads and Maritime TDT 2005/02b *Guidelines for the location and placement of variable message signs*.

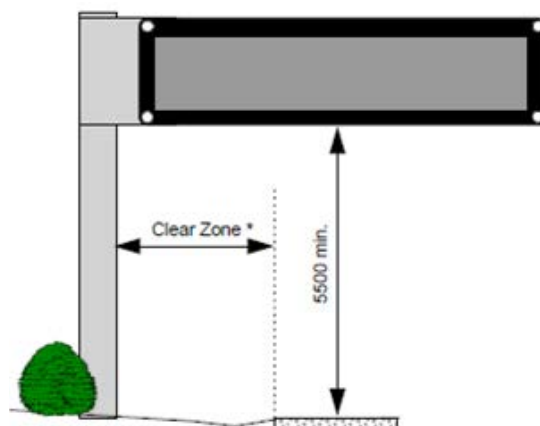


Figure 27: Variable message sign

## URBAN DESIGN CONCEPT

### 5.4 LANDSCAPE DESIGN

#### 5.4.1 Planting design principles

The planting design concept has been guided by the following principles:

- Complement the existing landscape, visual and spatial character through appropriate vegetation types and heights
  - Use vegetation to stabilise cut batters and to minimise their visual impact
  - Use vegetation to stabilise fill embankments, carefully balancing plant selection to ensure views of the surrounding landscape as identified on the strategy plans
  - Provide vegetation to screen the upgrade from sensitive nearby land uses where applicable
  - Provide tree cover in verges and medians where it is safe to do so, based on clear zone requirements
- Design softworks to direct views and vistas to emphasise the attractive rural setting, having regard to planned future land use changes, in particular the Western Sydney Airport and employment lands in the WSPGA
- Retain existing woodland where possible. Where removal can't be avoided reinstate native vegetation to compensate for the loss of vegetation and habitat
- Use vegetation to maximise potential for biodiversity links in areas of identified ecological value
- Enhance intersections through feature planting to provide 'gateways'. Examples include the entrances to the Luddenham town centre, to rural residential clusters, residential subdivisions and the service entry to the Western Sydney Airport. This would provide variety and visual interest along the route as well as visually enhance the local identity
- Select species around the end of the airport runway (at Willowdene Avenue) that are not bird-attracting to avoid safety risk for planes
- Wherever possible, use surplus local natural materials such as rock and timber in creek restoration and water quality treatments to help recover biodiversity and create habitat.

#### Refinement during detailed design

During detailed design, development of the planting concept and layouts for vegetation will be developed to ensure placement and species selection will be in accordance with all relevant requirements including the Roads and Maritime *Landscape guideline*, clear zone and stopping sight distance requirements and the OLS requirements of the Western Sydney Airport. Softworks will also need to consider the biodiversity offsetting requirements.

#### 5.4.2 Vegetation types

The plant species for the project would generally build on the native Cumberland Plain Woodland vegetation communities of the area. They may be supplemented by commercially available species known to perform well under arterial road conditions.

In selected areas including around the Luddenham town centre and the intersections that function as entrances to the Western Sydney Airport, additional feature species would be used to highlight the significance of these areas locally, regionally and nationally.

The following vegetation types have been identified for the project:

## URBAN DESIGN CONCEPT

1. **Low planting**  
This vegetation type would consist of species up to 700mm high and typically consist of native grasses and groundcovers. It would be used in areas with unique views from or across the road corridor. It would also be used in verges between the carriageway and the shared path, to provide a degree of visual separation while ensuring good passive surveillance.
2. **Low shrub planting**  
This vegetation type would consist of frangible fast growing species including groundcovers, grasses and low shrubs, typically up to about 1.4 metres tall. It would be used in medians to provide headlight glare attenuation and visual separation of carriageways. It would also be used on the lower slopes of embankments to provide stabilisation and integration with the surrounding landscape while maintaining views from or across the road corridor.
3. **Groundcover, shrub and tree planting**  
This vegetation type would be used in areas where there are no constraints in terms of views and would include the full range of grasses, groundcovers, low and tall shrubs and trees. It would provide dense vegetation for the purposes of ecological restoration, as well as visual separation between the road corridor and sensitive users such as rural residents.
4. **Riparian vegetation**  
Riparian vegetation would be located along creek lines and farm dams. It would include plants tolerant of flooding or submersion and be based on native vegetation communities as well as the existing species composition found in farm dams of the area.
5. **Feature planting**  
Feature planting would be located at intersections and around the Luddenham town centre. Feature trees such as Norfolk Islands Pines and Liquidambars would be used in areas where a landmark feature is desirable, including around major intersections and along the alignment of the existing The Northern Road on the approach to the Luddenham town centre.

### 5.4.3 Plant selection principles

A preliminary list of plant species for use in the proposed upgrade has been identified - refer **Indicative plant selection**. Selection principles include:

- Plant species that are consistent with the local ecology and landscape character, including identified visual values and cultural plantings
- Selection of plant species that are robust, noninvasive and not fire promoting
- Exclusion of all species identified as noxious or local weeds
- Minimise ongoing maintenance requirements.

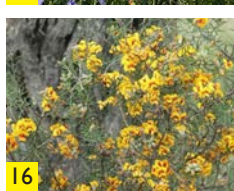
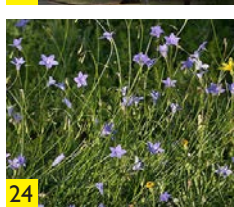
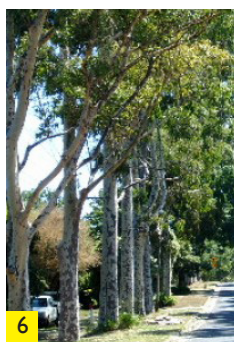
The detailed planting design stage would include further refinement of the plant species selection and detailed locations for different species and vegetation types, having regard to relevant Roads and Maritime policy including clear zone requirements, safe stopping sight distances, the *Landscape guideline* and the *Biodiversity guidelines*.

Specifications for plant material during the detailed design stage should maximise the use of local provenance plant material (plants grown from locally collected seeds) wherever possible for all native vegetation, in particular native revegetation.

## URBAN DESIGN CONCEPT

### Indicative plant selection

	Botanical name	Common name	Height at maturity
Feature Planting			
1	<i>Araucaria cunninghamii</i>	Hoop Pine	20m
2	<i>Fraxinus 'Raywoodii'</i>	Claret Ash	15m
3	<i>Liquidambar styraciflua</i>	Liquidambar	18m
4	<i>Nyssa sylvatica</i>	Black Tupelo	10m
5	<i>Photinia robusta</i>	Red-Leaf Photinia	5m
Cumberland Plain Woodland			
6	<i>Corymbia maculata</i>	Spotted Gum	30m
7	<i>Eucalyptus crebra</i>	Grey Ironbark	30m
8	<i>Eucalyptus moluccana</i>	Grey Box	25m
9	<i>Eucalyptus tereticornis</i>	Forest Red Gum	25m
10	<i>Acacia decurrens</i>	Black Wattle	2-10m
11	<i>Acacia implexa</i>	Lightwood	4-10m
12	<i>Asperula conferta</i>	Common Woodruff	0.5m
13	<i>Bursaria spinosa</i>	Blackthorn	3m
14	<i>Dodonaea viscosa</i>	Hop Bush	1-2m
15	<i>Dianella longifolia</i>	Blue Flax Lily	1m
16	<i>Dillwynia sieberi</i>	Prickly Parrot Pea	1m
17	<i>Hardenbergia violacea</i>	Native Sarsparilla	n/a
18	<i>Indigofera australis</i>	Native Indigo	1-2m
19	<i>Aristida ramosa</i>	Purple Wiregrass	1.2m
20	<i>Cymbopogon refractus</i>	Barbed Wire Grass	1.5m
21	<i>Themeda australis</i>	Kangaroo Grass	1m
22	<i>Lomandra filiformis</i>	Wattle Mat-rush	0.5m
23	<i>Microlaena stipoides</i>	Weeping Grass	0.3m
24	<i>Wahlenbergia gracilis</i>	Australian Bluebell	0.4m
Riparian			
25	<i>Carex appressa</i>	Tall sedge	1.2m
26	<i>Juncus usitatus</i>	Common Rush	1m
27	<i>Microlaena stipoides</i>	Weeping Grass	1m
28	<i>Pratia purpurascens</i>	Whiteroot	0.3m
Median & Verge Planting			
29	<i>Lomandra 'Katrinus'</i>	Mat-Rush	1m
30	<i>Lomandra 'Tanika'</i>	Mat-Rush	0.7m



## URBAN DESIGN CONCEPT

### 5.5 URBAN DESIGN CONCEPT

The urban concept design drawings are provided on the following pages. They include:

- Concept design plans
- Illustrative cross sections
- Illustrative bridge elevations and sections.

#### ***Concept design plans***

There are 15 drawing sheets to illustrate the concept design - also refer key plan on the following page:

1. Chainage 0 to 1,125 approximately.
2. Chainage 1,125 to 2,300 approximately
3. Chainage 2,250 to 3,425 approximately
4. Chainage 3,425 to 4,650 approximately
5. Chainage 4,550 to 5,775 approximately
6. Chainage 5,675 to 7,025 approximately
7. Chainage 6,875 to 7,850 approximately
8. Chainage 7,800 to 8,100, including the re-aligned Elizabeth Drive
9. Chainage 8,050 to 9,250 approximately
10. Chainage 9,175 to 10,400 approximately
11. Chainage 10,325 to 11,525 approximately
12. Chainage 11,525 to 12,700 approximately
13. Chainage 12,700 to 13,875 approximately
14. Chainage 13,875 to 15,075 approximately
15. Chainage 15,075 to 16,119 approximately.

#### ***Illustrative cross sections***

There are 11 cross sections, at the following locations (all road chainages are approximate):

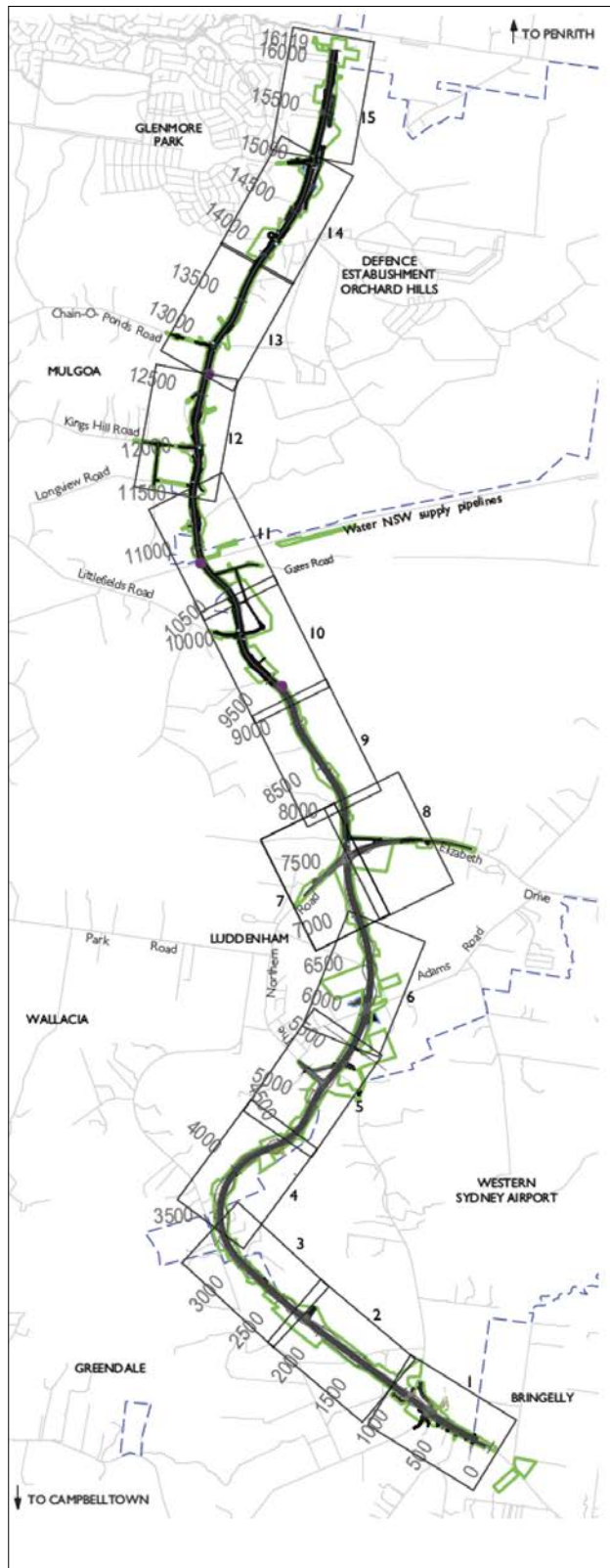
1. Chainage 925 approx – Badgerys Creek south of the new access culvert
2. Chainage 3,510 approx – Western Sydney Airport land near Willowdene Avenue
3. Chainage 3,795 approx – Rural residential in Willowdene Avenue
4. Chainage 4,440 approx – Duncans Creek dam
5. Chainage 5,930 approx – Cosgrove Creek Valley
6. Chainage 7,800 approx – 2,311 Elizabeth Drive
7. Chainage 9,145 approx – 2,776 The Northern Road
8. Chainage 10,970 approx – 2,559 The Northern Road
9. Chainage 12,320 approx – Grover Crescent Heavy Vehicle Inspection Bay
10. Chainage 13,280 approx – Orchard Hills Golf Club
11. Chainage 15,035 approx – Bradley Street intersection.

#### ***Illustrative bridge drawing***

A cross section and an elevation have been prepared for the Adams Road overbridge.

## URBAN DESIGN CONCEPT

KEY PLAN



LEGEND -

URBAN DESIGN CONCEPT SHEETS 1-15

### Road Design Features

- Proposed construction boundary
- Carriageway
- Bus lanes
- Footway or shared path
- Fill batter
- Cut batter
- Ancillary site / construction compound
- Variable Message Signs (VMS)
- Temporary basin (construction only)
- Indicative new location of bus stop

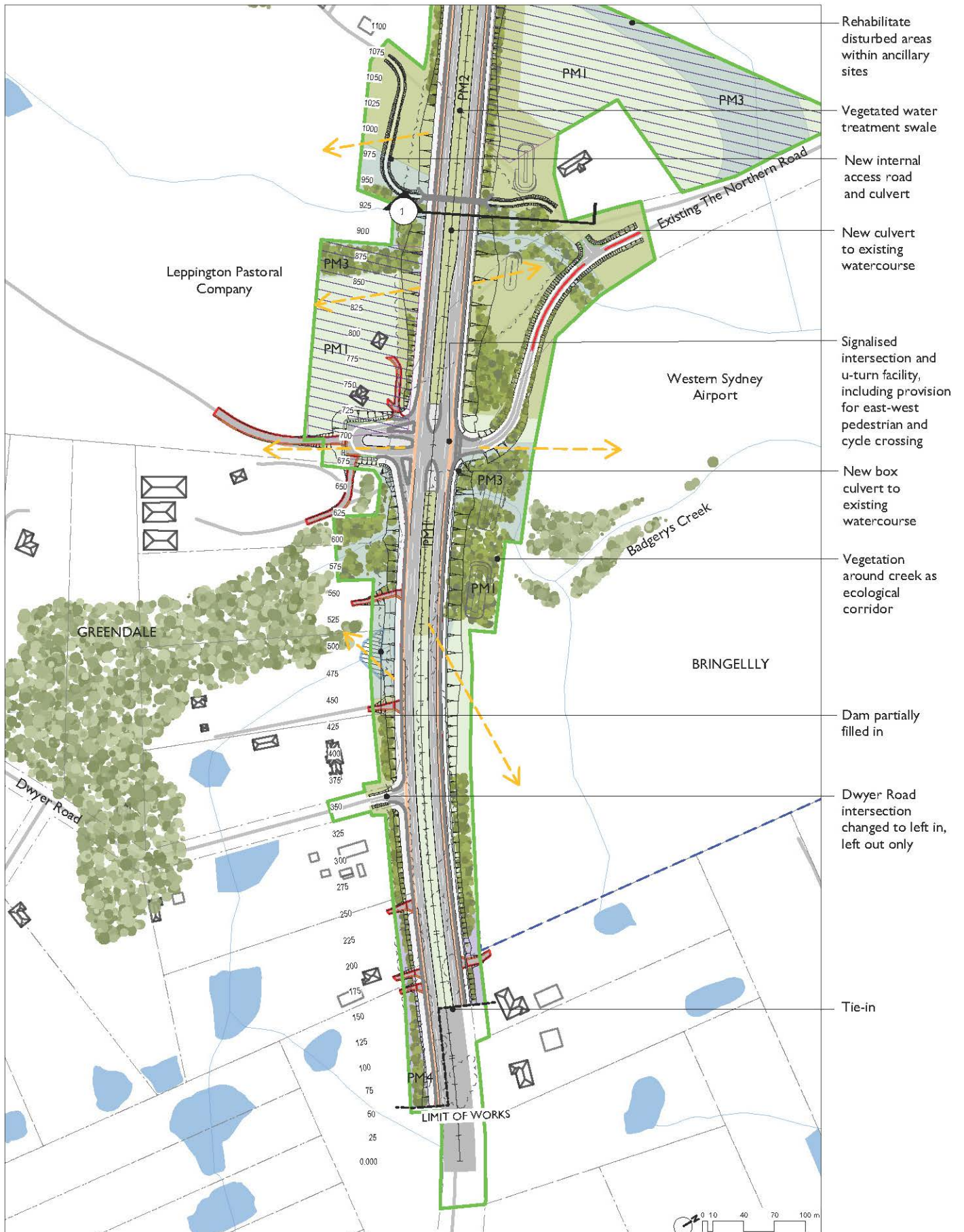
### Proposed Vegetation

- New tree cover
- PM1 Groundcovers and grasses
- PM2 Groundcovers, shrubs and trees
- PM3 Riparian vegetation
- PM4 Feature planting

### Existing Features

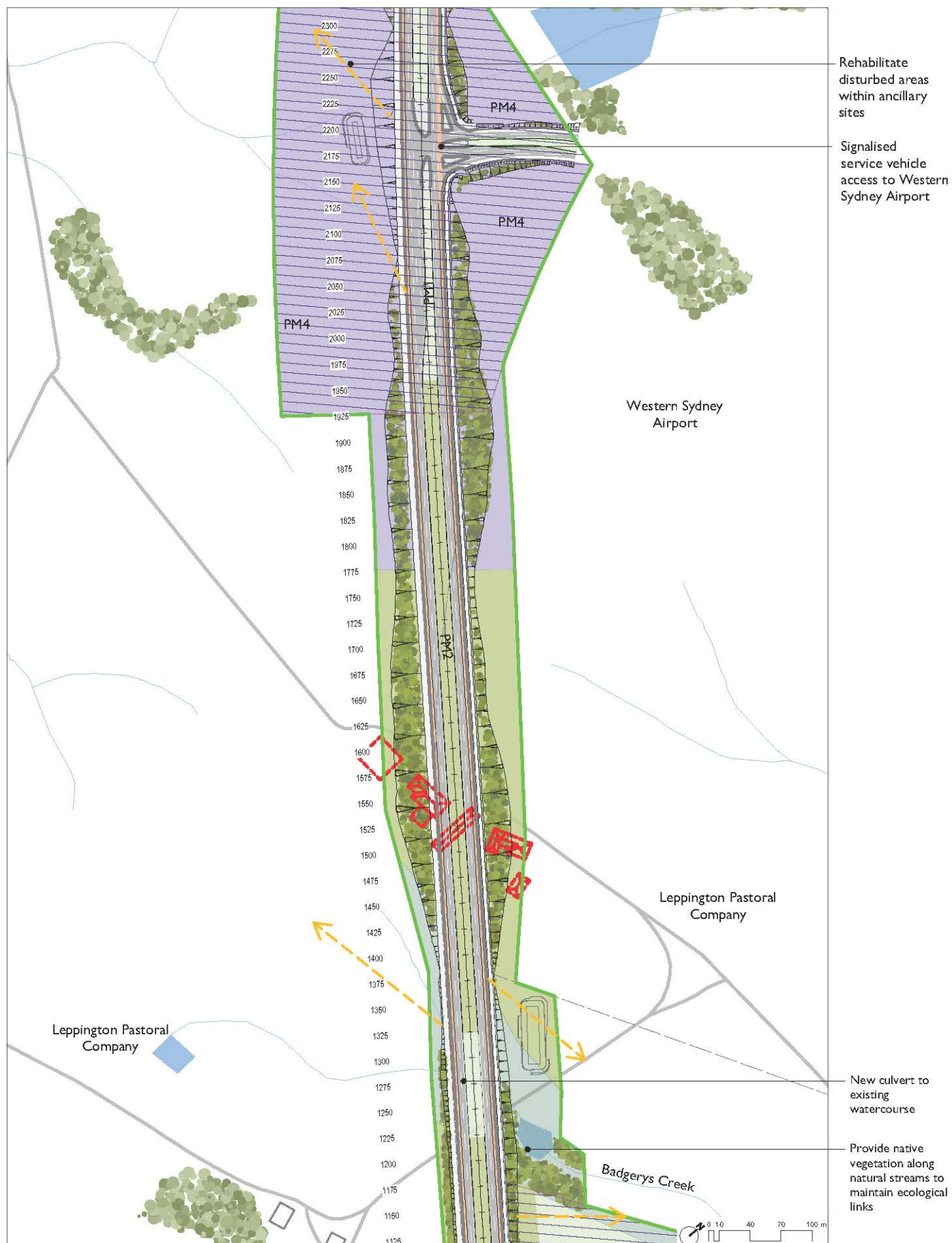
- Existing trees retained
- Existing trees removed
- Existing contours at 10m interval
- Waterbodies
- Existing dam filled
- Existing building
- Existing building removed
- Views from the proposed upgrade
- Commonwealth land

## URBAN DESIGN CONCEPT



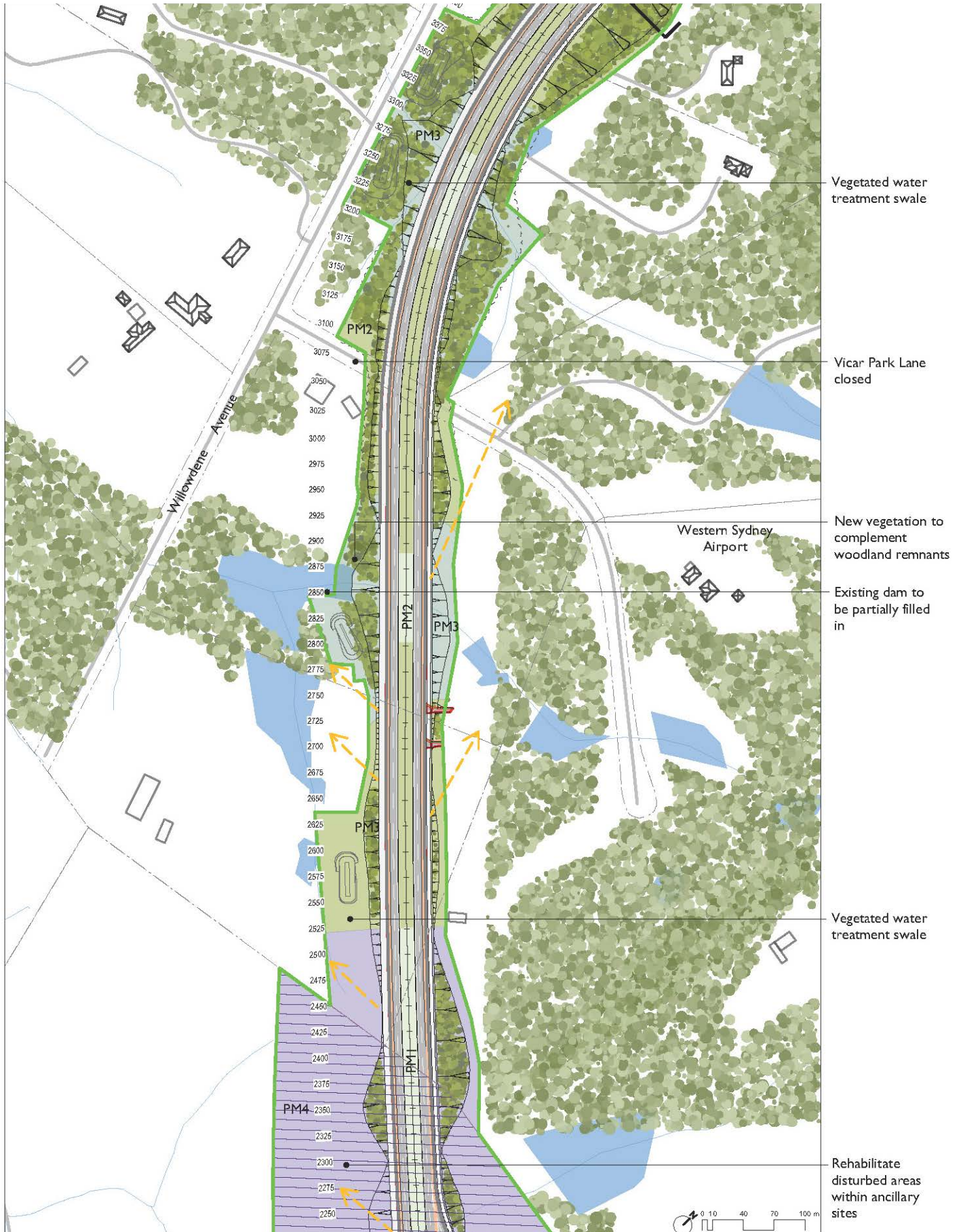
Sheet 1 - Chainage 0 to 1,125 approximately.

## URBAN DESIGN CONCEPT



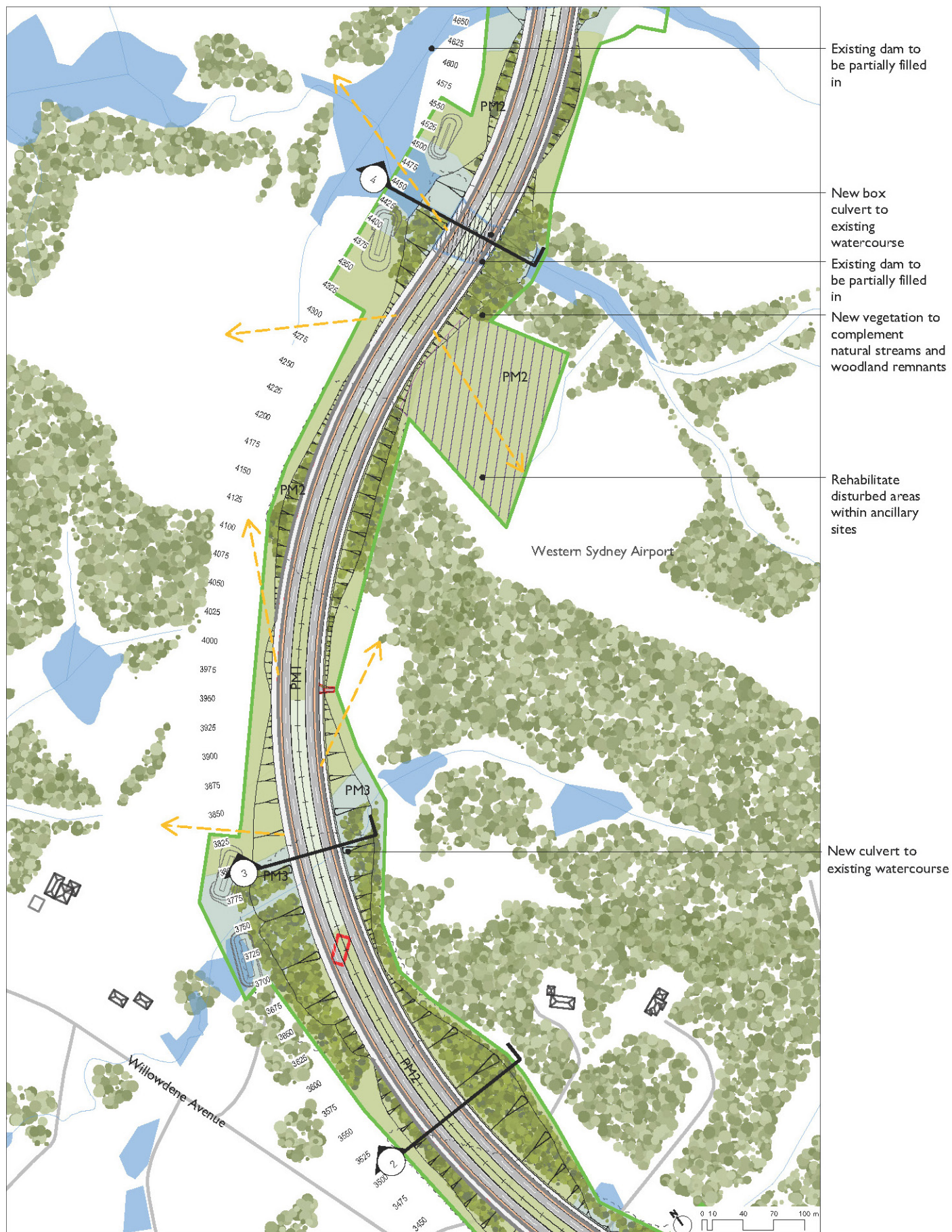
Sheet 2 - Chainage 1,125 to 2,300 approximately

## URBAN DESIGN CONCEPT



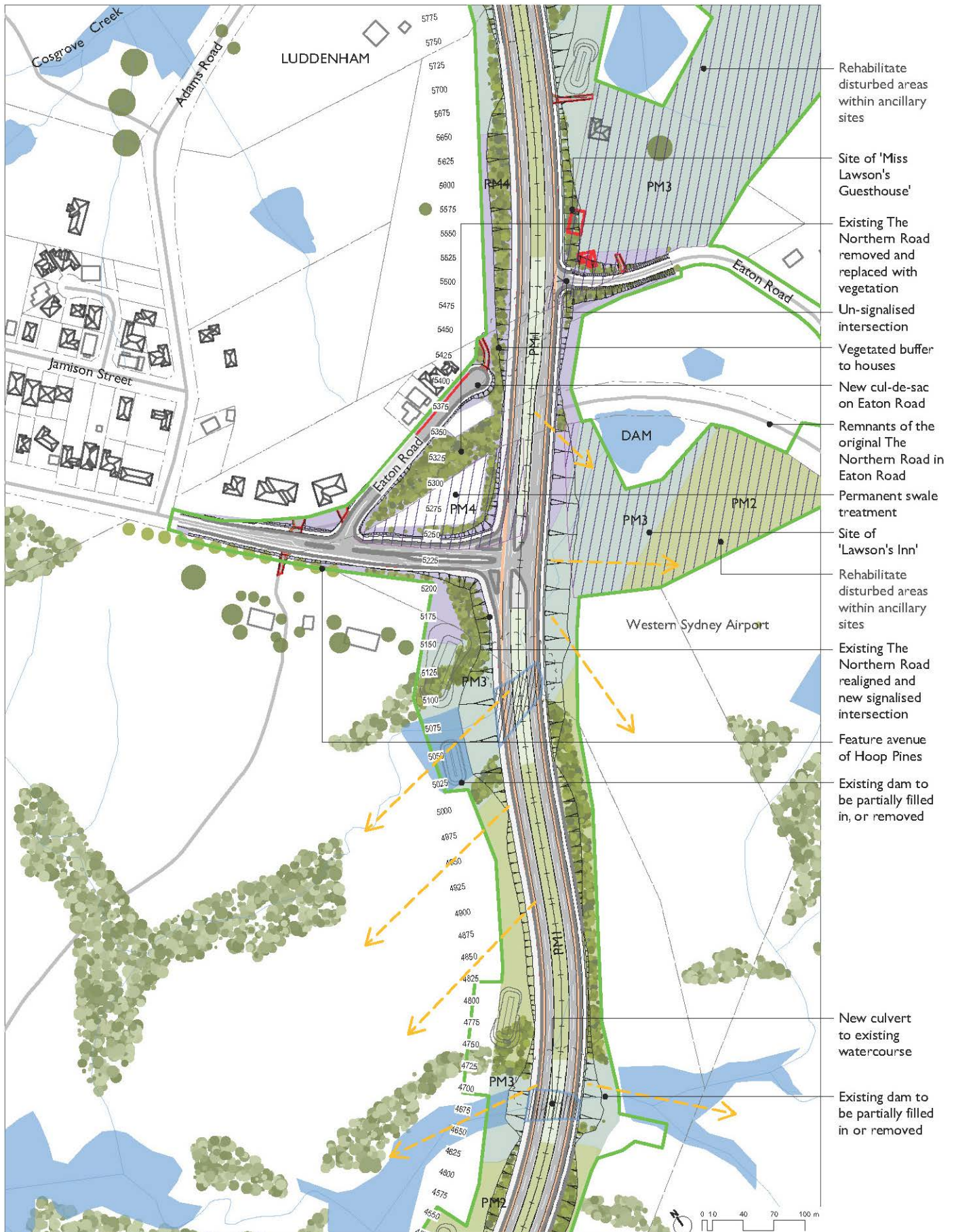
Sheet 5 - Channage 2,250 to 3,425 approximately

## URBAN DESIGN CONCEPT



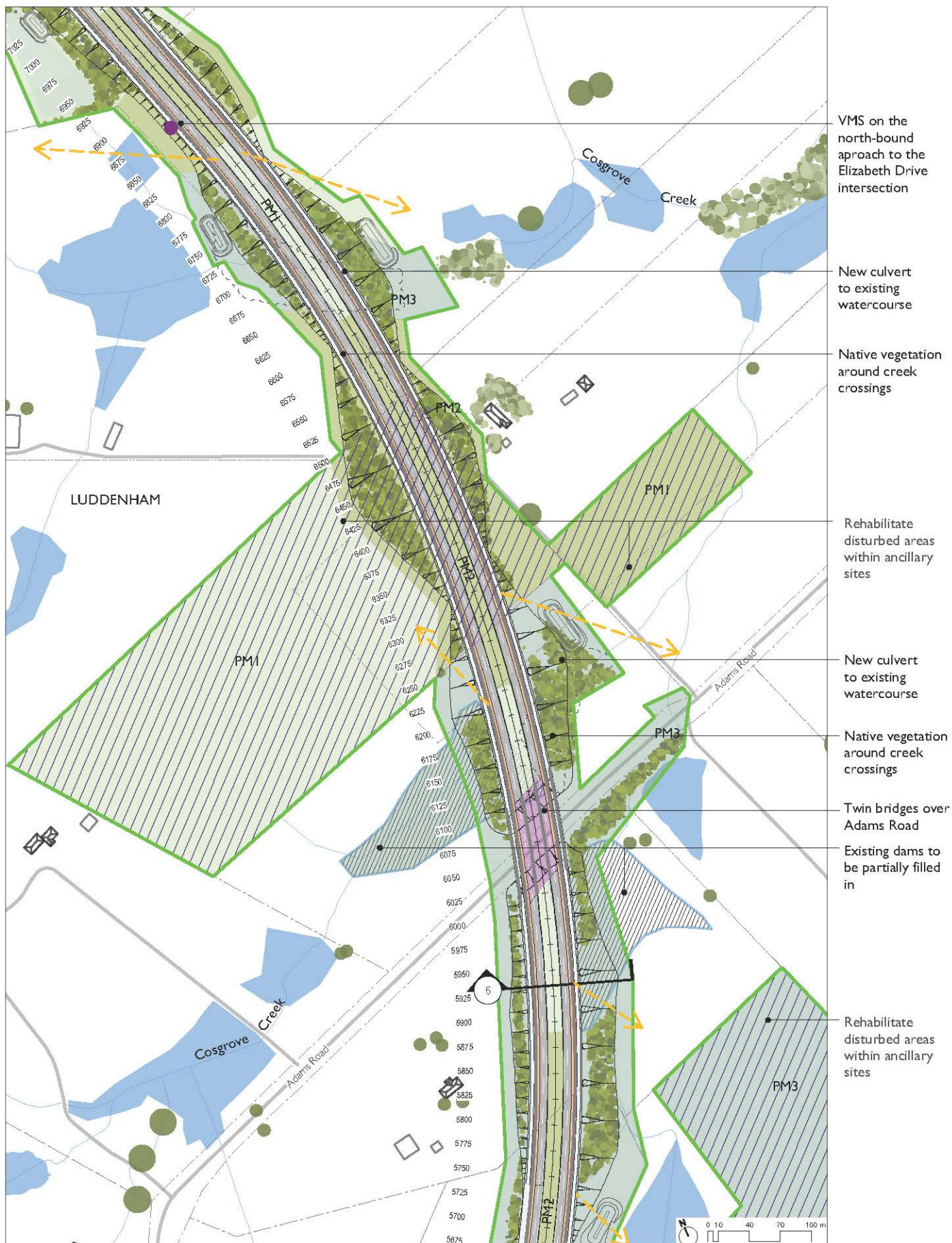
Sheet 4 - Chainage 3,425 to 4,650 approximately

## URBAN DESIGN CONCEPT



Sheet 5 - Chainage 4,550 to 5,775 approximately

## URBAN DESIGN CONCEPT



Sheet 6 - Chainage 5,675 to 7,025 approximately

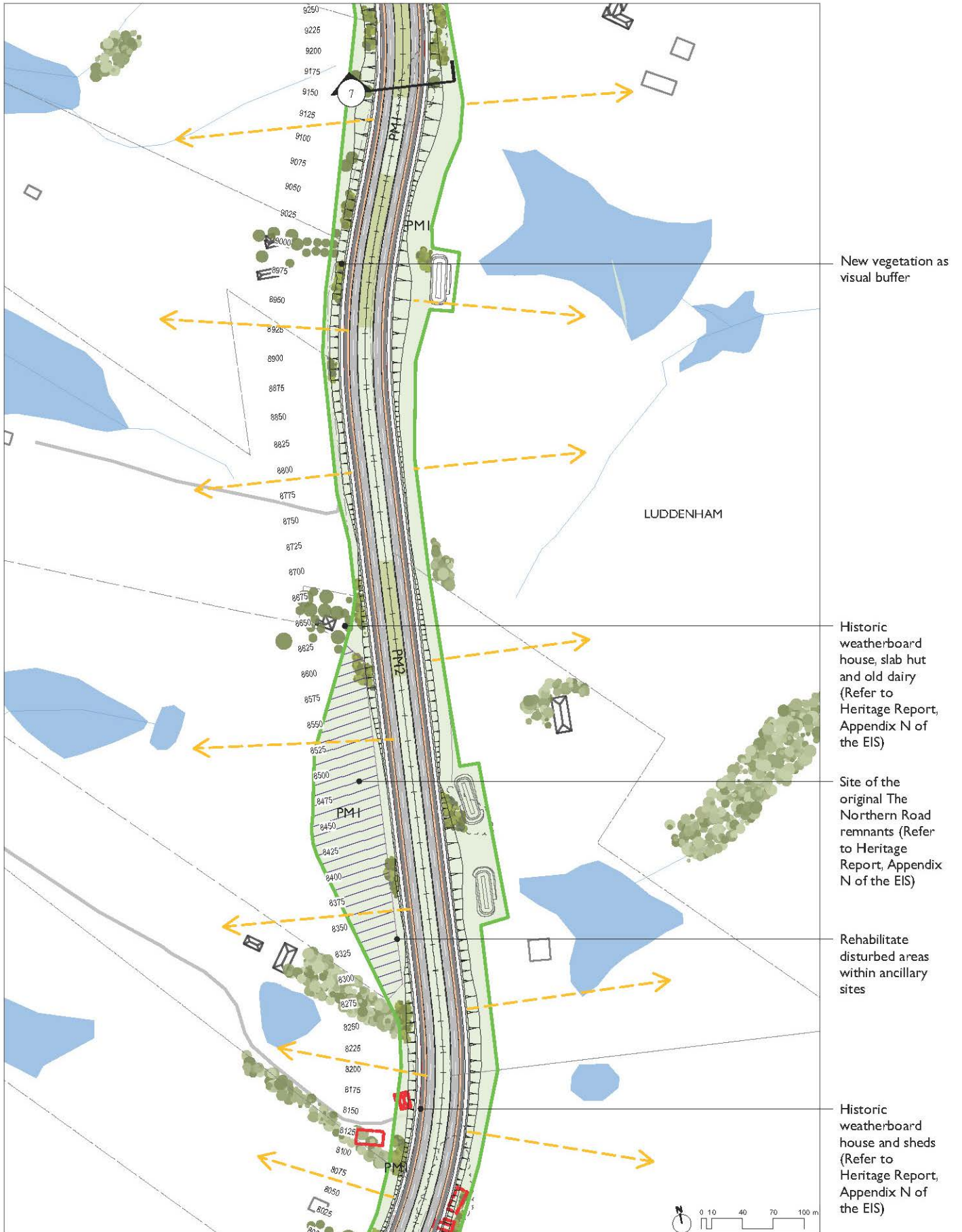


## URBAN DESIGN CONCEPT



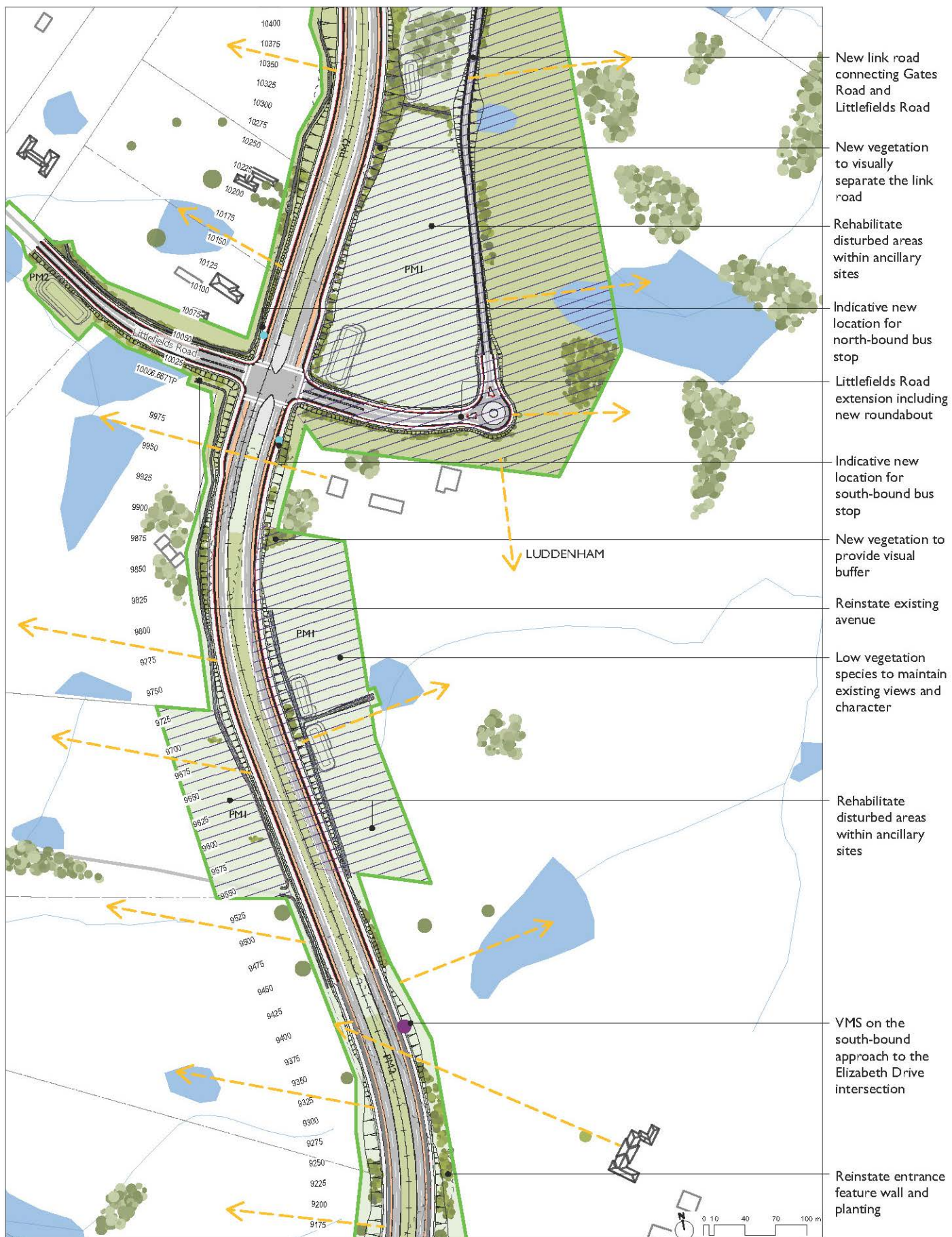
Sheet 8 - Chainage 7,800 to 8,100, including the re-aligned Elizabeth Drive

## URBAN DESIGN CONCEPT



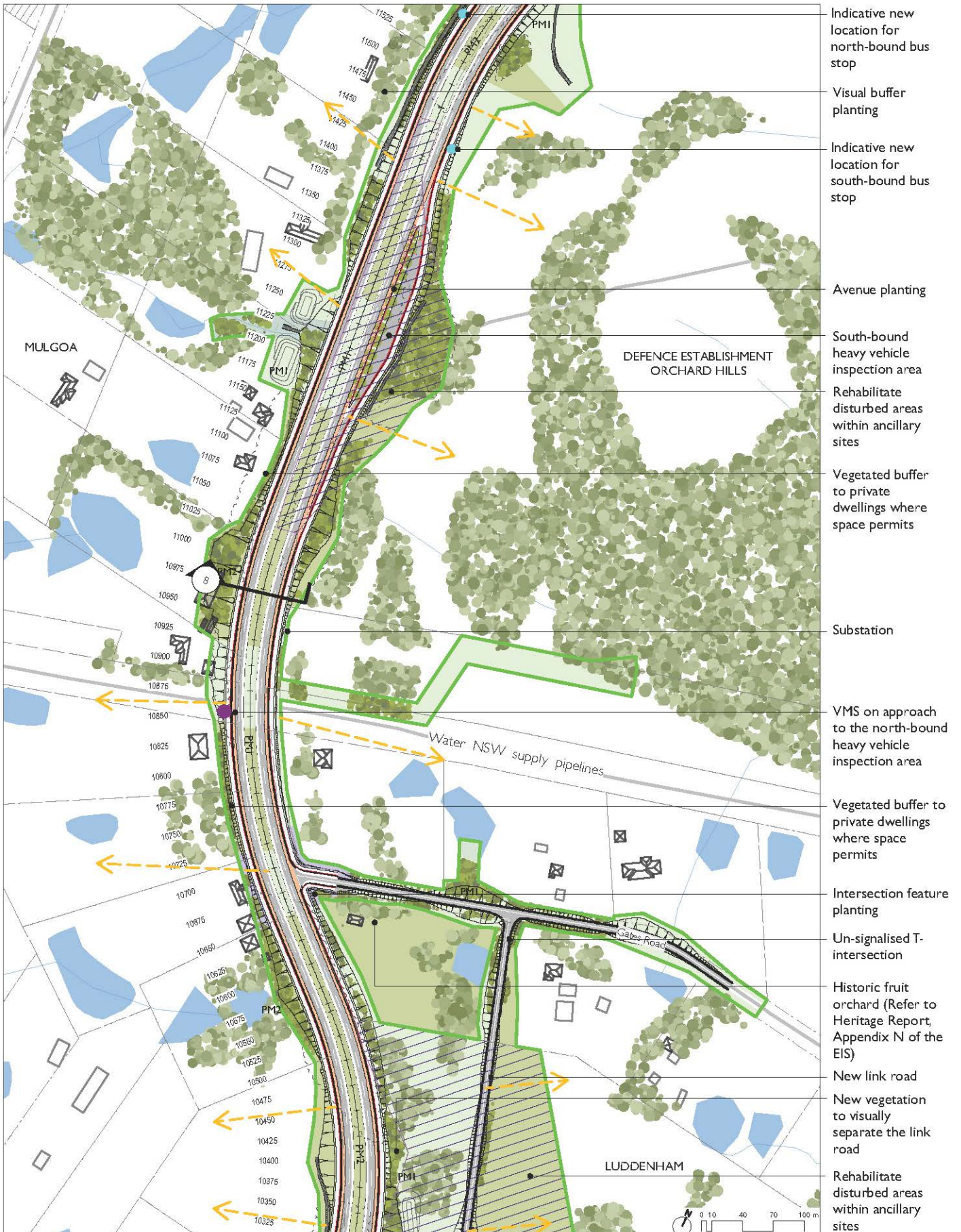
Sheet 9 - Chainage 8,050 to 9,250 approximately

## URBAN DESIGN CONCEPT



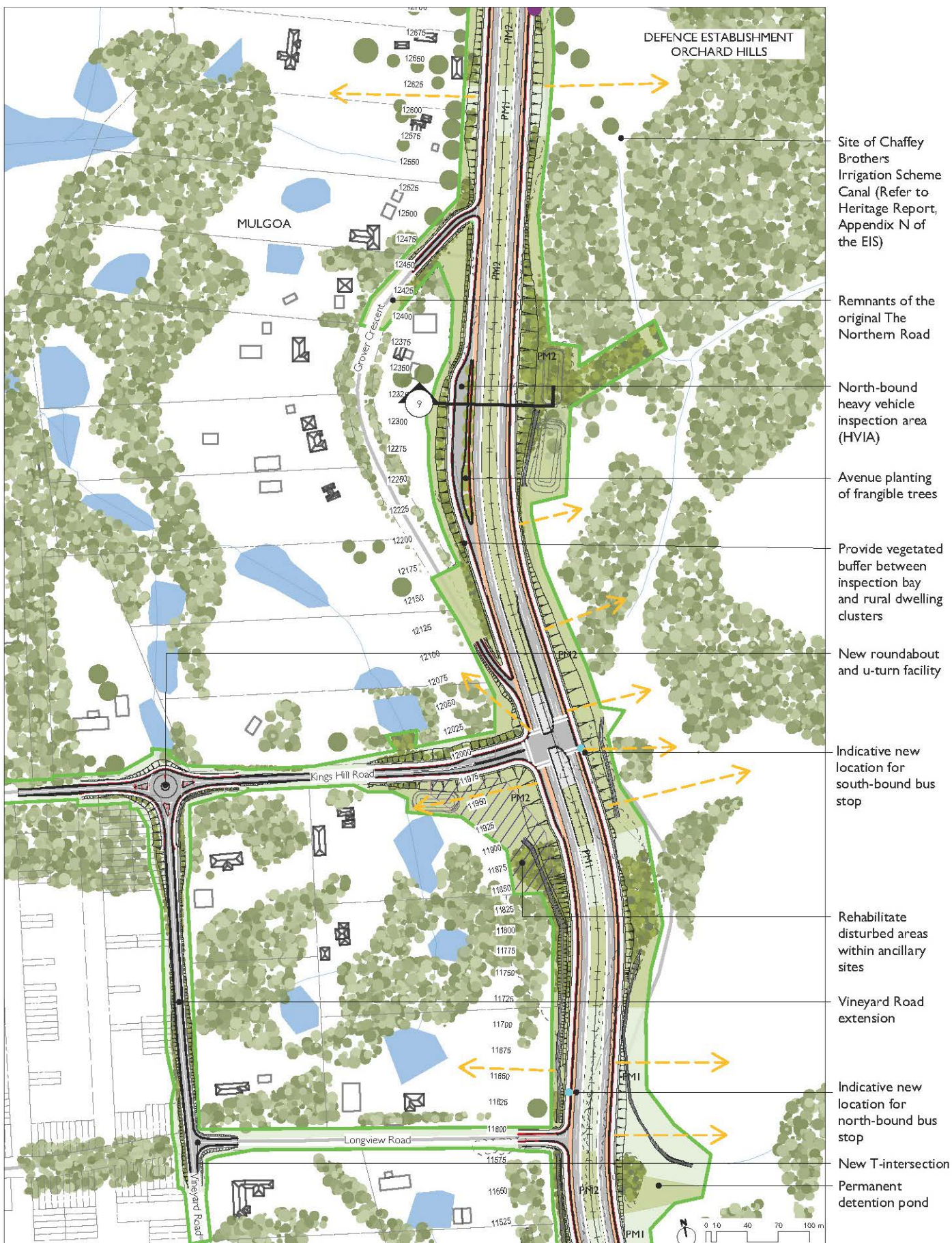
Sheet 10 - Chainage 9,175 to 10,400 approximately

## URBAN DESIGN CONCEPT



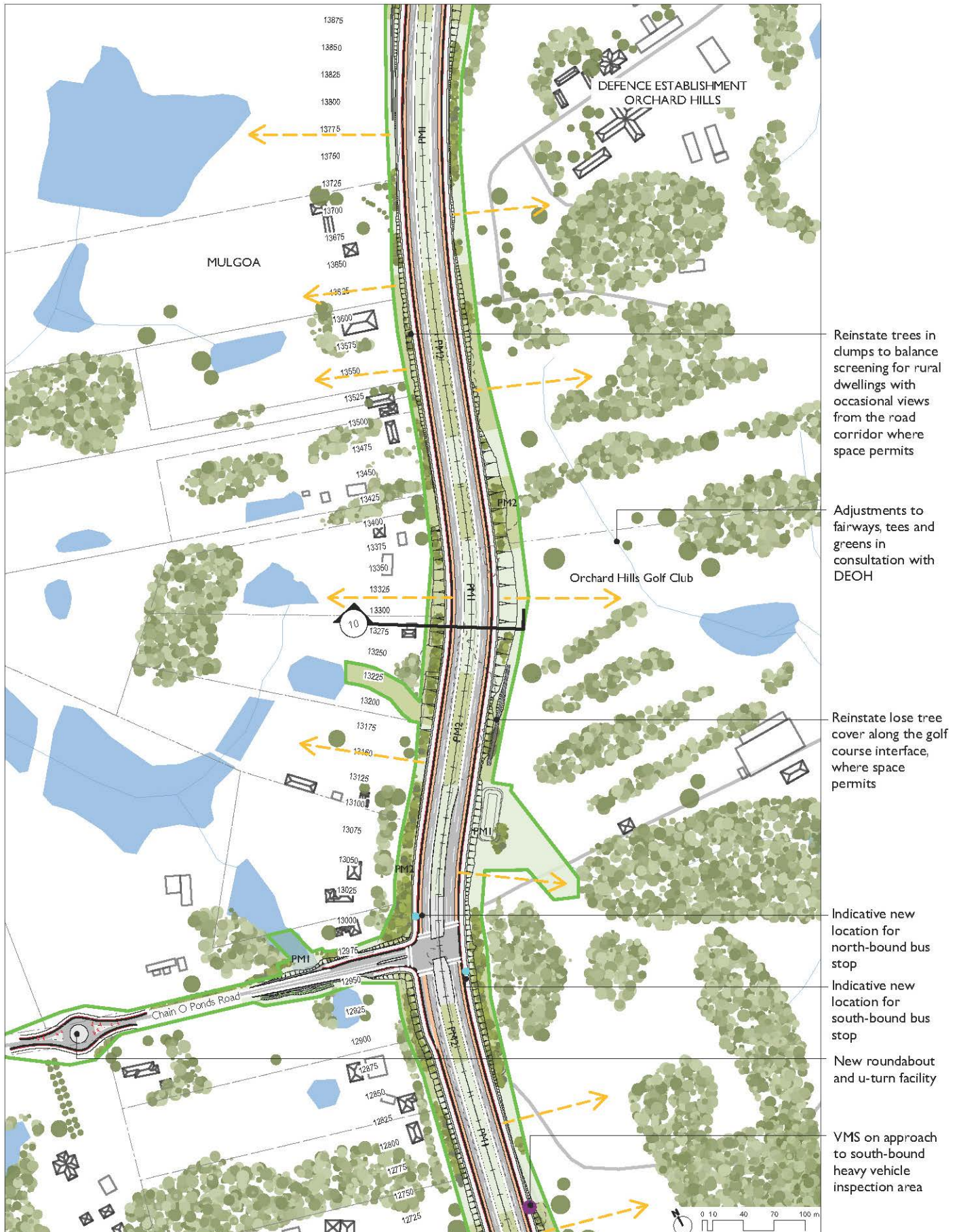
Sheet 11 - Chainage 10,325 to 11,525 approximately

## URBAN DESIGN CONCEPT



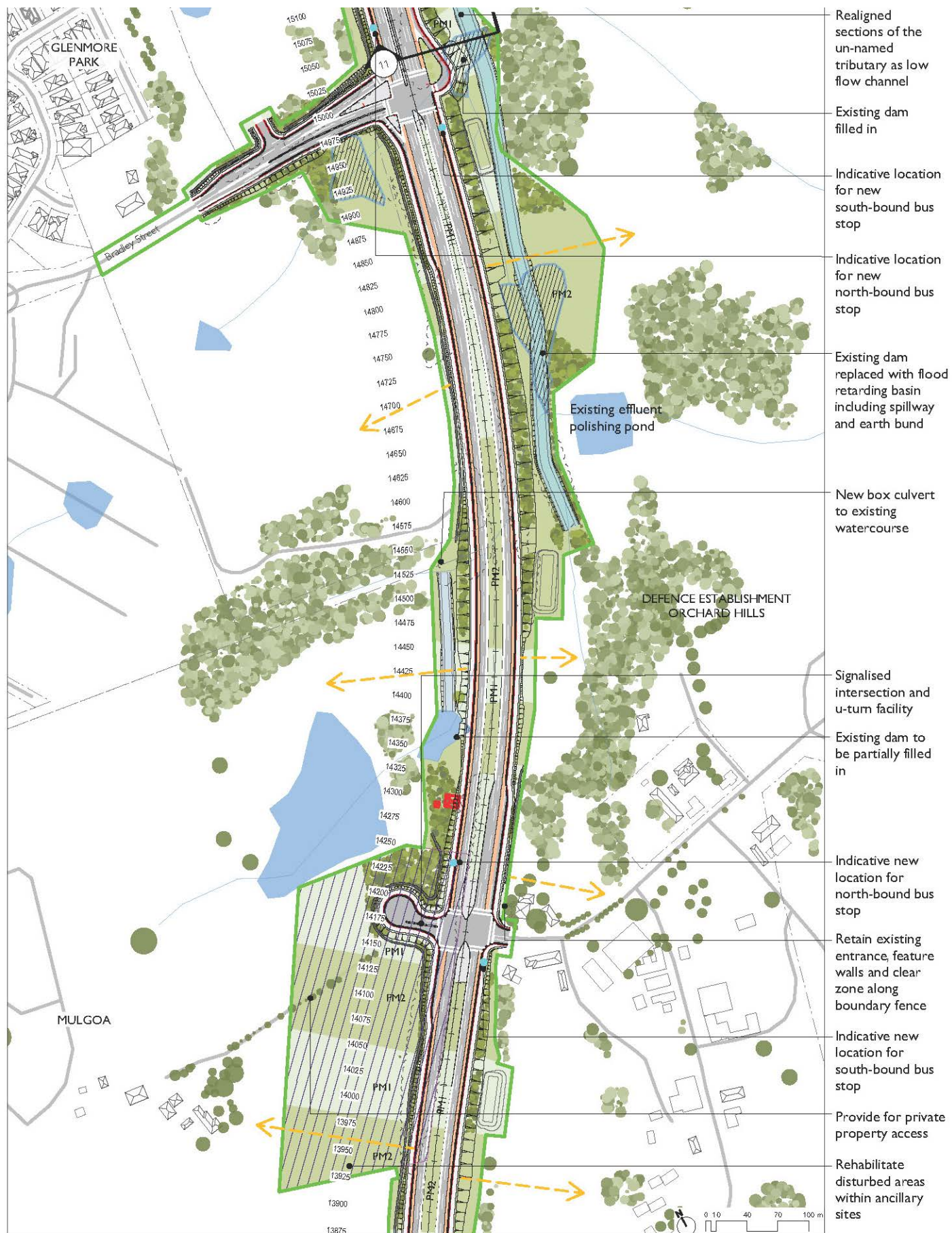
Sheet 12 - Chainage 11,525 to 12,700 approximately

## URBAN DESIGN CONCEPT



Sheet I3 - Chainage 12,700 to 13,875 approximately

## URBAN DESIGN CONCEPT



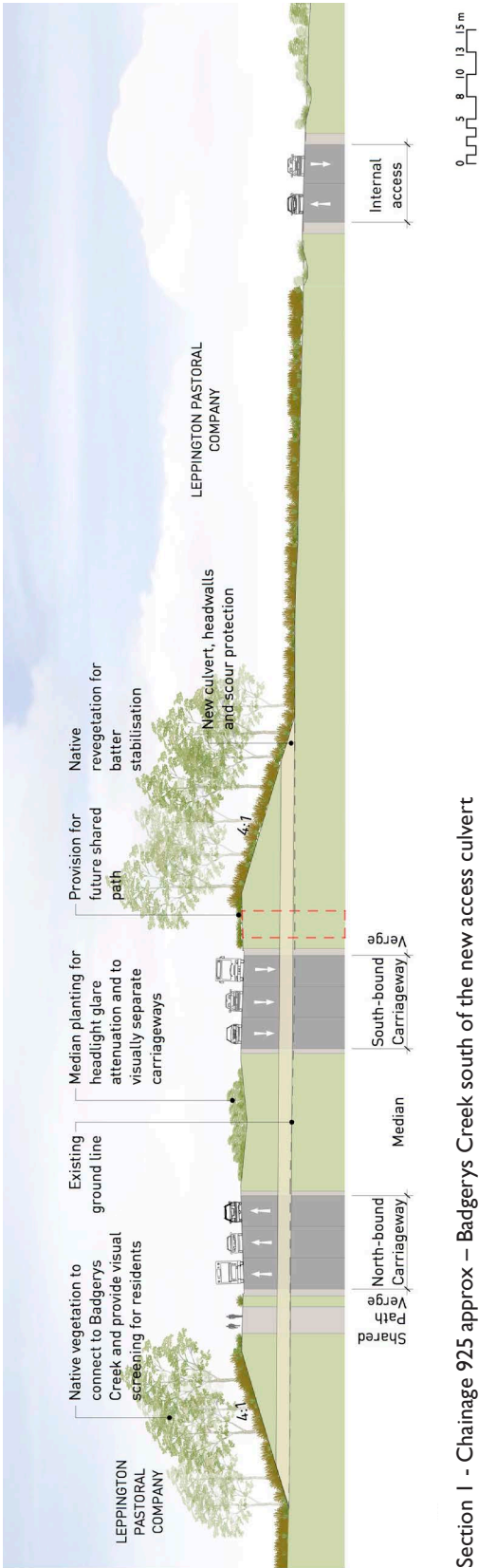
Sheet 14 - Chainage 13,875 to 15,075 approximately

## URBAN DESIGN CONCEPT

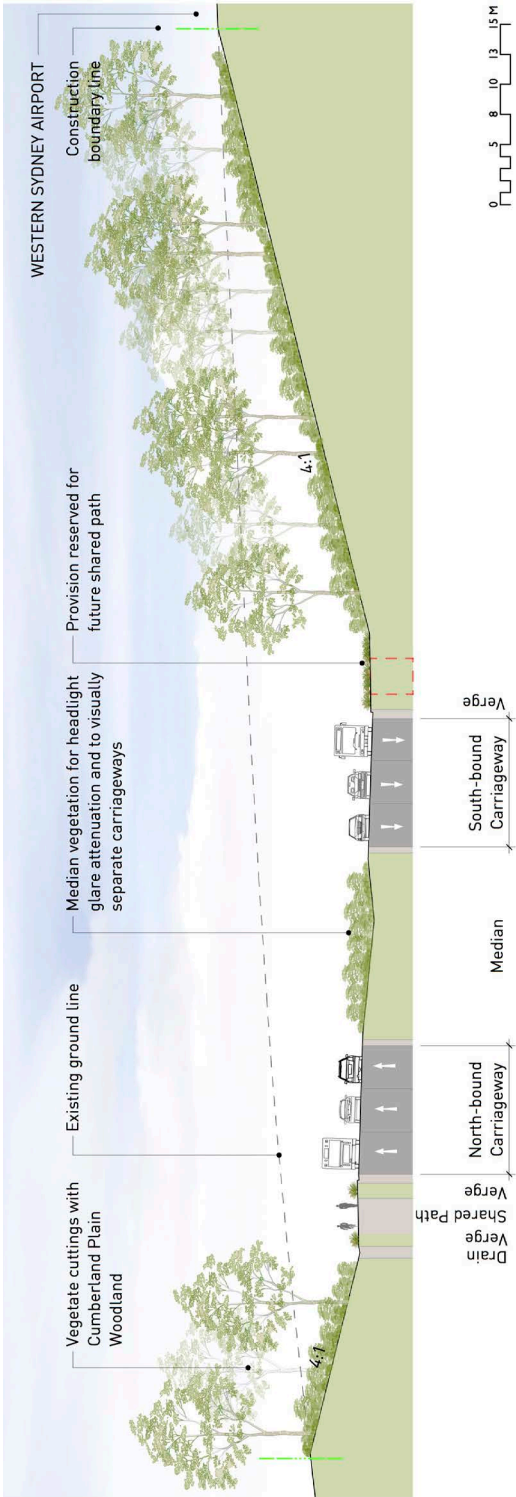


Sheet 15 - Chainage 15,075 to 16,119 approximately.

URBAN DESIGN CONCEPT

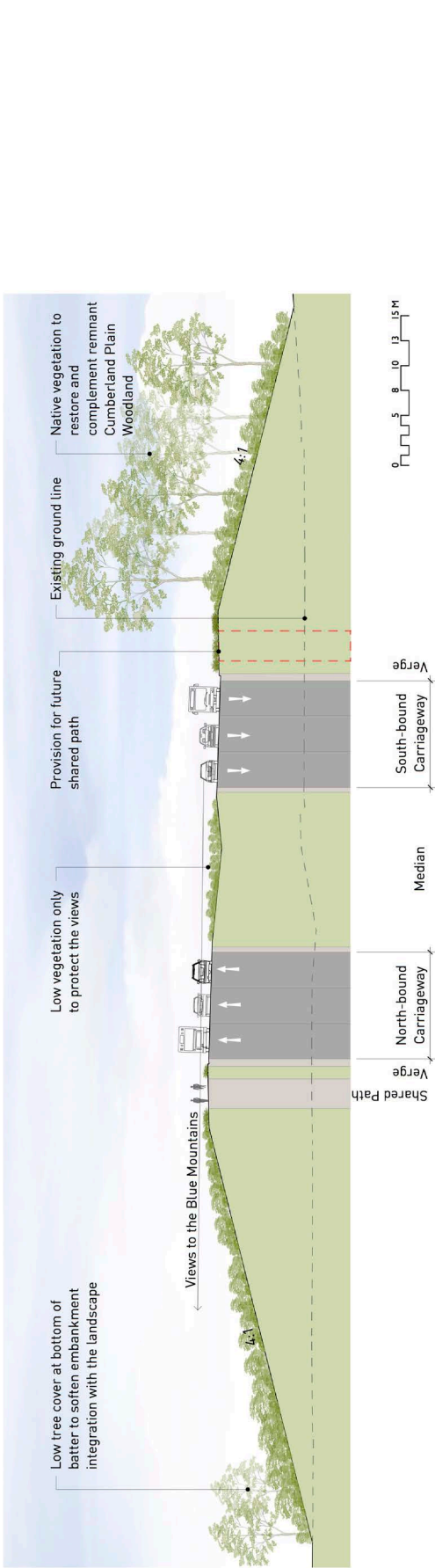


Section 1 - Chainage 925 approx – Badgerys Creek south of the new access culvert

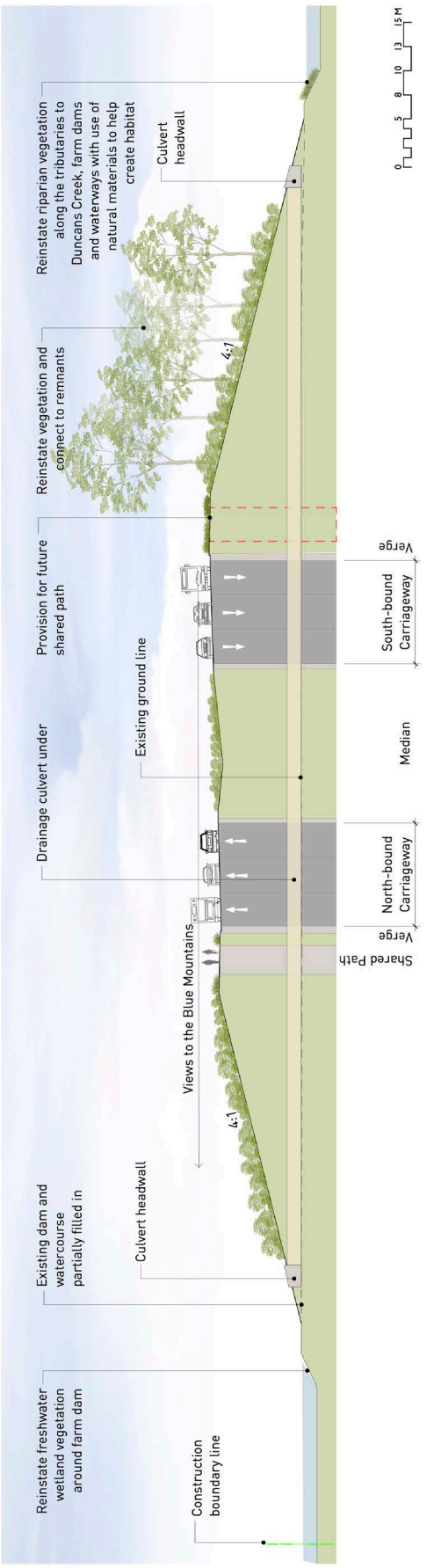


Section 2 - Chainage 3,510 approx – Western Sydney Airport land near Willowdene Avenue

URBAN DESIGN CONCEPT

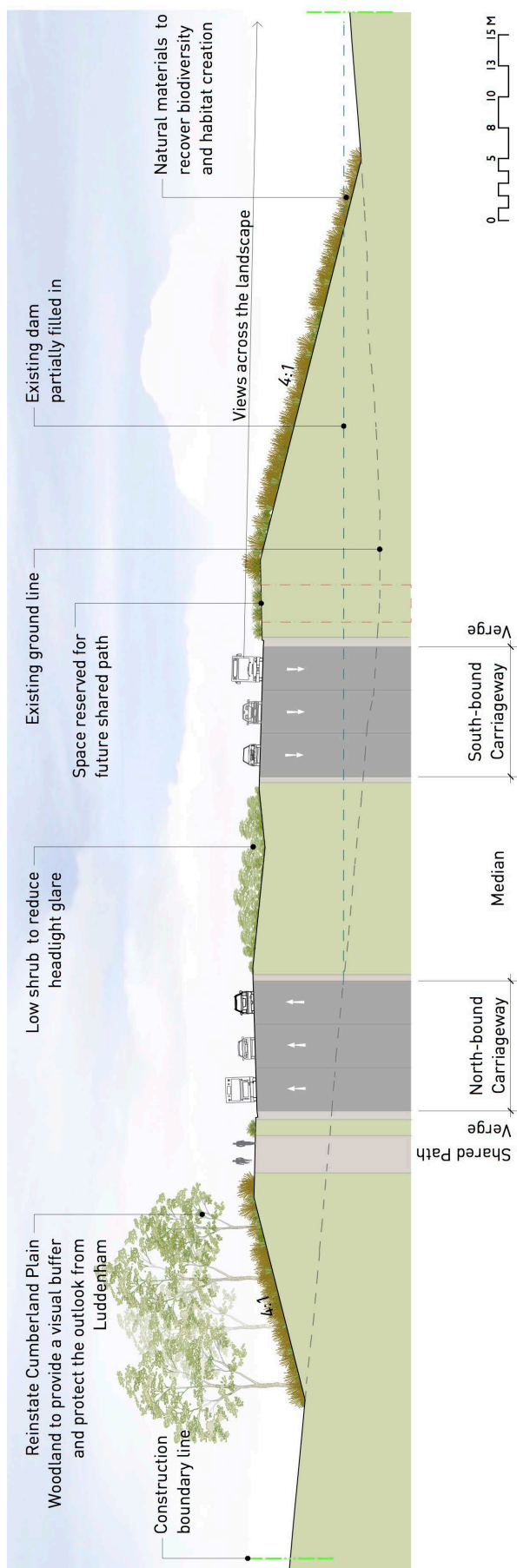


Section 3 - Chainage 3,795 approx – Rural residential in Willowdene Avenue

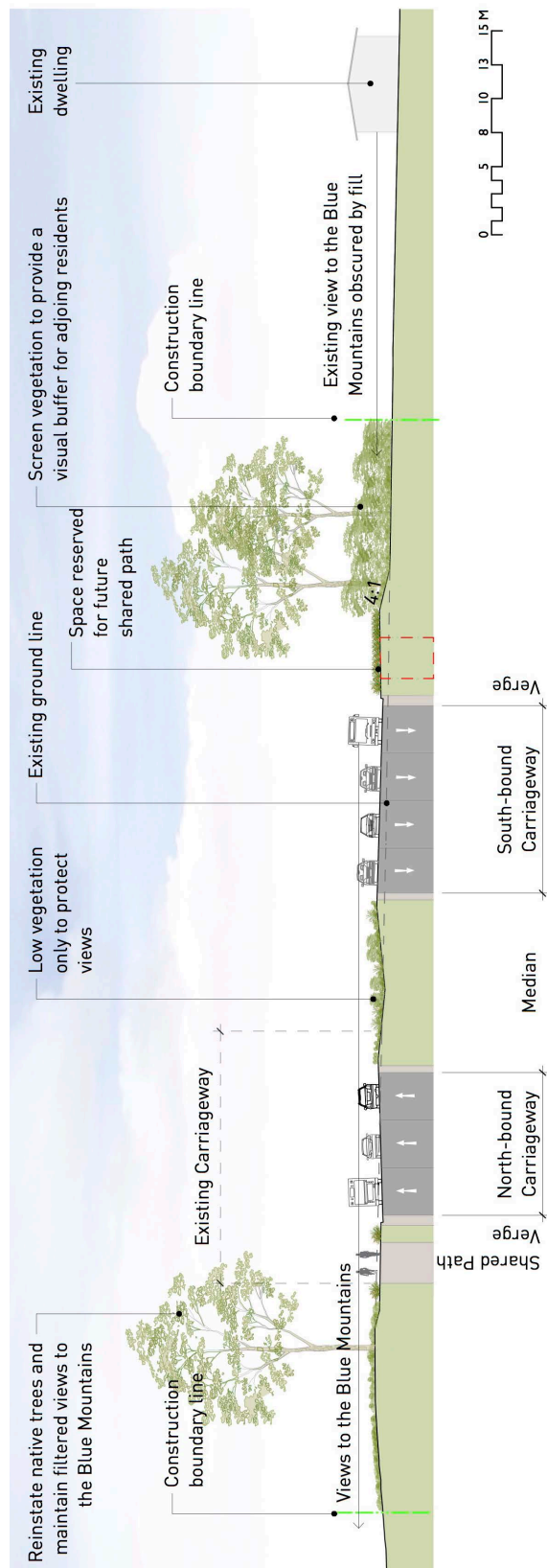


Section 4 - Chainage 4,775 approx – Duncan's Creek catchment dam

## URBAN DESIGN CONCEPT

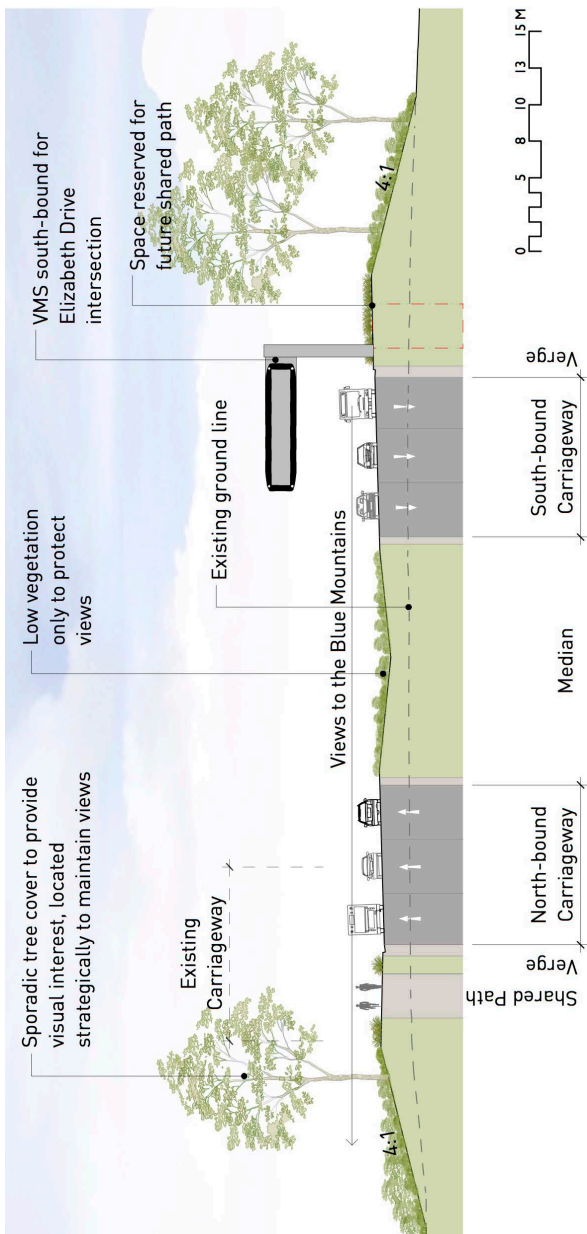


Section 5 - Chainage 5,930 approx - Cosgrove Creek Valley

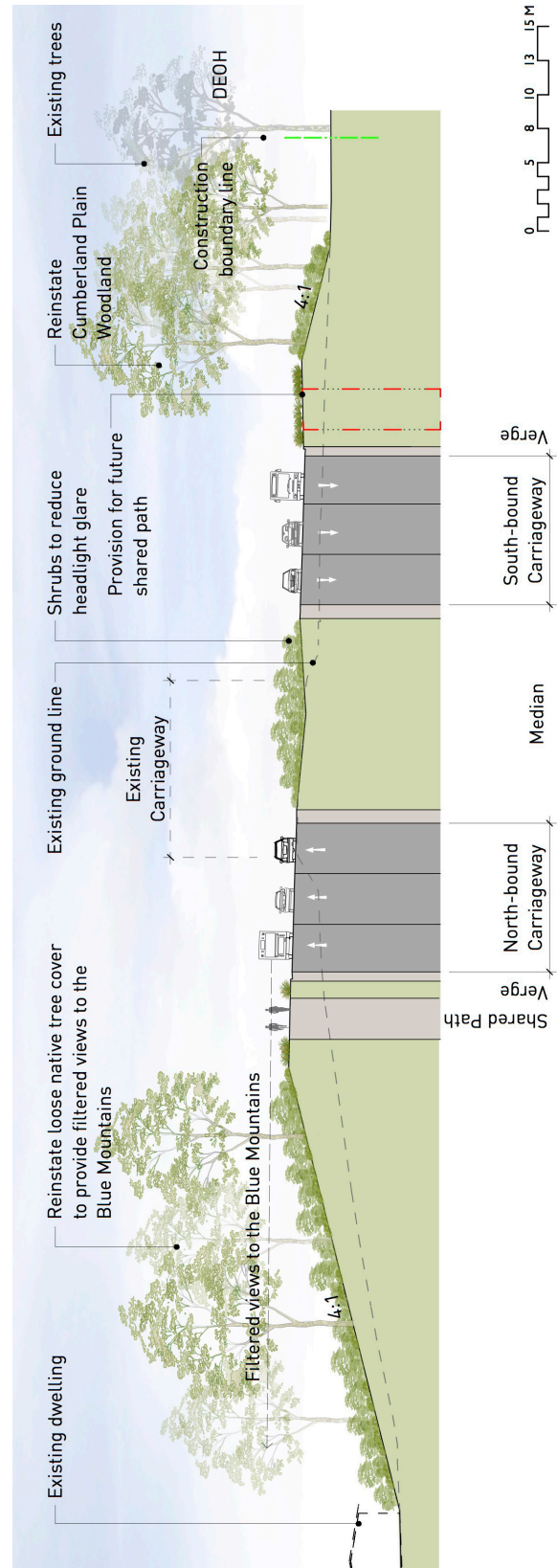


Section 6 - Chainage 7,800 approx - 2,311 Elizabeth Drive, Luddenham

## URBAN DESIGN CONCEPT

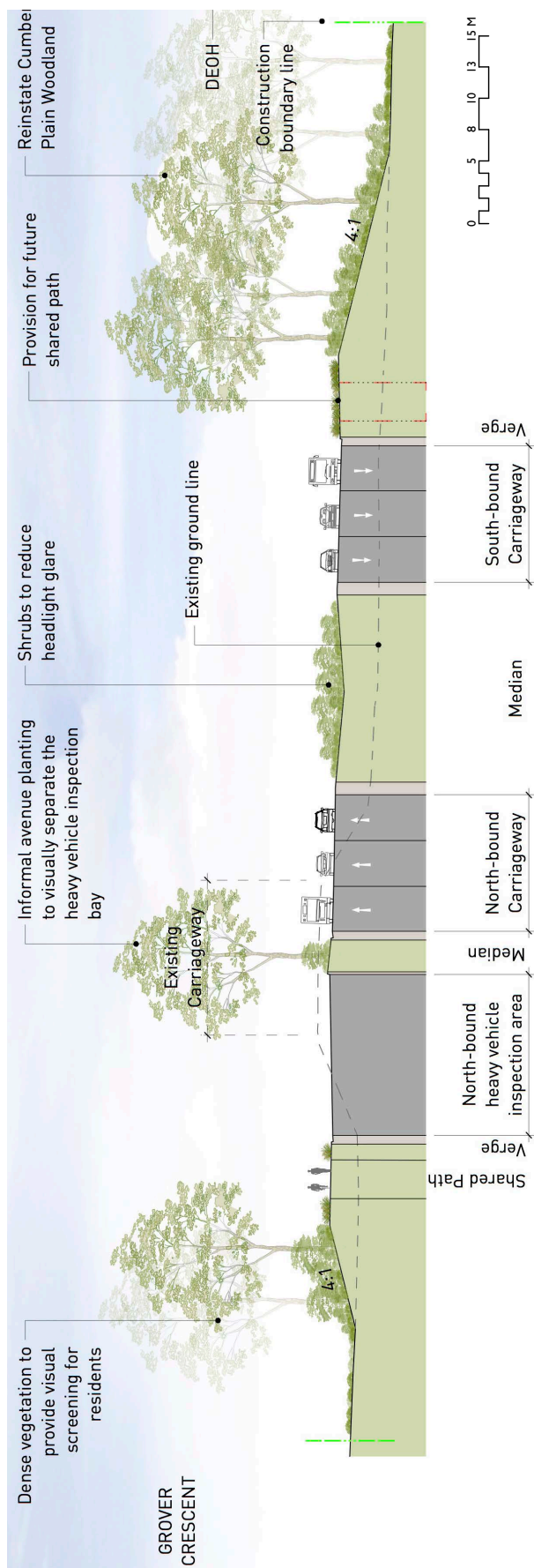


Section 7 - Chainage 9,145 approx - 2,776 The Northern Road, Luddenham

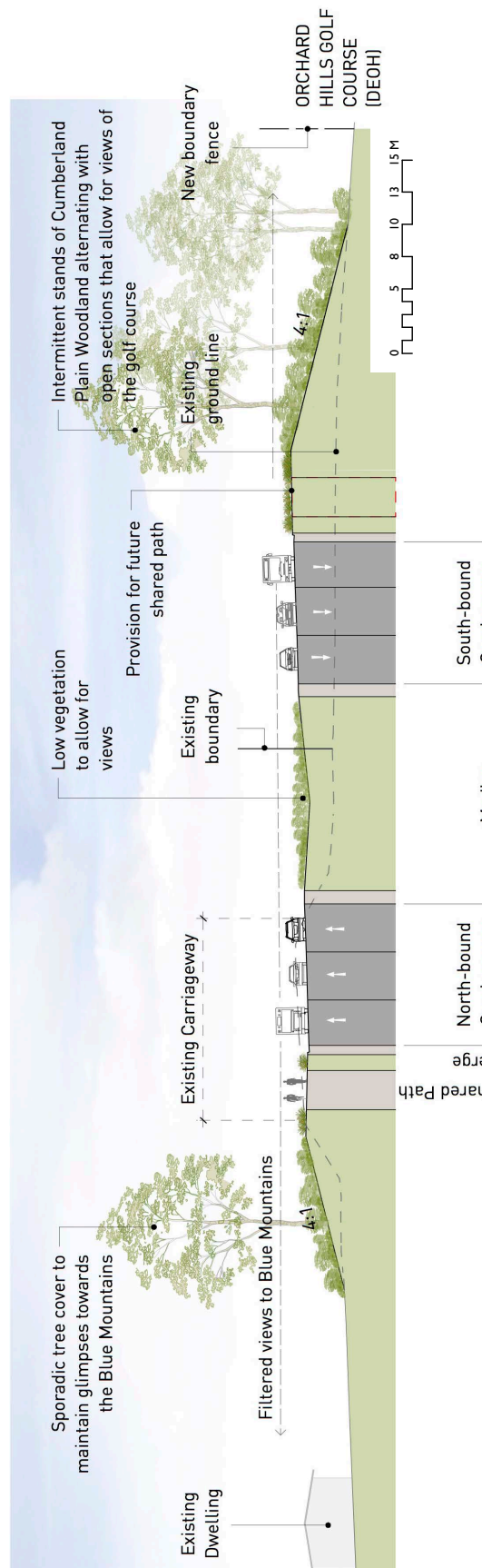


Section 8 - Chainage 10,970 approx - 2,559 The Northern Road

## URBAN DESIGN CONCEPT

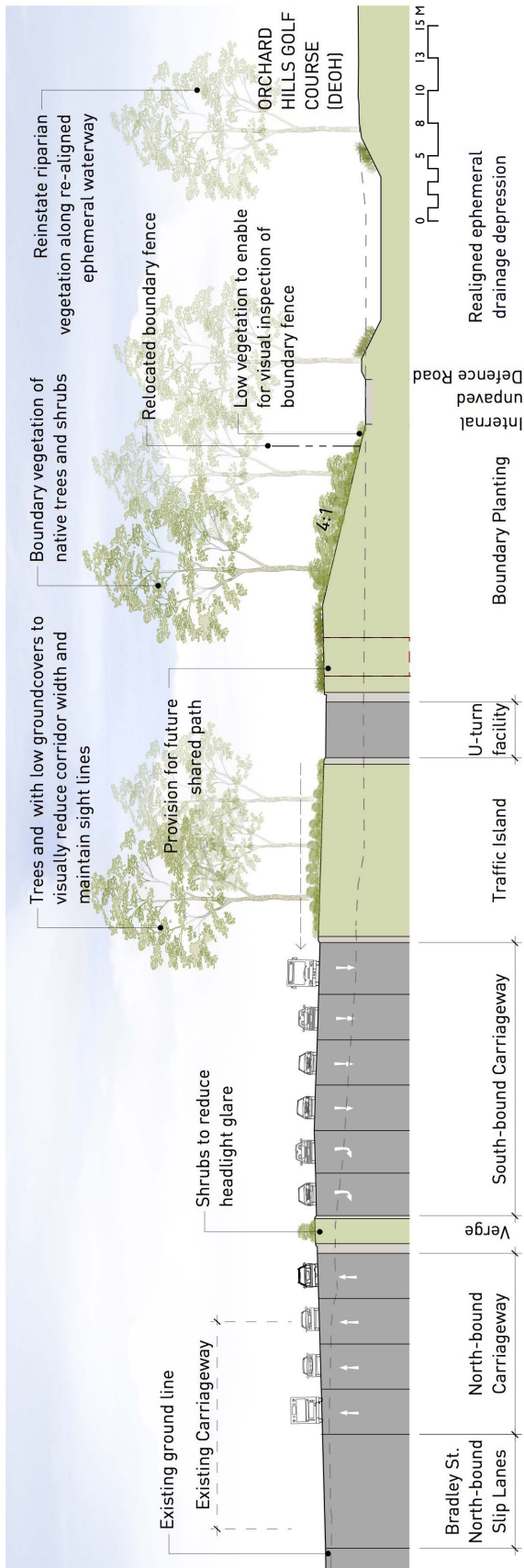


Section 9 - Chainage 12,320 approx - Grover Crescent Heavy Vehicle Inspection Bay



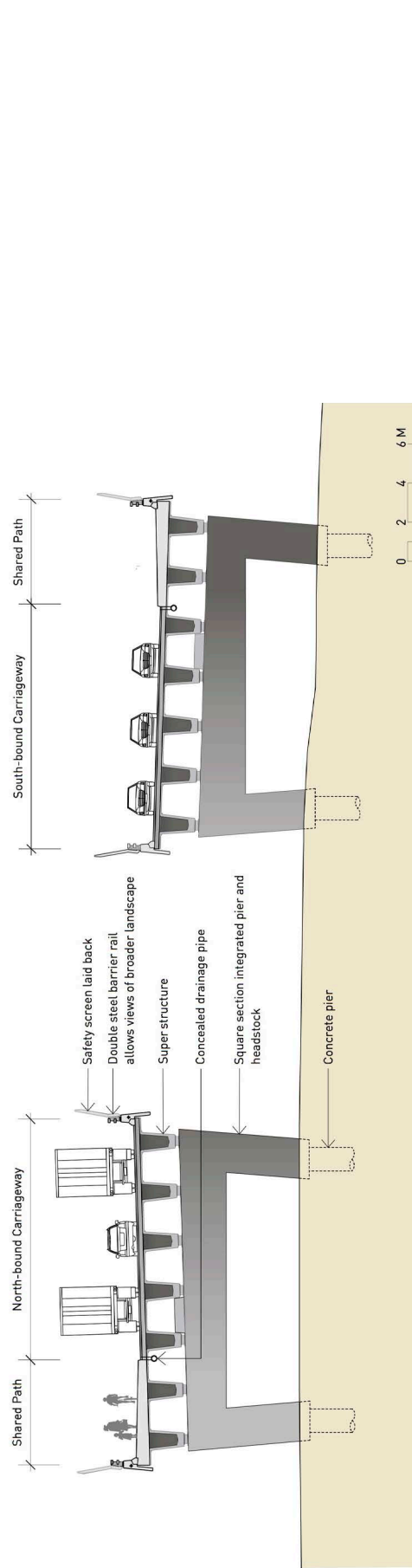
Section 10 - Chainage 13,280 approx - Orchard Hills Golf Club

## URBAN DESIGN CONCEPT

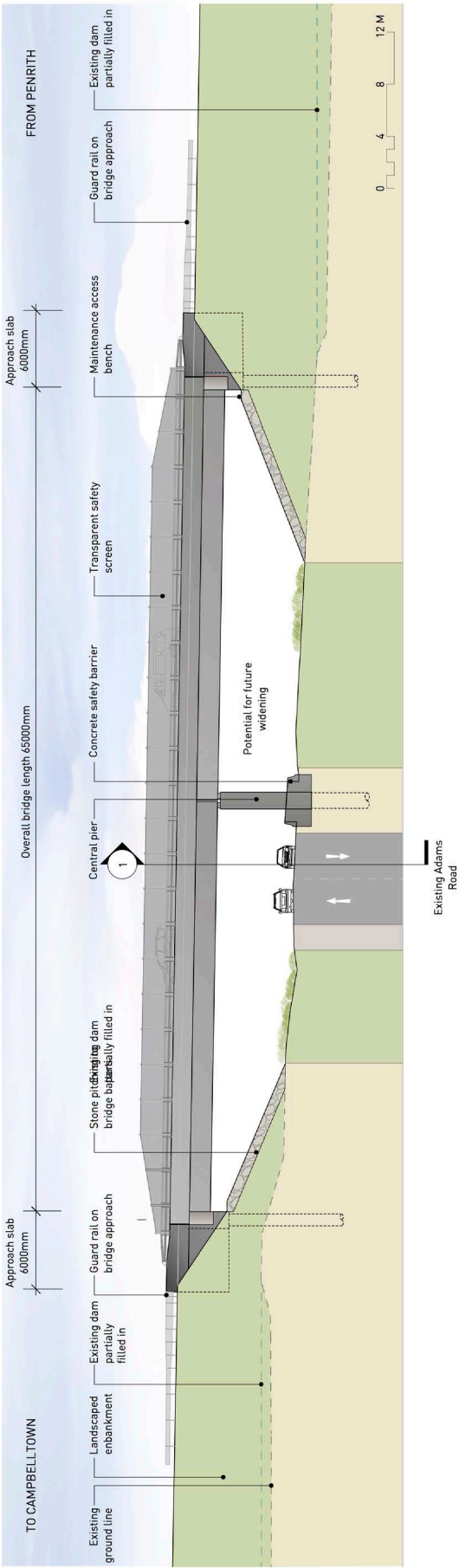


Section 11 - Chainage 15.035 approx - Bradley Street intersection

URBAN DESIGN CONCEPT



Adams Road bridge - cross section



Adams Road bridge - elevation

## 6. LANDSCAPE CHARACTER IMPACT

### 6.1 LANDSCAPE CHARACTER ASSESSMENT

#### 6.1.1 Overview

Landscape character assessment helps determine the overall impact of the project on an area's character and sense of place, including all built, natural and cultural aspects. It is one way of measuring how well the proposed works fits into the built, natural and community context. This is achieved by assessing the likely impact of proposed works on the aggregate of an area's built, natural and cultural character or sense of place.

The method to measure impact is based on the combination of the **sensitivity** of the existing area to change and the **magnitude** (scale, character, distance) of the proposed works within that area - also refer **Figure 1**.

For the purposes of assessment, the concept design is assessed, that is the integrated engineering and urban design concept as illustrated in **section 5**, including location, the vertical and horizontal alignment and overall three dimensional form of the road, heights of cuttings and fill embankments, the location and form of bridges and the landscape at an early stage of growth.

The assessment is undertaken consistent with *EIA-N04*. The impacts identified in the assessment would be avoided and minimised where possible through refinement of the concept design prior to its finalisation - refer **section 8**.

#### 6.1.2 Landscape Character Zones

The landform and vegetation, views and vistas, settlement pattern and built structures within and adjoining the study area combine to define the landscape character of the study area.

As outlined in **section 2.4.8** five LCZs were defined in the area surrounding the project, namely (refer **Figure 19**):

1. Bringelly - between Mersey Road and the transmission line easement
2. Duncans Creek - the Duncans Creek catchment around Willowdene Avenue
3. Luddenham Plateau - between Eaton Road and Littlefields Road
4. Cosgrove Creek - between Adams Road and Elizabeth Drive
5. Mulgoa-Orchard Hills - north of Littlefields Road.

#### Planned Land Use Changes

While the character of parts of the Bringelly, Luddenham Plateau and Cosgrove Creek LCZs is likely to change substantially with the development of the Western Sydney Airport, the WSPGA and the SWPGA, areas west of the new The Northern Road alignment and north of the Water NSW supply pipelines are unlikely to change in the foreseeable future (refer **sections 2.2.1** and **2.2.3**).

Based on planned land use changes, the study area in the future will likely feature two distinct characters:

- Urban development (including the Western Sydney Airport and associated residential/ employment/ industrial areas) in the north, east, and south
- Rural areas (including rural residential and Defence land) in the north and west-also refer **Figure 5**.

The LCZs were described in detail in **section 2.4.8**. The following provides the assessment of the likely impact of the proposed works on the identified LCZs.

## LANDSCAPE CHARACTER IMPACT

### 6.1.3 Common landscape character impacts - lighting

Lighting impacts would be common to all LCZs. They can be differentiated into temporary impacts during construction, and permanent impacts resulting from upgrades to existing lighting or new lighting.

#### **Lighting impacts during construction**

Construction would require some works at night and lighting will be installed on the roadside. As such, the immediate area surrounding the project activities, and the roadside during operation, will be subject to artificial lighting, essentially creating permanent 'daylight' conditions.

#### **Ecological light pollution**

Ecological light pollution may potentially affect nocturnal fauna by interrupting their life cycle. Some species such as light tolerant bats may benefit from the lighting due to increased food availability (insects attracted to lights) around these areas. Due to the frequency and sustained nature of the lighting, it is unlikely that animals will habituate to the light disturbance and a long-term impact in the area of lighting is likely. For more information refer to the *Biodiversity Assessment Report* (Appendix I of the EIS).

#### **Impact on residents and communities**

During construction, areas closest to construction compounds and construction works may experience temporary adverse changes to local amenity due to light spill from any night-time construction works. If unmanaged, noise, light spill, and dust from construction activities may impact on the health and wellbeing of some residents and occupants of buildings nearest to construction works.

All night work and lighting would be carried out in accordance with statutory requirements and guidelines to ensure that there are no unacceptable lighting impacts. A construction management plan would be prepared by the contractor selected to construct the proposed upgrade. This would need to detail the measures taken to reduce potential adverse impacts on people and communities as a result of night time works and associated increased light levels. They may include items such as lighting levels, projection angles and direction and length and frequency of exposure.

#### **Lighting impacts during operation**

Street lighting would be provided along the full length of the project to light the carriageway and shared path. Street lighting would be designed to ensure relevant guidelines are adhered to with regards to the required light levels and the need to manage light spill, pollution and glare.

Increased traffic and light spill from the roadway will add to the changes to the visual environment as a result of the proposed upgrade. They represent a notable change from the existing The Northern Road which has limited lighting.

They may impact on the use and enjoyment of rural properties and in particular the night-time amenity given the existing relatively low night-time light environment. This would affect areas where the upgrade follows the existing road character but in particular those areas near to the proposed new road alignment and bypass of Luddenham town centre that are currently remotely located relative to the road network.

While these changes may be a concern for affected property owners, these are expected to be minor in the context of the project as a whole. Further, they are consistent with the planned land use changes and progressive urbanisation anticipated for much of the area.

## LANDSCAPE CHARACTER IMPACT

### 6.2 LCZ 1: BRINGELLY

#### 6.2.1 Existing landscape character

LCZ 1 is generally an open and expansive rural landscape, interspersed with remnant vegetation, farm dams and buildings.

##### **Topography and views**

LCZ 1 is bisected by a north-south ridge that crosses the existing The Northern Road approximately half-way within the character zone. The LCZ 1 is generally gently sloping topography. There are occasional views of the Blue Mountains to the west.



Figure 28: Location of the Bringelly LCZ

##### **Hydrology**

LCZ 1 lies high up in the catchment of Badgerys and Duncans Creeks. Badgerys Creek and a small tributary cross The Northern Road north of Dwyer Street.

##### **Vegetation**

LCZ 1 has largely been cleared for rural purposes. Remnants of Cumberland Plain Woodland are primarily found along the road edge, along creek lines and along property boundaries.

##### **Built form and heritage**

The small amount of built form in this zone consists primarily of rural residential buildings and structures set back from the road. There are a number of sheds used for agricultural purposes.

Consistent with the current rural character and low levels of development The Northern Road is a relatively small rural road that generally follows and integrates with the natural form of the landscape.



Figure 29: The mix of open pastures and remnants with mid-distance views

## LANDSCAPE CHARACTER IMPACT

The study area features one Aboriginal heritage site and no Non-Aboriginal heritage items. For more detail refer *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS).

### **Spatial quality**

The distribution of vegetation and topography results in a largely open spatial quality with generally mid-distance views across the landscape. Small areas such as along Badgerys Creek are more enclosed.

### **Connectivity and access**

The Northern Road is the primary access route. A small number of local roads including Mersey and Dwyer Roads also provide access to rural properties in the area. There are access tracks associated with utility easements, however, there are no existing bus stops, or designated cycle or pedestrian paths.

### **Key activity areas**

The Northern Road is the key activity area within LCZ 1, carrying large volumes of local and regional traffic. Leppington Pastoral Company provides a moderate amount of activity through employment. Utility infrastructure and easements within LCZ 1 generate minor activity related to operations and maintenance.

### **6.2.2 The proposed works**

The proposed works within LCZ 1 include:

- Construction of a new road alignment to divert around the site of the Western Sydney Airport
- Two new intersections
  - At the intersection with the existing The Northern Road to provide a southern entrance to the Western Sydney Airport, as well as access to the Leppington Pastoral Company
  - A service entrance to the Western Sydney Airport



Figure 30: The ridge west of the existing The Northern Road (shown right in the photograph) blocks views of the Blue Mountains from the majority of the existing road alignment

## LANDSCAPE CHARACTER IMPACT

- An internal access road for the Leppington Pastoral Company including a cattle underpass through a culvert under the proposed new road alignment
- Cut and fill embankments up to about eight metres tall
- Five construction compounds:
  - North of The Northern Road, at the intersection with Mersey Road
  - On the southern side of The Northern Road, opposite Mersey Road
  - On the land of the Leppington Pastoral Company, north of the existing access road
  - On the land of the Leppington Pastoral Company, between the existing The Northern Road and the proposed new alignment
  - On the land of the Leppington Pastoral Company, surrounding the proposed new intersection to the Western Sydney Airport
- Removal of rural dwellings and structures
- Road drainage and water quality controls utilising swales or drainage channels, drainage inlets, culverts and pipe networks
- Road-side furniture and elements such as barriers, fences and signs. Final locations for these elements are yet to be determined
- Lighting is not required on the main carriageway, but it would be provided for local road intersections as appropriate. This is yet to be determined.

### 6.2.3 Landscape character changes

#### **Topography**

New cut and fill embankments would be up to about eight metres high. They would stand out as unnatural landforms in the gently undulating landscape.

#### **Hydrology**

Natural creek lines would be altered through the introduction of culverts under the new alignment. Combined with the width of the road corridor this would change the extent to which creeks can be perceived and appreciated as natural landscape features. Culverts would also prevent the development of open space links along creek lines as part of future urban development and associated open space networks and regenerate native vegetation around creek crossings to provide a landscape buffer and enhance creeks as ecological corridors.

#### **Vegetation**

Remnant vegetation would be removed along the existing road corridor between Dwyer Road and the Leppington Pastoral Company, including along Badgerys Creek. This would alter the creek character and the road interface with adjoining properties.

Revegetation would be provided in the road corridor and in other areas disturbed by construction activities.

#### **Built form and heritage**

The project would require the removal of a number of buildings and sheds, primarily associated with the Leppington Pastoral Company. The new road alignment would introduce a major new built form in the landscape. Other new built forms would be the access road and culvert.

## LANDSCAPE CHARACTER IMPACT

The proposed upgrade would not directly impact on Non-Aboriginal heritage items. An Aboriginal heritage site would be affected. For a discussion of the impacts on heritage values refer *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS).

### **Spatial quality**

The spatial quality within the southern section near Badgerys Creek would be modified with the removal of vegetation and the introduction of large fill embankments. They would alter views and vistas across the landscape.

### **Connectivity and access**

Existing intersections and driveways would be changed to left-in left-out only. The u-turn facility at the entrance to the Western Sydney Airport would ensure all movement and access is maintained. The existing alignment of The Northern Road would be closed as it bisects the site of the Western Sydney Airport.

The provision of a shared path along the upgraded road would enhance opportunities for safe active transport. The provision of bus lanes would improve opportunities for future public transport.

### **Key activity areas**

There would be no changes to activity areas as a result of the upgrade.

It is noted that the planned land use changes including development of the Western Sydney Airport and urban and residential development within the SWPGA will lead to the development of new activity areas in the future.

### **Construction activities**

There are five sites identified for use for ancillary facilities during construction. The sites are currently largely cleared. The site on the corner of Mersey Road features a small number of scattered remnant trees.

The sites would be surrounded by temporary fencing and may include activities such as site compounds, stockpile areas for materials, temporary storage of spoil and other construction activities.

The use of the areas would temporarily alter their character; with the exception of the site around the proposed new intersection to the Western Sydney Airport, they are located adjacent to The Northern Road and would be highly visible by the large numbers of people travelling along that route.

Ancillary facilities would therefore have a temporary impact on the landscape character of LCZ 1.

## **6.2.4 Landscape character assessment**

### **Sensitivity**

LCZ 1 is generally an attractive rural landscape largely experienced by rural residents, workers and motorists along The Northern Road, including tourists along this designed tourist drive. It is an open landscape with relatively low levels of vegetation cover, providing mid-distance views rural views and limited glimpses to the Blue Mountains.

## LANDSCAPE CHARACTER IMPACT

The rural nature of LCZ 1 is essential to its character and is highly sensitive to change, as it has a limited capacity to absorb a major new piece of infrastructure.

Due to this, the LCZ has been assessed to have **high** sensitivity

### **Magnitude**

Features of the project within this LCZ would include the widening of approximately 700 metres of existing road and the introduction of a new road alignment through a greenfield site, with a total width of over 110 metres in some sections. It represents a major new road and built infrastructure in a setting with currently low levels of development.

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

### **Landscape character impact**

The qualitative assessment indicates that the landscape character impact of the proposed works in LCZ 1 is likely to be:

Sensitivity	High
Magnitude	High
<b>Landscape character impact</b>	<b>High</b>

It is noted that major land use changes are proposed for LCZ 1 including urban (town centre and residential) development and the Western Sydney Airport.

The project seeks to support these planned changes that will themselves lead to a transformation of the landscape character of the area to meet identified community needs over the next 20 to 25 years.

## LANDSCAPE CHARACTER IMPACT

### 6.3 LCZ 2: DUNCANS CREEK

#### 6.3.1 Existing landscape character

LCZ 2 is characterised by a diverse pattern of large and small rural holdings, woodland remnants, pastures, food production, creek corridors and farm dams. They combined to produce an attractive and visually interesting character.

##### **Topography and views**

LCZ 2 is largely located west of the main ridge line where the topography is noticeably steeper; with a number of sharply incised steep and narrow valleys that cross Willowdene Avenue.

Due to the diverse pattern of vegetation and topography, views are generally limited to the short to mid-distance.

##### **Hydrology**

There are a large number of creek lines and ephemeral watercourses draining to Duncans Creek. They have been extensively dammed on private rural properties. Farm dams are an important visual and landscape character feature of this setting.

##### **Vegetation**

There are extensive stands of remnant Cumberland Plain Woodland along creek lines, dams and a number of ridge tops. There are also some cultural plantings associated with food production and ornamental gardens on rural properties.

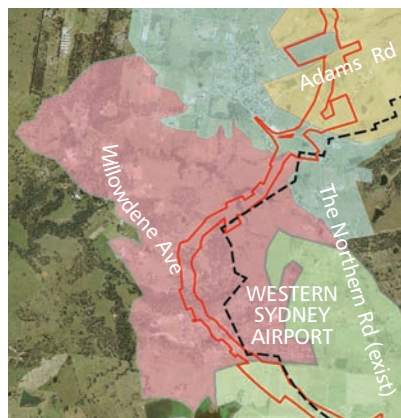


Figure 32: Location of the Duncans Creek LCZ



Figure 31: The steeper and diverse landscape of the Duncans Creek Valley includes a small-scale pattern of pastures and woodland remnants

## LANDSCAPE CHARACTER IMPACT

### **Built form and heritage**

Built form in this zone is limited to rural dwellings and structures and small access roads.

The site of Lawson's Inn is partially located within LCZ 2 and has been identified as having local heritage significance. There are also a number of Aboriginal heritage items and sites. Refer *Non-Aboriginal Heritage Working Paper* (Appendix N of the EIS) and *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS).

### **Spatial quality**

LCZ 2 is a diverse zone with a generally visually contained character as views are restricted by vegetation cover and topography.

### **Connectivity and access**

Willowdene Avenue is the main access road to rural holdings, together with Vicar Park Lane. There are no current cycle routes or pedestrian footpaths.

### **Key activity areas**

There are no major activity areas in LCZ 2.

### **6.3.2 The proposed works**

The proposed works within LCZ 2 include:

- Construction of a new road alignment to divert around the site of the Western Sydney Airport
- Closure of Vicar Park Lane
- One construction compound site adjacent to a farm dam between Willowdene Avenue and the proposed new alignment of The Northern Road
- Removal of rural structures



Figure 33: View along Willowdene Avenue showing the relatively steep topography and low key character of existing roads

## LANDSCAPE CHARACTER IMPACT

- Road drainage and water quality controls utilising, swales or drainage channels, drainage inlets, culverts and pipe networks
- Road-side furniture and elements such as barriers, fences and signs. Final locations for these elements are yet to be determined
- Lighting is not required on the main carriageway, but it would be provided for local road intersections as appropriate. This is yet to be determined.

### 6.3.3 Landscape character changes

#### **Topography**

A large amount of earthworks would be required to meet the geometric requirements within the steeper topography of LCZ 2. This would include batter heights in excess of ten metres in some areas, for both cut and fill. They would stand out as highly unnatural landforms.

#### **Hydrology**

All existing creek lines would be modified culverts under the new alignment. A number of farm dams would be wholly or partially filled in, including dams situated on land not currently included in the site of the Western Sydney Airport.

#### **Vegetation**

A large amount of remnant vegetation would be cleared between the Leppington Pastoral Company and Luddenham town centre. Where possible, subject to airport operational requirements and views, native revegetation would be provided within the road corridor and in areas affected by construction activities.

#### **Built form and heritage**

The new road alignment would introduce a major new built form in the landscape. It would require removal of a small number of rural structures.

The project would not directly impact on structures identified as having heritage values. However, the proposed road alignment would bisect land that forms part of the Lawson's Inn site, identified as an item of local heritage value under the Liverpool Local Environmental Plan 2008. It would further bisect several Aboriginal heritage sites. For a discussion on the likely impact on heritage items and their curtilage, refer to the *Non-Aboriginal Heritage Working Paper* (Appendix N of the EIS). For a discussion of impacts on Aboriginal heritage refer to the *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS).

#### **Spatial quality**

The spatial quality of each valley would be changed as a result of major earthworks. The overall diversity of spatial character within the LCZ would not change.

#### **Connectivity and access**

Vicar Park Lane would be closed. Properties located within the Western Sydney Airport are being resumed as part of planning for the airport, removing the need for access.

As the proposed alignment deviates from the existing road through existing properties, it would result in new segments of land that require access to the proposed alignment. Changes to access arrangements for the majority of properties that currently have access directly onto The Northern Road and some

## LANDSCAPE CHARACTER IMPACT

properties that have access along roads that connect to The Northern Road would occur as a result of the project. .

This applies in particular to a number of properties that are not currently located within the site of the Western Sydney Airport and that would be severed by the new road alignment. Design resolution of access, including stock access, between severed portions of farm land is yet to be finalised. Options for proposed alternative access arrangements outlined in the *Traffic and Transport Assessment* (Appendix G of the EIS).

The provision of a shared path along the upgraded road would enhance opportunities for safe active transport. The provision of bus lanes would improve opportunities for future public transport.

### **Key activity areas**

The project elements would not result in any changes to activity areas. It is noted that the Western Sydney Airport will introduce a major new activity area.

### **Construction activities**

During construction, an area adjoining the large u-shaped farm dam would be used for ancillary facilities. The majority of this area is currently cleared.

The site would be surrounded by temporary fencing and may include activities such as site compounds, stockpile areas for materials, temporary storage of spoil and other construction activities.

While use of the site as a construction compound would temporarily alter the character of the landscape, the site is not readily visible from surrounding areas. It would have little impact on the landscape character of LCZ 2.

### **6.3.4 Landscape character assessment**

#### **Sensitivity**

LCZ 2 has a scenic, undulating landscape character with extensive areas of Cumberland Plain Woodland. The landscape is largely viewed by local residents and visitors but would have a low capacity to absorb major new infrastructure.

Overall, the LCZ has been assessed to have **high** sensitivity.

#### **Magnitude**

The project within this LCZ would introduce a new road alignment through a greenfield site, with a total width of about 130 metres in some sections and requiring substantial earthworks and embankments. It represents a major new road and built infrastructure in a setting with currently low levels of development.

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

## LANDSCAPE CHARACTER IMPACT

### Landscape character impact

The qualitative assessment indicates that the landscape character impact of the proposed works in LCZ 2 is likely to be:

Sensitivity	High
Magnitude	High
<b>Landscape character impact</b>	<b>High</b>

It is noted that the Western Sydney Airport will lead to major land use changes for the parts of LCZ 2 east of the proposed road alignment.

The project seeks to support these changes. The changes will result in a progressive transformation of the landscape character of the area to meet identified community needs over the next 20 to 25 years.

However, there are no current plans for land use changes west of the proposed alignment. These areas form part of the Metropolitan Rural Area and are not likely to change in the foreseeable future. The identified high landscape character impact would have a lasting effect on these areas.

## 6.4 LCZ 3: LUDDENHAM PLATEAU

### 6.4.1 Existing landscape character

The Luddenham Plateau LCZ is characterised by a broad ridge with scenic panoramic views over a gently sloping pastoral landscape.

#### Topography and views

A broad ridge line runs north to south through LCZ 3 along the existing North Road alignment. The lower ground within this zone has both undulating topography and flat, open plains.

#### Hydrology

LCZ 3 is situated within the upper catchment of Duncans, Mulgoa, Blaxland and Cosgrove Creeks. There are only minor ephemeral watercourses. A network of farm dams provide visual interest and are an attractive and important visual and landscape character feature.

#### Vegetation

LCZ 3 has largely been extensively cleared for rural and urban purposes. A large woodland remains near St James Anglican Church. The remainder of LCZ 3 features limited scattered trees.

Vegetation within Luddenham town centre consists of a mix of native vegetation remnants and cultural plantings associated with residential properties. There are also pockets of freshwater wetland flora around farm dams.



Figure 34: Location of the Luddenham Plateau LCZ

## LANDSCAPE CHARACTER IMPACT

### **Built form and heritage**

The built form within Luddenham town centre generally consists of low density dwellings, as well as community buildings such as a post office, churches and schools, and a number of shops including cafes, service stations and a supermarket.

Beyond the town built form is limited and includes rural dwellings and structures.

Heritage items within the study area in LCZ 3 include the site of Lawson's Inn, remnants of The Northern Road in Eaton Road, and at 2,778 The Northern Road, the site of Miss Lawson's Guesthouse, 'Pleasant View' at 2,901 The Northern Road, and two weatherboard houses and associated huts and sheds including the Old Dairy at 2,778 The Northern Road.

Other nearby heritage items include the Luddenham Public School and St James Anglican Church and cemetery. There are also a number of Aboriginal heritage items and sites. Refer *Non-Aboriginal Heritage Working Paper* (Appendix N of the EIS) and *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS).

### **Spatial quality**

There is an open and expansive spatial quality to LCZ 3 due to the high elevation and long distance views. The sky and the landscape are the predominant visual features, together with the blue ribbon of the Blue Mountains providing a backdrop to the west.

This is in contrast with the spatial quality of Luddenham town centre which is more enclosed as a result of denser development including buildings and vegetation.

### **Connectivity and access**

The Northern Road is the primary access route through LCZ 3, together with Elizabeth Drive. There are a number of secondary roads to surrounding areas such as Park Road and Adams Road. There is a network of local streets within Luddenham town centre. There are currently no dedicated cycle paths or footpaths beyond the Luddenham town centre.



Figure 35: Expansive sky, farm dams and the constant ribbon of the Blue Mountains in the west are characteristic features of the Luddenham Plateau

## LANDSCAPE CHARACTER IMPACT

### **Key activity areas**

Luddenham town centre functions as the local centre servicing the surrounding rural area. It is the key activity area in LCZ 3 with a public school, catholic primary school, shops, cafes, a showground and parks, as well as a number of churches.

The other key activity area is The Northern Road itself. It carries large volumes of local and regional traffic including tourism traffic.

### **Public domain**

The public domain within LCZ 3 includes the public roads and footpaths within the Luddenham town centre. The Luddenham showground is an important community and agricultural venue. Sales Park is a major oval. Wilmington Reserve in Jamison Street also provides for community recreation.

### **6.4.2 The proposed works**

The proposed works within LCZ 3 includes:

- Construction of a new road alignment south of Elizabeth Drive
- Widening the existing Northern Road north of Elizabeth Drive
- New intersections
  - With the existing The Northern Road south of Luddenham town centre including realignment of the existing The Northern Road
  - With the eastern part of Eaton Road
  - With Elizabeth Drive including re-alignment of Elizabeth Drive to create a four-way intersection with the existing The Northern Road
- Modifications to the existing Elizabeth Drive to provide a new left-in intersection from the proposed new Elizabeth Drive alignment and changing the existing intersection with The Northern Road to left-out only
- Cut and fill embankments up to about five and eight metres tall respectively



Figure 36: View of the Western Sydney Parklands from The Northern Road, near Luddenham Village Café

## LANDSCAPE CHARACTER IMPACT

- Eight construction compounds:
  - Two compounds south of the existing The Northern Road near Eaton Road
  - One compound north of Eaton Road and west of the proposed new alignment of The Northern
  - One compound along The Northern Road, opposite 2,342 The Northern Road
  - One compound between the existing The Northern Road and the existing Elizabeth Drive
  - One compound at 2,778 The Northern Road, Luddenham
  - Two compounds south of Littlefields Road, one on each side of the corridor
- Alterations to property access to generally left-in left-out only
- Removal of rural dwellings and structures
- Partial infilling of farm dams
- Clearing of remnant vegetation and Christmas tree farms near Eaton Road and Elizabeth Drive
- Road drainage and water quality controls utilising swales or drainage channels, drainage inlets, culverts and pipe networks
- Road-side furniture and elements such as barriers, fences and signs. Final locations for these elements are yet to be determined
- Lighting is not required on the main carriageway, but it would be provided for local road intersections as appropriate. This is yet to be determined.

### 6.4.3 Landscape character changes

#### **Topography**

The upgrade would require substantial earthworks with batters up to eight metres tall required to achieve geometric parameters for both the new alignment and upgraded section of the existing The Northern Road. They would introduce a large unnatural land form in a visually open and exposed area.

#### **Hydrology**

All existing creek lines would be modified to accommodate new culverts under the new alignment. A number of farm dams would be wholly or partially filled in.

#### **Vegetation**

The main loss of vegetation would be associated with the two Christmas tree farms, as well as a number of scattered remnants. Revegetation would be provided in the road corridor and in other areas disturbed by construction activities.

#### **Built form and heritage**

A number of buildings would require removal including near Eaton Road, near the realigned Elizabeth Drive and new intersection and between Elizabeth Drive and the Blue Mountains Honey Shed.

The project would not directly impact on structures identified as having heritage values. However, the proposed road alignment would bisect land that forms part of the Lawson's Inn site, identified as an item of local heritage value under the Liverpool Local Environmental Plan 2008. It would further bisect several Aboriginal heritage sites.

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For a discussion on the likely impact on heritage items and their curtilage, refer to the *Non-Aboriginal Heritage Working Paper* (Appendix N of the EIS). For a discussion of impacts on Aboriginal heritage refer to the *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS).

### **Spatial quality**

The overall open quality of LCZ 3 would not change as a result of the project. However there are localised changes where fill embankments interrupt the open flow of the landscape towards the Blue Mountains, closing off existing views from a small number of properties east of The Northern Road.

### **Connectivity and access**

The proposed new road alignment would bypass Luddenham town centre, reducing through traffic and delivering improved amenity in the town.

Eaton Road would be severed by the new road alignment with access maintained via the existing The Northern Road and the new intersection with the proposed new The Northern Road alignment.

Property access and access to and from the existing Elizabeth Drive alignment would be changed to left-in left-out only, with turn-around facilities provided on the existing The Northern Road and the Littlefields Road extension (**refer LCZ 5**). All other movements would be maintained.

The provision of a shared path along the upgraded road would enhance opportunities for safe active transport. The provision of bus lanes would improve opportunities for future public transport.

### **Key activity areas**

The proposed upgrade would provide a bypass around Luddenham town centre and would reduce through traffic. There is the potential removal of through traffic would affect existing businesses such as service stations, food outlets that benefit from passing traffic and associated incidental trade. Potential impacts have been identified and assessed in the *Socioeconomic Assessment* (Appendix J of the EIS).

It is noted that development of employment lands within the WSPGA and the Western Sydney Airport would introduce major new activity areas in the future.

### **Public domain**

It is anticipated that the public domain in and amenity of Luddenham town centre would be improved as a result of the proposed bypass. It would remove through traffic from the town, including large numbers of vehicles including heavy vehicles. This would improve public safety and amenity, while reducing noise and pollution, make the town a safer and more pleasant place to walk or cycle.

### **Construction activities**

The sites identified for ancillary facilities during construction are generally cleared areas, with the exception of the Christmas tree farm near the intersection of The Northern Road and Elizabeth Drive. The sites would be surrounded by temporary fencing and may include activities such as site compounds, stockpile areas for materials, temporary storage of spoil and other construction activities.

Situated in prominent locations along existing major road corridors the use of the site for construction compounds or other ancillary facilities would temporarily alter the character of the landscape.

## LANDSCAPE CHARACTER IMPACT

### 6.4.4 Landscape character assessment

#### ***Sensitivity***

LCZ 3 attracts a larger number of potential viewers including residents and visitors to Luddenham and motorists and tourists along The Northern Road. Due to its open and exposed ridge top location LCZ 3 has a low capacity to absorb major changes. The elevated plateau provides a spectacular setting for views over an attractive rural landscape to the Blue Mountains.

Overall, the LCZ has been assessed to have **high** sensitivity.

#### ***Magnitude***

The upgrade would introduce a major new road corridor into a rural setting in the south, and increase the width of the existing road north of Elizabeth Drive more than fourfold. This would represent a large new built form in a visually exposed area. However, the upgrade would deliver some benefit to the character and amenity of the town of Luddenham.

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

#### ***Landscape character impact***

The qualitative assessment indicates that the landscape character impact of the proposed works in LCZ 3 is likely to be:

Sensitivity	High
Magnitude	Moderate
<b>Landscape character impact</b>	<b>High to moderate</b>

It is noted that the character of parts of LCZ 3 east of the road corridor around Elizabeth Drive are likely to change substantially as employment lands in the WSPGA are developed and the area transforms from a rural area.

The project seeks to support these planned changes that will themselves lead to a transformation of the landscape character of the area to meet identified community needs over the next 20 to 25 years.

There are no current plans that indicate major changes to land uses around Luddenham town centre and west of the existing alignment of The Northern Road. The identified high landscape character impact would have a lasting effect on these areas.

## LANDSCAPE CHARACTER IMPACT

### 6.5 LCZ 4: COSGROVE CREEK

#### 6.5.1 Existing landscape character

The landscape of LCZ 4 is comprised of a rural valley surrounded by steep slopes leading up to the ridges of the surrounding Luddenham Plateau.

##### **Topography and views**

LCZ 4 is comprised of a valley along Cosgrove Creek and its tributaries and has a relatively broad valley floor framed by steep slopes. Views are contained by surrounding ridges and range from short to long distance along the valley floor.

##### **Hydrology**

LCZ 4 lies within the upper catchment of Cosgrove Creek. It includes a number of tributaries extensively dammed to create a series of cascading dams that characterised the view along the valley.

##### **Vegetation**

LCZ 4 has largely been widely cleared. Stands of vegetation remain along creek lines and farm dams, as well as on rural properties.

##### **Built form and heritage**

The built form in this zone is limited to rural dwellings and structures.

The study area within LCZ 4 features several Aboriginal heritage sites and no Non-Aboriginal heritage items. For more detail refer *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS).



Figure 37: Location of the Cosgrove Creek LCZ



Figure 38: The steep topography between Adams Road and Eaton Road

## LANDSCAPE CHARACTER IMPACT

### **Spatial quality**

The spatial quality is that of an open valley framed by bald ridge lines.

### **Connectivity and access**

Adams Road, a two-lane country road, is the primary vehicular link between Luddenham town centre and the north-eastern parts of Luddenham along Luddenham Road. It has been identified as a future arterial road within the WSPGA, linking to employment areas in Erskine Park together with Luddenham Road. Additionally, the proposed alignment around Luddenham town centre deviates from the existing road through existing properties. This would result in new segments of land that require access to the proposed alignment.

### **Key activity areas**

Adams Road is the major activity areas but carries relatively low volumes of traffic.

### **6.5.2 The proposed works**

The proposed construction within LCZ 4 includes:

- Construction of a new road alignment south of Elizabeth Drive.
- An over bridge over Adams Road consisting of twin bridges approximately 65 metres long
- Cut and fill embankments in excess of ten metres tall in some areas
- Two construction compounds north of Adams Road
- Two Variable Message Signs on the north- and south-bound approaches to Elizabeth Drive
- Partial infilling of farm dams
- Clearing of remnant vegetation
- Road drainage and water quality controls utilising swales or drainage channels, drainage inlets, culverts and pipe networks
- Road-side furniture and elements such as barriers, fences and signs. Final locations for these elements are yet to be determined
- Lighting is not required on the main carriageway, but it would be provided for local road intersections as appropriate. This is yet to be determined.



Figure 39: Looking east along Adams Road showing the steep hillsides of the Cosgrove Creek Valley, as well as the series of dams stepping down along the creek

## LANDSCAPE CHARACTER IMPACT

### 6.5.3 Landscape character changes

#### **Topography**

The upgrade would require extensive earthworks, exceeding ten metres in height for both cuts and fills. This would represent a highly unnatural and visible new landform.

#### **Hydrology**

Natural creek lines would be altered through the introduction of culverts under the new alignment. Combined with the width of the road corridor this would change the extent to which creeks can be perceived and appreciated as natural landscape features.

A number of farm dams would be wholly or partially filled in.

#### **Vegetation**

Vegetation clearing would generally be limited to small areas along existing creek lines and farm dams. Revegetation would be provided in the road corridor and in other areas disturbed by construction activities.

#### **Built form and heritage**

The new road alignment would introduce a major new built form in a landscape that has relatively low levels of development to date. With clearance requirements of six metres underneath, the Adams Road bridge would be a major new structure in the centre of the valley.

The proposed upgrade would not directly impact on Non-Aboriginal heritage items. Several Aboriginal heritage site would be affected. For a discussion of the impacts on heritage values refer *Aboriginal Cultural Heritage Assessment Report* (Appendix M of the EIS).

#### **Spatial quality**

The Adams Road bridge and associated embankments would spatially divide the valley into two halves and interrupt open views along the valley floor.

#### **Connectivity and access**

There would be no changes to vehicular access and movement.

The provision of a shared path along the upgraded road would enhance opportunities for safe active transport. The provision of bus lanes would improve opportunities for future public transport.

#### **Key activity areas**

The project would not result in any changes. It is noted that the planned development of employment lands in the WSPGA would introduce new activity areas into LCZ 4 in the future.

#### **Construction activities**

The sites identified for ancillary facilities during construction are extensively cleared areas. They would be surrounded by temporary fencing and may include activities such as site compounds, stockpile areas for materials, temporary storage of spoil and other construction activities.

Situated in prominent locations on the ridge tops and slopes adjoining existing road corridors the construction compounds would be highly visible from surrounding areas and would temporarily alter the character of the landscape.

## LANDSCAPE CHARACTER IMPACT

### 6.5.4 Landscape character assessment

#### ***Sensitivity***

The generally open and attractive rural valley has a low capacity to absorb major infrastructure, but has a potentially large number of viewers including residents and visitors to Luddenham.

Overall, the LCZ has been assessed to have **high** sensitivity.

#### ***Magnitude***

The project would introduce a major new piece of infrastructure into a greenfield site that is a rural valley with currently low levels of development. It would include a large new bridge structure and associated earthworks located in the centre of the valley floor where it would be highly visible.

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

#### ***Landscape character impact***

The qualitative assessment indicates that the landscape character impact of the proposed works in LCZ 4 is likely to be:

Sensitivity	High
Magnitude	High
<b>Landscape character impact</b>	<b>High</b>

It is noted that the character of parts of LCZ 4 is likely to change substantially as employment lands in the WSPGA are developed and the area transforms from a rural area.

The project seeks to support these planned changes that will themselves lead to a transformation of the landscape character of the area to meet identified community needs over the next 20 to 25 years.

## LANDSCAPE CHARACTER IMPACT

### 6.6 LCZ 5: MULGOA-ORCHARD HILLS

#### 6.6.1 Existing landscape character

LCZ 5 is a diverse undulating landscape with pockets of remnant woodlands, open paddocks and rural residential clusters.

##### Topography

A north-south ridge follows the road existing alignment, occasionally crossing it. As a result, The Northern Road slopes up and down through a series of gentle valleys, with occasional views to the Blue Mountains.

##### Hydrology

LCZ 5 generally follows the watershed. The main creek is unnamed ephemeral waterway and extends from Orchard Hills Golf Course across the corridor into Glenmore Park and beyond. A number of farm dams are located throughout the LCZ and can be seen from The Northern Road. They make an important contribution to the outlook from The Northern Road and the surrounding landscape character.

##### Vegetation

Vegetation within LCZ 5 includes large some stands of Cumberland Plain Woodland interspersed with open paddocks. Orchard Hills Golf Course is characterised by manicured and tree-lined fairways, greens and tees.

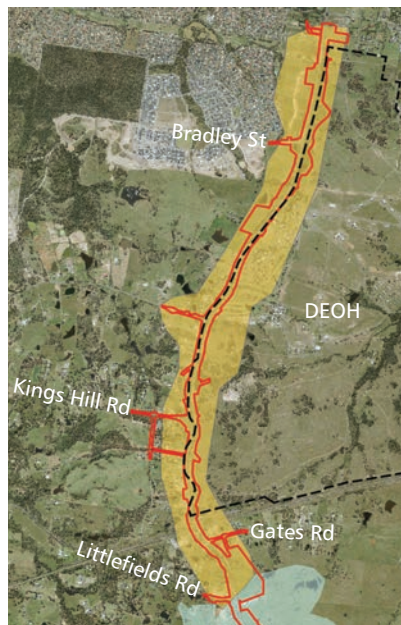


Figure 41: Location of the Mulgoa-Orchard Hills LCZ



Figure 40: The main ridge line runs west of The Northern Road for most of the Mulgoa-Orchard Hills LCZ, enclosing the road corridor and blocking views of the Blue Mountain

## LANDSCAPE CHARACTER IMPACT

### **Built form and heritage**

There are low amounts of built form consisting of rural dwellings and structures and a somewhat denser cluster of buildings within the DEOH site.

There are several Non-Aboriginal heritage items within the study area: a fruit orchard on Gates Road, the Water NSW supply pipelines, the Chaffey Brothers Irrigation Scheme Canal within DEOH and remnants of The Northern Road in Grover Crescent. For more detail refer *Non-Aboriginal Heritage Working Paper* (Appendix N of the EIS).

There are no known Aboriginal heritage sites within the study area in LCZ 5.

### **Spatial quality**

The spatial quality is generally enclosed as a result of the interplay of topography and vegetation. There are some mid to long-distance views across open valleys, including a number of glimpses to the Blue Mountains.

### **Connectivity and access**

The Northern Road is the primary access route through LCZ 5 and connects to the M4 Motorway to the north. Secondary roads include Littlefields, Gates, Longview, Kings Hill and Chain-O-Ponds Roads and Bradley Street. They provide access to rural residential clusters as well as the suburb of Glenmore Park beyond LCZ 5.

There are no current dedicated cycle lanes or pedestrian or shared paths.

### **Key activity areas**

The Northern Road is the key activity area within LCZ 5, carrying large volumes of local and regional traffic. The Orchard Hills Golf Club provides a moderate amount of activity through recreation use, and the DEOH through employment and training.



Figure 42: The combination of short- and mid-distance views from the road corridor typical of this LCZ.

## LANDSCAPE CHARACTER IMPACT

### 6.6.2 The proposed works

The project within LCZ 5 includes:

- Widening of the existing The Northern Road
- Upgrades to all intersections
- South and north bound heavy vehicle inspection areas
- Three u-turn facilities, including one near the DEOH entrance and new roundabouts in Chain-O-Ponds Road and Kings Hill Road
- Extension of Littlefields Road across The Northern Road including a new link road to Gates Road, upgrading of Gates Road and a roundabout/ u-turn facility
- Extension of Vineyard Road through the unmade road reservation to Kings Hill Road including a new roundabout/ u-turn on Kings Hill Road and a T intersection with Longview Road
- Two Variable Message Signs on the approaches to the north- and south-bound heavy vehicle inspection areas
- Removal of one rural dwelling/ structure
- Seven construction compounds
  - Along the Littlefields Road extension and new link road to Gates Road
  - North of the Water NSW supply pipelines on the eastern side of the corridor
  - At the intersection with Kings Hill Road
  - Opposite the DEOH entrance
  - On the western side of the corridor near The Northern DEOH boundary
  - On the eastern side of the corridor at The Northern project boundary (two compound sites)
- Cut and fill embankments in excess of seven metres tall in some areas
- Vegetation clearing
- Realignment of the unnamed ephemeral waterway
- Flood mitigation structures including a flood retarding basin and spillway replacing an existing dam, re-alignment of an unnamed tributary to Surveyors Creek, earth bunds, box culverts and concrete lining of an existing unlined trapezoidal channel
- Road drainage and water quality controls utilising swales, drainage inlets, culverts and pipe networks
- Road-side furniture and elements such as barriers, fences and signs. Final locations for these elements are yet to be determined
- Lighting is not required on the main carriageway, but it would be provided for local road intersections as appropriate.

### 6.6.3 Landscape character changes

#### **Topography**

Embankments up to about seven metres tall would be required. They would represent a large unnatural landform.

## LANDSCAPE CHARACTER IMPACT

### **Hydrology**

A number of new and ungraded culverts would be required. Flood risk mitigation requires a number of notable changes including the construction of a flood retarding basin replacing an existing farm dam and including a four metre high earth embankment and spillway, realignment of an unnamed tributary to Surveyors Creek, box culverts, earth bunds, a flood bypass channel and concrete lining of an existing unlined trapezoidal channel.

A number of farm dams would be wholly or partially filled in.

These works would be located immediately adjoining The Northern Road and would result in a notable change to the existing landscape and drainage systems that are likely to be inconsistent with the current rural character the generally small scale of infrastructure along the route.

### **Vegetation**

Large amounts of native roadside vegetation would be removed as a result of the road widening. Revegetation would be provided in the road corridor and in other areas disturbed by construction activities.

### **Built form and heritage**

The proposed widening would result in a large increase to the built form of the road itself. It would require the removal of a number of dwellings and other structures.

Of the Non-Aboriginal heritage items within the study area, the Chaffey Brothers Irrigation Scheme Canal within DEOH and remnants of The Northern Road in Grover Crescent would be directly impacted by the proposed upgrade. The Water NSW supply pipelines pass under The Northern Road and would not be directly impacted. For more detail on the impacts on heritage items and their curtilage refer *Non-Aboriginal Heritage Working Paper* (Appendix N of the EIS).

### **Spatial quality**

The spatial quality would likely become more open due to vegetation removal and road widening. Revegetation may partially reverse this although the new corridor width precludes a similarly enclosed character even where areas within the corridor are able to be revegetated.

### **Connectivity and access**

Driveway access and a number of intersections would change to left-in left-out only. Modifications to the local road system and intersections including extensions of local roads and the provision of u-turn facilities would maintain full access to all properties.

The provision of a shared path along the upgraded road would enhance opportunities for safe active transport. The provision of bus lanes would improve opportunities for future public transport.

### **Key activity areas**

The project works would require modifications to the existing golf course layout to compensate for the physical impacts (land take) of the project.

## LANDSCAPE CHARACTER IMPACT

### **Construction activities**

The sites identified for ancillary facilities during construction are generally cleared areas, with the exception of the site north of the Water NSW supply pipelines. The latter retains a larger number of scattered remnant trees.

The sites would be surrounded by temporary fencing and may include activities such as site compounds, stockpile areas for materials, temporary storage of spoil and other construction activities.

Situated in prominent locations along The Northern Road the construction compounds would be highly visible to large numbers of potential viewers and would temporarily alter the character of the landscape.

### **6.6.4 Landscape character assessment**

#### **Sensitivity**

LCZ 5 is a largely linear zone along the existing road corridor. Due to the variable topography and tree cover, proposed changes would be more easily absorbed and not widely visible beyond the road corridor. However, the areas has been identified as possessing important scenic landscape values.

Overall, the LCZ has been assessed to have **moderate** sensitivity

#### **Magnitude**

The project would increase in road width approximately fourfold, representing a very larger increase. This would fundamentally change the currently relatively small road from a low key country road to a major arterial that would be more typical of an urban context. Relative to other LCZs the project would integrate more readily with the landscape, requiring less earthworks to meet the geometric requirements.

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

#### **Landscape character impact**

The qualitative assessment indicates that the landscape character impact of the proposed works in LCZ 5 is likely to be:

Sensitivity	Moderate
Magnitude	Moderate
<b>Landscape character impact</b>	<b>Moderate</b>

## LANDSCAPE CHARACTER IMPACT

### 6.7 SUMMARY OF LANDSCAPE CHARACTER IMPACTS

The landscape character impact assessment of the project described above represents a qualitative assessment based on five LCZs. The result of these assessments ranges from **moderate** to **high**, and is summarised in the table below.

While The Northern Road is already an arterial road, it retains a rural quality along the route that easily integrates with the surrounding landscape.

The project will fundamentally alter the character of the existing road north of Elizabeth Drive, and introduce a new road alignment into greenfield areas south of Elizabeth Drive. The change in road character, in particular the width of the road, combined with extensive earthworks and removal of vegetation and farm dams will have a considerable impact on the existing rural landscape along the route.

The project would impact on all LCZs, due to the scale of the proposed works and the high sensitivity of surrounding areas.

Landscape Character Zone	Landscape Character Impact Rating
LCZ 1	High
LCZ 2	High
LCZ 3	High to moderate
LCZ 4	High
LCZ 5	Moderate

#### ***Planned land use changes***

It is noted that substantial land use changes are planned for areas along the project south of Elizabeth Drive and east of the new road alignment. They include the development of employment lands within the WSPGA, the Western Sydney Airport and the development of urban centres and residential areas within the SWPGA.

The project seeks to support these planned changes that will themselves lead to a transformation of the landscape character of the area to meet identified community needs over the next 20 to 25 years.

Nevertheless the project represents one of the first steps in this transformation and the identified impacts will be highly noticeable in an area that as yet retains its rural character.

Further, there are no current plans that indicate major changes to land uses around the Luddenham town centre and to the west of the existing alignment of The Northern Road. These areas are identified as part of the MRA and are unlikely to change in the foreseeable future.

The identified moderate to high landscape character impacts would have a lasting effect on these areas.

Residual impacts following implementation of the recommended mitigation measures are further discussed in **section 8**.

## LANDSCAPE CHARACTER IMPACT

### 6.7.1 Summary of impacts on Commonwealth land

The majority of potential landscape character impacts to Commonwealth land would occur as a result of proposed works within

- LCZ 1 and LCZ 2 within or immediately adjacent to the Western Sydney Airport,
- LCZ 2 with regards to some parcels of Commonwealth land at Willowdene Avenue
- LCZ 5 in relation to works within or immediately adjacent to the DEOH.

Generally construction related impacts would occur as a result of proposed construction sites and ancillary facilities. For the most part, the proposed compound sites for the project would not be located directly on Commonwealth land, with the exception of site C7 on lands associated with the Western Sydney Airport in LCZ 2, and site C17 on lands at the DEOH within LCZ 5. Any potential impacts would be temporary and mitigated through the measures outlined in **section 8**.

Potential landscape character impacts during operation of the project generally relate to changes in the landscape. Impacts to Commonwealth land would include the following:

- New cut and fill embankments would stand out as unnatural landforms in the gently undulating landscape
- Natural creek lines such as Badgerys Creek within LCZ 1 would be altered which would change the extent to which these creeks can be perceived and appreciated as natural landscape features
- Removal of native vegetation in all LCZs
- In the case of LCZ 1 and LCZ 2, the new road alignment would introduce a major new built form in the landscape, including some areas directly on or immediately adjacent to Commonwealth land associated with the Western Sydney Airport
- At the DEOH within LCZ 5, the Chaffey Brothers Irrigation Scheme Canal heritage item would be directly impacted which would impact on the landscape character of the area
- At the DEOH within LCZ 5, flood mitigation measures including earth bunds, drainage channels and spillways would be potentially highly visible and inconsistent in character with the rural landscape
- Within LCZ 5 works would require modifications to the existing golf course layout on Commonwealth land to accommodate the project.

This would result in long-term impacts to Commonwealth land during operation of the project. Impacts would be minimised through the implementation of the measures outlined in **section 8**.

## 7. VISUAL IMPACT

### 7.1 VISUAL IMPACT ASSESSMENT

#### 7.1.1 Overview

The potential visual impact of the proposed The Northern Road upgrade works has been assessed in relation to a number of key viewpoints and groups of viewpoints. The selection of viewpoints has considered the existing pattern of land use and development adjoining the study area.

Consistent with *EIA-N04*, the visual impact assessment has been carried out based on the following method:

- Assessing the visibility of the proposed works by defining a Visual Envelope Map (VEM)
- Defining the scale (magnitude) of the proposed works including temporary works
- Identifying key viewpoints and groups of viewpoints from where the proposed works will be visible
- Rating viewpoints according to their sensitivity to change, considering direction and composition of the view; and
- Assessing the level of potential visual impact of the proposed works on viewers at these viewpoints, based on the magnitude of the proposed works and the sensitivity of viewers.

## VISUAL IMPACT

### 7.1.2 Visual catchment

The extent from which The Northern Road is visible from adjoining areas varies along the length of the study area. It is influenced by topography, vegetation, buildings and land use patterns. A detailed field and desktop assessment was undertaken to determine the area from where The Northern Road is visible. This is defined as the visual catchment or visual envelope and is illustrated in the Visual Envelope Map (VEM) - refer **Figure 44**.

#### Key viewpoints

A number of key viewpoints and groups of viewpoints within the visual envelope of the study area have been selected for the visual impact assessment. Locations and directions of chosen viewpoints are representative of the range of viewpoints both within and beyond the road corridor, and are indicated on **Figure 44**.

In the case of views from residential properties, views from the road corridor were analysed to identify which buildings would be visible and therefore would be able to view the proposed works in return.

### 7.1.3 Visual impact assessment

The chosen viewpoints essentially assess the impact of the project against two primary conditions:

- The impact from private properties or other selected locations likely to be accessed by viewers from within the visual envelope; and
- The impact upon users of the road itself or other connecting roads.

In measuring the impact of change, the following are taken into account:

- The distance between viewers and the proposed works.
- The category of viewer (i.e. the activity the viewer is engaged in when viewing the proposed works)
- The elements of the project that are visible.

The following pages quantify the visual impact at each viewpoint. The gradings are measured on their impact 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. Design opportunities and areas requiring mitigation have emerged and these are discussed in **section 8**.

## VISUAL IMPACT

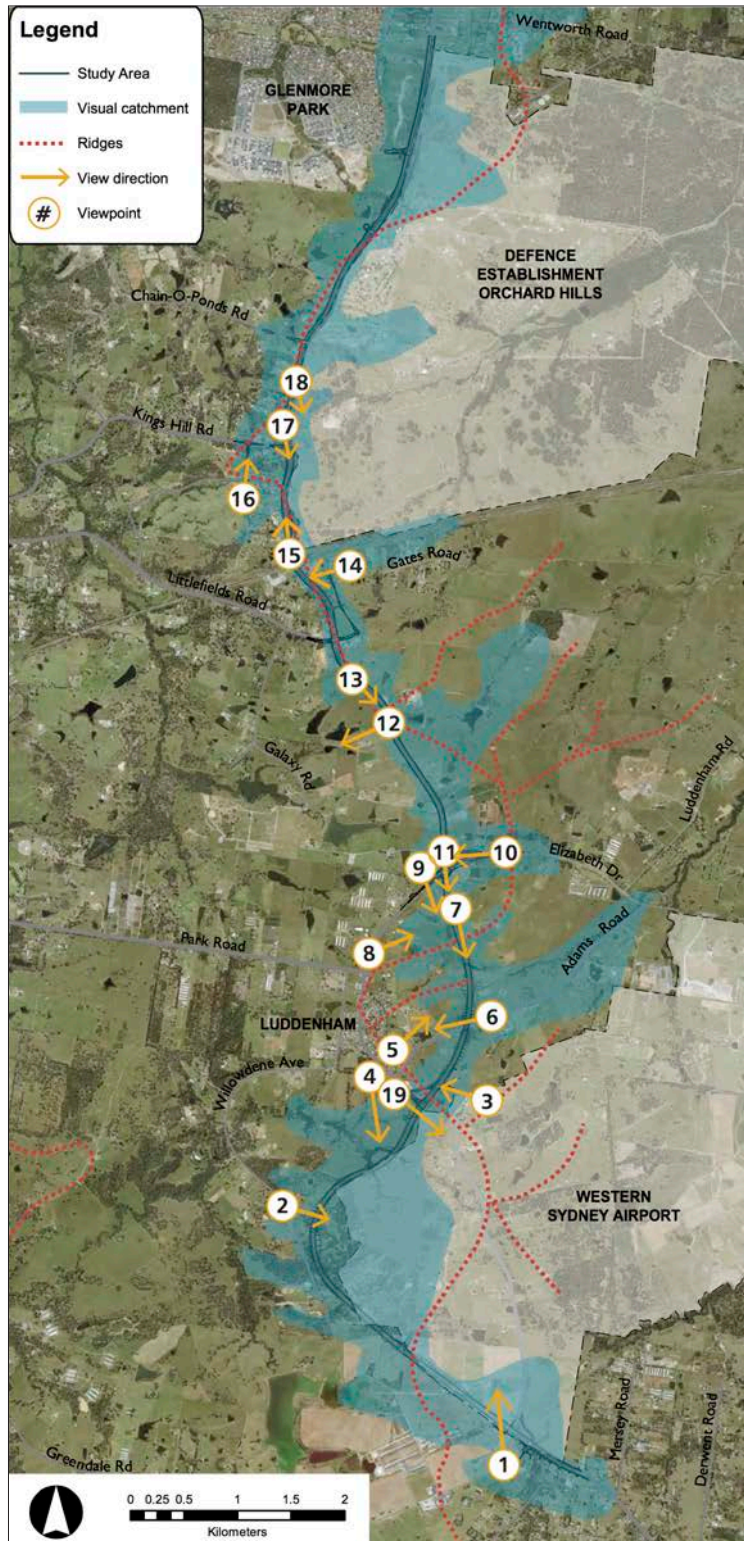


Figure 4.3: Visual Envelope and Viewpoint Location Map

# VISUAL IMPACT

## 7.2 VIEWPOINT 1

### Location description

Leppington Pastoral Company, Greendale, view from private access road looking north east.

### Potential viewers

Residents, workers, and visitors to the Leppington Pastoral Company.

### Visible project elements

- Elevated road alignment on fill embankments up to about 5.5 metres high
- Internal access road including culvert under the new road alignment
- New intersection including u-turn facility
- Removal of existing buildings and structures
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	Moderate	The open rural landscape with undulating topography and limited tree cover has a relatively low capacity to absorb a major new road. The sensitivity of the view is reduced by the oblique angle and the distance between the viewer and the project.
Magnitude	Moderate	The new road alignment would be elevated, introducing a highly unnatural landform out of scale with the existing landscape. The culvert and associated headwall and road would introduce further new built form. A number of mature trees would be removed.
Impact	Moderate	The visual impact is assessed to be moderate.

## VISUAL IMPACT



Figure 45: Viewpoint 1 - Leppington Pastoral Company looking north east - existing



Figure 44: Viewpoint 1 - Leppington Pastoral Company looking north east - photomontage  
(supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.3 VIEWPOINT 2

### Location description

Willowdene Avenue, Luddenham, looking south-east.

### Potential viewers

Residents from nearby properties, rural residents, and travellers along Willowdene Road

### Visible project elements

- New road alignment including fill embankments exceeding 10 metres in some areas
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The picturesque view of a diverse rural landscape interspersed with remnant vegetation has a low capacity to absorb a major new piece of infrastructure.
Magnitude	High	This view will undergo a major change as a result of extensive vegetation removal and the introduction of a major new road and associated large cut and fill embankments.
Impact	High	The visual impact is assessed to be high. It may somewhat diminish over time as vegetation establishes and matures, assisting the new alignment to blend into the landscape setting.

## VISUAL IMPACT



Figure 46: Viewpoint 2 - looking south-east along Willowdene Avenue - existing



Figure 47: Viewpoint 2 - looking south-east along Willowdene Avenue - photomontage  
(supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.4 VIEWPOINT 3

### Location description

Eaton Road, Luddenham, at the intersection with the proposed new alignment of The Northern Road, looking west.

### Potential viewers

Residents in the eastern part of Eaton Road

### Visible project elements:

- Re-alignment of Eaton Road and intersection with the proposed new alignment of The Northern Road, including cut batters
- Removal of buildings and structures
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The view is along a small unsealed lane, in a rural residential setting along the outskirts of Luddenham. Located along a ridge line, the landscape is open with long-distance views to the Blue Mountains and interspersed with tree cover. It has a relatively low capacity to absorb a major new road infrastructure.
Magnitude	Moderate	Much of the proposed new road alignment will be in cut, reducing the extent to which the road itself will be visible. However, the cutting would alter the topography in the view. Removal of large existing trees in Eaton Road would result in notable changes to the view, creating a more open vista until proposed vegetation establishes and matures.
Impact	High to moderate	The visual impact is assessed to be high to moderate.

## VISUAL IMPACT



Figure 48: Viewpoint 3 - looking west along Eaton Road - existing



Eaton Road East  
re-alignment and  
t-intersection  
with proposed  
new alignment

New vegetation on  
sections of Eaton  
Road no longer used

Figure 49: Viewpoint 3 - looking west along Eaton Road - photomontage (prepared by Spatial Media)

# VISUAL IMPACT

## 7.5 VIEWPOINT 4

### Location description

St James Anglican Church Cemetery, looking south.

### Potential viewers

Local community of Luddenham town centre and surrounds, including Church members and visitors, families, and descendants of deceased, local residents, and motorists along The Northern Road.

### Visible project elements

- New road alignment and embankments up to nine metres tall
- Modifications to farm dams
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The picturesque outlook over the diverse rural landscape would be highly sensitive to change. The view is taken from a cemetery where viewers would be highly sensitive to change in the setting.
Magnitude	Low	The new road alignment would introduce a major new built form into a greenfield site with some sections requiring large cut and fill embankments. The oblique angle of view and the distance between the proposed new alignment and the view would reduce the extent to which it would be able to be perceived in the view. The rural landscape would continue to comprise the vast majority of the view.
Impact	Moderate	The visual impact is assessed to be moderate. The impact may reduce over time as vegetation establishes and matures, assisting the new alignment to blend into the landscape setting.

## VISUAL IMPACT



Figure 50: Viewpoint 4 - Looking south from St James Anglican Church Cemetery - existing



Figure 51: Viewpoint 4 - Looking south from St James Anglican Church Cemetery - photomontage (supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.6 VIEWPOINT 5

### Location description

Wilmington Reserve on Jamison Street, Luddenham, looking north-east into Cosgrove Valley.

### Potential viewers

Local community, including residents from nearby dwellings, park users, and motorists along Jamison Street.

### Visible project elements

- Bridge over Adams Road and associated embankments
- New road alignment including cut and fill embankments
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The rural landscape has a low capacity to absorb the proposed introduction of a major new road. There are a large number of viewers in Luddenham that overlook the valley, including sensitive residential and recreation users.
Magnitude	Moderate	The new bridge over Adams Road and associated embankments will introduce a large new built form in the rural landscape. They will interrupt the open view along the valley. The cutting through the hillside will visibly alter the existing topography. The distance between the viewer and the proposed new alignment reduces the scale of the upgrade in the view.
Impact	High to moderate	The visual impact is assessed to be high to moderate.

## VISUAL IMPACT



Figure 52: Viewpoint 5 - looking north east from Wilmington Reserve - existing



Figure 53: Viewpoint 5 - looking north east from Wilmington Reserve - photomontage  
(supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.7 VIEWPOINT 6

### Location description

Adams Road, looking west.

### Potential viewers

Motorists and residents on rural properties. Residents of the area accessing Luddenham town centre for services or daily needs.

### Visible project elements

- New road alignment including twin bridge over Adams Road and associated fill embankments in excess of ten metres high
- Modifications to farm dams including partial filling in
- Modifications to Cosgrove Creek including culvert, headwall and transition apron
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	This view would have low capacity to absorb the proposed changes. It is situated in a rural environment on the outskirts of Luddenham where viewers would be sensitive to change. It is characterised by the rural landscape outlook, including a series of cascading farm dams along Cosgrove Creek.
Magnitude	High	The bridge over Adams Road and associated tall embankments will constitute a major new built form, out of scale and character with the existing landscape. It would block the existing open vista along the valley floor. The introduction of the new road infrastructure would substantially alter the existing view.
Impact	High	The visual impact is assessed to be high.

## VISUAL IMPACT



Figure 54: Viewpoint 6 - looking west along Adams Road - existing



- Adams Road bridge including central pier and throw screens
- Provision for potential future widening of Adams Road
- Fill embankments >10m high

Figure 55: Viewpoint 6 - looking west along Adams Road - photomontage (supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.8 VIEWPOINT 7

**Location description**

Private property driveway at 2,901 The Northern Road, Luddenham, looking south

**Potential viewers**

Residents on small farms, motorists along the proposed new road alignment

**Visible project elements:**

- New road alignment/ Luddenham bypass including cut and fill embankments
- VMS on the southern approach to the intersection with Elizabeth Drive
- Modifications to farm dams including partial filling in
- Modifications to Cosgrove Creek including culverts
- Vegetation clearing
- Landscape works.

**Visual impact assessment**

Sensitivity	High	The elevated outlook over the picturesque rural landscape would be highly sensitive to the introduction of a major new arterial road. Rural residents would be highly sensitive to change in their surroundings.
Magnitude	High	The new road alignment would introduce a major new built form into a greenfield site, requiring large cut and fill embankments, modifications to farm dams and bisecting the property.
Impact	High	The visual impact is assessed to be high.

## VISUAL IMPACT



Figure 56: Viewpoint 7 - looking south within 2,901 The Northern Road - existing



Figure 57: Viewpoint 7 - looking south within 2,901 The Northern Road - photomontage (prepared by Spatial Media)

# VISUAL IMPACT

## 7.9 VIEWPOINT 8

### Location description

The Northern Road, Luddenham, opposite the Park Road intersection, looking east.

### Potential viewers

Motorists. Residents on rural properties. Residents of the area accessing Luddenham town centre for services or daily needs.

### Visible project elements

- New road alignment including cut and fill embankments
- VMS on the southern approach to the intersection with Elizabeth Drive
- Modifications to farm dams including partial filling in
- Modifications to watercourses including culverts and headwalls
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The elevated outlook over the picturesque rural landscape would be highly sensitive to change as it has limited capacity to absorb a major new arterial road. Rural residents would be highly sensitive to change in their surroundings.
Magnitude	Low	The new road alignment would introduce a major new built form into a greenfield site, requiring large embankments of about 6 metres in height, as well as modifications to farm dams and watercourses. The scale of the changes is moderated by the distance of over 800 metres between the view and the proposed upgrade. Long-distance views would not be affected and the landscape would continue to be the major feature in the view.
Impact	Moderate	The visual impact is assessed to be moderate.

## VISUAL IMPACT



Figure 58: Viewpoint 8 - looking east from The Northern Road - existing



Figure 59: Viewpoint 8 - looking east from The Northern Road - still photo from project animation (source: Spatial Media)

# VISUAL IMPACT

## 7.10 VIEWPOINT 9

**Location description**

Private property driveway at 2,901 The Northern Road, Luddenham, looking west

**Potential viewers**

Residents on small farms, motorists along the proposed new road alignment

**Visible project elements**

- New road alignment/ Luddenham bypass including cut and fill embankments
- Incident response facility including roads, car parks and associated building structures
- Vegetation clearing
- Landscape works.

**Visual impact assessment**

Sensitivity	High	The view is characterised by a rural setting of pastures, remnant trees and rural dwellings. It has limited capacity to absorb the proposed changes. Rural residents would be highly sensitive to change in their surroundings.
Magnitude	High	The new road alignment and incident response facility would introduce a large amount of new built form into a greenfield site. The view would change fundamentally.
Impact	High	The visual impact is assessed to be high.

## VISUAL IMPACT



Figure 60: Viewpoint 9 - looking west within 2,901 The Northern Road - existing



Figure 61: Viewpoint 9 - looking west within 2,901 The Northern Road - photomontage (prepared by Spatial Media)

# VISUAL IMPACT

## 7.11 VIEWPOINT 10

**Location description**

Elizabeth Drive, looking west.

**Potential viewers**

Local and regional motorists. Residents on rural properties.

**Visible project Elements**

- New Elizabeth Drive alignment including widening and changes to existing road levels
- Partial removal of boundary fence
- Vegetation clearing including inside private property
- Landscape works.

**Visual impact assessment**

Sensitivity	Moderate	The view is along the existing Elizabeth Drive which currently remains a two lane rural road. While motorists may be accepting of a certain amount of change within the road corridor, the road passes through a rural landscape. Remnant and planted trees as well as glimpses into adjoining farmland are important visual elements that contribute to the driver experience.
Magnitude	High	There will be notable increase in road infrastructure in this view due to road widening and re-alignment. This will change the scale and scenic quality currently experienced along the drive. In addition, large amounts of mature trees lining the road would be removed changing the outlook and spatial qualities.
Impact	High to moderate	The visual impact is assessed to be high to moderate. It may reduce somewhat over time as new vegetation establishes and matures.

## VISUAL IMPACT



Figure 62: Viewpoint 10 - looking west along Elizabeth Drive - existing



Figure 63: Viewpoint 10 - looking west along Elizabeth Drive - photomontage  
(supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.12 VIEWPOINT 11

### Location description

The Northern Road, roundabout at the existing Elizabeth Drive intersection, looking south.

### Potential viewers

Motorists along the Northern Road. Resident from surrounding areas accessing Luddenham as the local service centre.

### Visible project elements

- Removal of the existing roundabout and replacement with a left-out intersection
- New road alignment and widening of The Northern Road south of the existing Elizabeth Drive intersection
- New intersection with the re-aligned Elizabeth Drive and the existing The Northern Road
- Removal of existing dwellings and associated structures
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The view is characterised by a pleasant outlook over the open rural landscape. Exposed on the high plateau, the view would have a low capacity to absorb the proposed changes.
Magnitude	High	The view would undergo major change as a result of road widening, re-alignment, levelling, tree removal, and earthworks. The outlook would change from a view into rural areas to one overlooking major road infrastructure.
Impact	High	The visual impact is assessed to be high.

## VISUAL IMPACT



Figure 64: Viewpoint 11 - The Northern Road roundabout with Elizabeth Drive looking south - existing



Figure 65: Viewpoint 11 - The Northern Road roundabout with Elizabeth Drive looking south - photomontage (supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.13 VIEWPOINT 12

### Location description

2,776 The Northern Road, Luddenham, looking west.

### Potential viewers

Motorists. Residents in surrounding rural areas travelling along The Northern Road to Penrith or to access the local centre at Luddenham.

### Visible project elements

- Widening of The Northern Road including additional lanes, shared path, level changes and associated earthworks
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The view is located along one of the most scenic sections of The Northern Road. It affords long-distance views over farmland and dams towards the Blue Mountains. These views are shared by residents in adjoining rural properties. They would be sensitive to changes in the outlook.
Magnitude	Moderate	The upgrade would fundamentally alter the existing scale and character of The Northern Road. It would result in a large increase in road infrastructure, more than doubling the existing road width, thereby increasing the prominence of the road infrastructure in the view. The panoramic outlook and background would not be affected.
Impact	High to moderate	The visual impact is assessed to be high to moderate.

## VISUAL IMPACT



Figure 66: Viewpoint 12 - looking west from 2,776 The Northern Road - existing



Figure 67: Viewpoint 12 - looking west from 2,788 The Northern Road - photomontage (supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.14 VIEWPOINT 13

### Location description

The Northern Road, adjoining 2-18 Littlefields Road, Luddenham, looking south-east.

### Potential viewers

Motorists. Residents in surrounding rural areas travelling along The Northern Road to Penrith or to access the local centre at Luddenham.

### Visible project elements

- Widening of The Northern Road including additional lanes, shared path, level changes and associated earthworks
- VMS on the southern approach to the intersection with Elizabeth Drive
- Land acquisition/ conversion of farm land to arterial road corridor
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The view is located along one of the most scenic sections of The Northern Road. The road is currently a two lane rural road along pastures separated from the road by a line of trees. The view has relatively little capacity to absorb the proposed changes and residents in adjoining rural properties would be sensitive to changes in the visual environment.
Magnitude	High	The upgrade would fundamentally alter the existing scale and character of The Northern Road in this view. It would result in a large increase in road infrastructure, more than doubling the existing road width into areas of existing pasture. It would replace the outlook over pastures with a major arterial road. New variable message sign would be a large built structure that would be inconsistent with the surrounding rural environment.
Impact	High	The visual impact is assessed to be high.

## VISUAL IMPACT



Figure 68: Viewpoint 13 - looking south-east along The Northern Road from 2-18 Littlefields Road - existing (image supplied by Roads and Maritime)



Figure 69: Viewpoint 13 - looking south-east along The Northern Road from 2-18 Littlefields Road - photomontage (supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.15 VIEWPOINT 14

### Location description

Gates Road, Luddenham, looking west

### Potential viewers

Residents in the rural residential cluster along Gates Road.

### Visible project elements

- Widening, re-grading and re-alignment of Gates Road
- T-intersection with the new link road connecting Littlefields Road to Gates Road
- Upgrade of the intersection with The Northern Road including widened verges
- Cut and fill embankments
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The view is along the existing small rural road. It would be seen by residents in the rural living cluster along Gates Road. These residents are likely to be sensitive to changes in their visual environment. The adjoining rural landscape including tree cover framing the road are important visual elements and have a low capacity to absorb major changes.
Magnitude	High	The construction of the new link road through a greenfield site, widening and regrading of Gates Road and associated tree and shrub removal would result in notable changes to the view. Place a greater focus on the road infrastructure in the view. It would change the existing character of Gates Road, increase road infrastructure and remove a large amount of vegetation.
Impact	High	The visual impact is assessed to be high. It may reduce somewhat over time as vegetation establishes and matures.

## VISUAL IMPACT



Figure 70: Viewpoint 14 - looking west along Gates Road - existing



Figure 71: Viewpoint 14 - looking west along Gates Road - photomontage  
(supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.16 VIEWPOINT 15

**Location description**

2,567 The Northern Road, Mulgoa, looking north.

**Potential viewers**

Motorists. Adjoining rural residents as well as residents in surrounding rural areas travelling along The Northern Road.

**Visible project elements**

- Widening of The Northern Road including additional lanes, depressed median, shared path, level changes and associated earthworks
- Changes to property and access arrangements of existing private dwelling
- VMS on the approach to the northbound heavy vehicle inspection area at Grover Crescent
- Land acquisition/ conversion of small rural holdings land to arterial road corridor
- Vegetation clearing
- Landscape works.

**Visual impact assessment**

Sensitivity	High	The view is characterised by the mix of rural dwelling, remnant vegetation and glimpses of the Blue Mountains. The Northern Road itself is a two-lane rural road that is subservient to the larger landscape setting. The view has relatively little capacity to absorb the proposed changes and residents in adjoining rural properties would be sensitive to changes in the visual environment.
Magnitude	High	The upgrade would fundamentally alter the existing scale and character of The Northern Road in this view. It would result in a large increase in road infrastructure, more than doubling the existing road width. Large fill batters would extend into areas of small rural holdings. The variable message sign would be a large built structure that would be inconsistent with the surrounding rural environment.
Impact	High	The visual impact is assessed to be high.

## VISUAL IMPACT



Figure 72: Viewpoint 15 - looking north from 2,567 The Northern Road - existing  
(image supplied by Roads and Maritime)



VMS on approach  
to north-  
bound vehicle  
inspection area

North-bound  
carriageway

Figure 73: Viewpoint 15 - looking north from 2,567 The Northern Road - photomontage  
(supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.17 VIEWPOINT 16

**Location description**

Corner of Longview and Vineyard Roads, looking north

**Potential viewers**

Residents of Vineyard Road

**Visible project elements**

- Extension of Vineyard Road to connect to Kings Hill Road through the existing unmade road reserve, associated earthworks
- T-intersection with Longview Road, including upgrades to Longview Road and Vineyard Road on the approach to the intersection such as re-grading, widened shoulders and earthworks
- Vegetation clearing
- Landscape works.

**Visual impact assessment**

Sensitivity	High	The natural vegetated setting of the unmade road reserve has a low capacity to absorb new road infrastructure. Rural residents are likely to be sensitive to changes in the visual environment.
Magnitude	High	The extension of the road would change the view from a setting dominated by pasture and remnant vegetation to looking along a new road. Removal of mature trees along the boundary with 23-33 Longview Road would further change the outlook and open up views into the private property.
Impact	High	The visual impact is assessed to be high.

## VISUAL IMPACT



Figure 74: Viewpoint 16 - looking north along Vineyard Road - existing



Figure 75: Viewpoint 16 - looking north along Vineyard Road - photomontage  
(supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.18 VIEWPOINT 17

**Location description**

Grover Crescent, Mulgoa, looking south.

**Potential viewers**

Residents of Grover Crescent.

**Visible project elements**

- Upgrade of Grover Crescent including a new carriageway at the southern end and a new left-in only entrance from The Northern Road
- Widening of The Northern Road including additional lanes, depressed median, shared path, level changes and associated earthworks
- Upgrade of the intersection of The Northern Road with Kings Hill Road
- Vegetation clearing
- Landscape works.

**Visual impact assessment**

Sensitivity	High	The view is characterised by an existing informal road providing access to a small rural residential cluster. Remnant and planted trees provide important elements in the view. Residents are likely to be sensitive to changes in the visual environment.
Magnitude	High	The extent and scale of formal road infrastructure will increase notably in this view. Widening of The Northern Road itself would be difficult to perceive due to the angle of the view. However, associated earthworks and removal of trees currently framing and terminating the view will be highly noticeable changes.
Impact	High	The visual impact is assessed to be high. It may reduce somewhat over time as vegetation establishes and matures.

## VISUAL IMPACT



Figure 76: Viewpoint 17 - looking south along Grover Crescent - existing



Figure 77: Viewpoint 17 - looking south along Grover Crescent - photomontage (supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.19 VIEWPOINT 18

### Location description

Defence Establishment Orchard Hills, opposite 2,359-2,365 The Northern Road, Mulgoa, looking south.

### Potential viewers

Motorists. Adjoining rural residents as well as residents in surrounding rural areas travelling along The Northern Road.

### Visible project elements

- Widening of The Northern Road including additional lanes, depressed median, shared path, level changes and associated earthworks
- Boundary adjustments at the Defence Establishment/ conversion of Defence land to arterial road corridor
- VMS on the approach to the southbound heavy vehicle inspection area south of Longview Road
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The view is characterised by a mix of woodland remnants and open pasture at the interface to the DEOH, and small rural holdings to the west. The Northern Road itself is a two-lane rural road that is subservient to the larger landscape setting. The view is generally open and has little capacity to absorb the proposed changes. Residents in adjoining rural properties would be sensitive to changes in the visual environment.
Magnitude	High	The upgrade would fundamentally alter the existing scale and character of The Northern Road in this view. It would result in a large increase in road infrastructure, more than doubling the existing road width. The variable message sign would be a large built structure that would be inconsistent with the surrounding rural environment.
Impact	High	The visual impact is assessed to be high.

## VISUAL IMPACT



Figure 78: Viewpoint 18 - DEOH looking south from the western side of The Northern Road - photomontage - existing



Figure 79: Viewpoint 18 - DEOH looking south from the western side of The Northern Road - photomontage (supplied by Roads and Maritime, prepared by Spatial Media)

# VISUAL IMPACT

## 7.20 VIEWPOINT 19

### Location description

The Northern Road, Luddenham, opposite the IGA supermarket, looking south.

### Potential viewers

Motorists. Shoppers at IGA Luddenham and patrons of the Shell Service Station. Residents in surrounding rural areas travelling along The Northern Road.

### Visible project elements

- Re-alignment of the existing The Northern Road and new t-intersection with the proposed new alignment including additional lanes, depressed median, shared path, level changes and associated earthworks
- Proposed new alignment of The Northern Road including fill embankments up to in excess of eight metres tall
- Extension of Eaton Road and new t-intersection with the re-aligned The Northern Road
- Partial infilling of farm dam
- Vegetation clearing
- Landscape works.

### Visual impact assessment

Sensitivity	High	The view is characterised by gentle rural valley comprised of a mix of woodland remnants and open pasture, west of the existing The Northern Road. The foreground of the view is open. As a result it has little capacity to absorb the proposed changes. Residents in Luddenham town centre and from adjoining rural properties would be sensitive to changes in the visual environment.
Magnitude	High	The re-alignment of Eaton Road and of the existing The Northern Road, combined with road widening and the new road alignment through the rural valley at the southern perimeter of Luddenham town centre, will fundamentally alter this view, replacing the rural setting with large road infrastructure.
Impact	High	The visual impact is assessed to be high.

## VISUAL IMPACT



Figure 80: Viewpoint 19 - looking south from The Northern Road near Luddenham IGA - existing



Figure 81: Viewpoint 19 - looking south from The Northern Road near Luddenham IGA - photomontage (supplied by Roads and Maritime, prepared by Spatial Media)

## VISUAL IMPACT

### 7.21 VISUAL IMPACT ASSESSMENT SUMMARY

A total of 19 viewpoints form the basis of the visual impact assessment. The viewpoints are generally focused on locations that will be commonly viewed by the local community. It is generally anticipated that the viewpoints selected will provide for an even range of magnitude and sensitivity impact ratings.

Out of the 19 selected viewpoints, the range of visual impact ratings were determined to be the following:

- 12 viewpoints would have high visual impact
- 4 viewpoint would have high to moderate visual impact
- 3 viewpoints would have moderate visual impact.

Ratings of high and high to moderate impacts occur in areas where the landscape is the dominant or major element in the view and has limited capacity to absorb the proposed changes, where potential viewers are likely to have a high level of sensitivity to change, and where the magnitude of the works is both large and readily noticed, based on proximity to the viewer.

The moderate ratings occur in areas of lower sensitivity, for example in settings where infrastructure is already the predominant visual element, or where the distance between the viewer and the proposed changes is large, making it difficult to perceive the changes.

The assessment indicates that the proposed upgrade of The Northern Road would have a high visual impact on two thirds of the assessed views. Remaining visual impacts would be in the high to moderate and moderate range, indicating that the project would notably affect the views and visual qualities within the study area.

Based on this assessment a series of visual impact mitigation measures have been identified. They are discussed in the following chapter:

Viewpoint	Visual sensitivity	Magnitude of visual effect	Overall rating of visual impact
1	M	M	<b>M</b>
2	H	H	<b>H</b>
3	H	M	<b>HM</b>
4	H	L	<b>M</b>
5	H	M	<b>HM</b>
6	H	H	<b>H</b>
7	H	H	<b>H</b>
8	H	L	<b>M</b>
9	H	H	<b>H</b>
10	M	H	<b>HM</b>
11	H	H	<b>H</b>
12	H	M	<b>HM</b>
13	H	H	<b>H</b>
14	H	H	<b>H</b>
15	H	H	<b>H</b>
16	H	H	<b>H</b>
17	H	H	<b>H</b>
18	H	H	<b>H</b>
19	H	H	<b>H</b>

## VISUAL IMPACT

### 7.21.1 Summary of impacts on Commonwealth land

The majority of potential visual impacts to Commonwealth land would occur as a result of proposed works within or immediately adjacent to the Western Sydney Airport, around Willowdene Avenue and within or immediately adjacent to the DEOH.

Potential construction related impacts are generally temporary and were discussed in **section 6**.

Potential visual impacts during operation of the project generally relate to changes to existing views as demonstrated in the viewpoint assessment. Impacts to Commonwealth land would include the following:

- The high visual impact identified for viewpoint 18 would effect views to and from the adjacent DEOH
- The moderate and high visual impacts identified for viewpoints 1 and 2 respectively would effect views to and from the site of the Western Sydney Airport
- The high visual impact identified for viewpoint 2 would also effect views in relation to the parcels of Commonwealth land at Willowdene Avenue.

This would result in long-term impacts to Commonwealth land during operation of the project. Visual impacts would be minimised through the implementation of the mitigation measures outlined in **section 8**. **Section 8** also provides a discussion of residual impacts following implementation of the mitigation measures.

## VISUAL IMPACT

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## 8. MITIGATION STRATEGY

The aim of the mitigation strategy is to realise the engineering and performance objectives of the proposed upgrade while producing a design outcome that produces good urban design outcomes and has a high visual quality.

Therefore a range of mitigation measures are recommended for incorporation into the project. These measures combine with the urban concept design to develop a solution that maximises the protection of the existing visual values and landscape character of The Northern Road and adjoining areas. Mitigation measures may be considered under two categories:

- **Primary mitigation measures** are embedded in the design of the proposed works through an iterative process between the engineering and urban design teams. This form of mitigation is generally the most effective
- **Secondary mitigation measures** are designed to specifically address the remaining (residual) adverse effects arising from the proposed works.

### 8.1 MITIGATION TO BE INCORPORATED IN DETAILED DESIGN

Complementing the urban design for the project described in **section 5**, the following outlines additional measures to be considered during the detailed design phase. They have been developed in accordance with the urban design objectives and principles in **section 4**, and are aimed at further reducing the identified landscape character and visual impacts from **section 6** and **section 7**.

#### **Road design**

- Consider relocating the proposed north-bound heavy vehicle inspection area away from the rural residential cluster in Grover Crescent, to maintain residential amenity and minimise noise, exhaust and light pollution for adjoining residents
- Review road design levels to ensure residents' views to the Blue Mountains are maintained
- Investigate opportunities for localised increases in batter steepness to reduce the corridor footprint and to maximise retention of remnant vegetation and farm dams
- Review typical road sections and reduce the median widths, where possible based on geometric constraints and potential for future widening, to reduce the overall footprint of the corridor, while maintaining sufficient median width for vegetation
- Review the lengths of concrete nosings at intersections to minimise their lengths. Maximise soft landscaping in the median on the approaches to intersections using appropriate frangible and low-growing species to provide for sight lines
- Review the allocation and placement of the utility corridors to ensure they do not inhibit vegetation, in particular the provision of tree cover, along the corridor
- Review the design for opportunities to mitigate level changes through the median to reduce the extent of earthworks required and associated impacts on views and vegetation.

#### **Access and connectivity**

- Review the design to ensure access to residual lands particularly between The Northern Road and the Western Sydney Airport, where there are no current provisions
- Consider access to employment lands in the detailed design phase, including for pedestrians and cyclists

## MITIGATION STRATEGY

- Investigate the feasibility and desirability of a shared path link along the existing The Northern Road to Luddenham, to provide a connection from the proposed new alignment to Luddenham town centre. This applies to both intersections with the Luddenham bypass. The proximity of the town centre from the southern intersection, combined with re-alignment of the existing The Northern Road provides a major opportunity to provide such a link as part of detailed design.
- Review the design to ensure it does not prevent the creation of future pedestrian and cycle links along the creek system in accordance with the principles of the *Sydney Green Grid*. In particular Badgerys Creek is planned to run through planned urban residential areas where it has the potential to function as an open space, recreation and ecological corridor.

### **Public domain and private recreation areas**

- In consultation with the club, design adjustments to the Orchard Hills Golf Course to maintain existing functionality and PAR levels.

### **Lighting**

- Design temporary and permanent lighting in accordance with Australian Standard *AS1158 Lighting for roads and public spaces* (AS1158) and to avoid unnecessary light spill on adjacent residents or sensitive receivers.

### **Bridges**

- Review the structural design of the bridge to provide an elegant form
- Consider increasing the length of the bridge over Adams Road to span over Cosgrove Creek to maintain the integrity of the creek system and the character of the valley with a series of cascading dams along a natural watercourse
- Review the road design to provide a safety barrier between the carriageway and the shared path.
- Design the bridge and potential future widening of Adams Road to allow for tree planting in a central median and behind safety barriers on the approach to the bridge pier, in order to mitigate the scale and bulk of the bridge structure.

### **Drainage design**

- Review the drainage design to minimise hard structures. Integrate WSUD and maximise soft landscape solutions to drainage channels and swales to maximise ecological outcomes and protect the water quality of major creeks
- Minimise the extent of infill of existing farm dams to retain them as essential features of the rural landscape.

### **Biodiversity**

- Investigate opportunities to provide a fauna crossing to support existing riparian and ecological corridors in the Duncans Creek catchment
- Review the design of bridges and culverts as fish friendly crossings and ensure that they do not create barriers to fish and that impacts to the existing hydrology are minimised
- Ensure replacement or reinstatement of habitat in accordance with Roads and Maritime *Biodiversity Guidelines*, to maximise creek restoration vegetation to ecological corridors
- Enhance and restore native vegetation communities along watercourses. Ensure appropriate riparian buffers are provided for waterways and streams, in accordance with the *Biodiversity Assessment Report* (Appendix I of the EIS). Integrate the use of excess local materials such as rock and timber to help recover biodiversity and create habitat.

## MITIGATION STRATEGY

### **Landscape and vegetation**

- Review the engineering design to minimise the removal of existing vegetation within the proposed construction boundary and maximise reinstatement of native vegetation through use of appropriate species
- If the north-bound heavy vehicle inspection area near Grover Crescent cannot be re-located, investigate opportunities to provide additional visual screening to maximise residential amenity and privacy.

### **8.2 MITIGATION DURING CONSTRUCTION**

The following mitigation measures are recommended for implementation during construction:

- Contain construction activities within the construction works zone boundary and occupy the minimum area practicable for limit impacts on adjoining areas, including the extent of native vegetation clearing
- Consider the provision of barriers to screen views from visually sensitive nearby areas such as rural dwellings, residential and recreational areas
- Construction programming must show how progressive rehabilitation of disturbed areas will be undertaken to minimise the duration and extent of temporary visual and landscape character impacts and to minimise soils exposure and the potential for erosion and dust generation
- Existing trees to be retained within construction areas are to be identified, protected and maintained in accordance with Australian Standard *AS4970 Trees on Development Sites* (AS4970), or as otherwise directed by a qualified ecologist or arborist
- The design of temporary lighting must avoid unnecessary light spill on adjacent residents or sensitive receivers and be designed in accordance with *AS1158*.

### **8.3 RESIDUAL IMPACTS**

The residual impacts are those landscape character and visual impacts which remain after the proposed mitigation measures have been implemented.

This has been assessed both during the construction period and during the design year. The design year is typically taken to be ten to 15 years after the project has been opened to normal operation. By this time the landscape works are deemed to have reached a level of maturity that allows them to perform according to original design objectives and intent.

Irrespective of the mitigation measures and the degree to which they are implemented, the proposed upgrade will result in substantial changes to the landscape and visual character of the area surrounding the project.

While some of the changes will appear less severe over time as proposed vegetation establishes and matures, the project will result in the following long-term irreversible residual impacts:

- Alterations to the topography as a result of the required earthworks
- Filling in of farm dams and disruptions to creeks as ecological corridors through the introduction of culverts which will alter the rural outlook and natural systems long term

- The loss of views as a result of earthworks and other structures associated with the proposed upgrade (it is noted that the project would also create opportunities for new views not currently available to the general public)
- The scale of the proposed upgrade itself as a major arterial through a rural landscape including previous greenfield sites
- The introduction of lighting along the proposed upgrade will persist long-term and is required to support the safe functioning of the road.

Based on the above, the identified landscape character and visual impacts would not substantially reduce over time. That is they will remain

- In the moderate to high range for landscape character impacts
- In the moderate to high range for visual impacts.

While the impacts themselves would not reduce over time, it is likely that the perception of the severity of the impacts may reduce, as people gradually adjust to the changes in their visual environment.

#### ***Residual impacts in the context of planned land use changes***

An essential part of the environmental assessment process is the consideration of known planning proposals. Of these, the planned changes for western Sydney as outlined in *A Plan for Growing Sydney* are a relevant consideration, in particular planning for the SWPGA and WSPGA.

That is, the proposed upgrade is a direct result of the WSIP that itself aims to support future growth and land use changes in the area by integrating transport in the region. The SWPGA and WSPGA will see the area south of Elizabeth Drive and east of the upgraded The Northern Road become progressively urbanised including for employment lands and the Western Sydney Airport.

The identified landscape character and visual impacts are based on the currently predominantly rural setting. Once the landscape surrounding the project transforms into an urban setting, the visual and landscape character contrast between the upgraded road and surrounding areas would reduce. As a result, the project would appear less 'out of place', reducing the severity of the landscape character and visual changes over time. That is, the identified landscape character impacts for LCZ 2 and 3 may reduce to moderate. In LCZs that would continue to have a rural interface, i.e. LCZ 1, 4 and 5, the landscape character impact would continue to remain in the moderate to high range.

Similarly, in the context of urbanisation, the visual impacts on views 3, 5-11 may reduce to range from low to moderate to high to moderate. The visual impacts on remaining views would remain in the moderate to high range.

## 9. CONCLUSION

The proposed upgrade extends from Mersey Road in Bringelly to Glenmore Parkway in Glenmore Park, a total length of about 16 kilometres.

The southern part of the study area is located in an area earmarked for substantial change through transformation of large tracts of land from rural to urban uses that include the Western Sydney Airport, employment lands in the Western Sydney Priority Growth Area and town centres and residential lands in the South West Priority Growth Area.

Areas to the west of the upgraded The Northern Road and north of Elizabeth Drive are planned to remain part of the Metropolitan Rural Area.

This contrast will characterise the journey along The Northern Road in both a north-south and east-west direction. It will become the defining feature of the landscape and visual character of the study area. It represents a unique opportunity to inform the urban design for the proposed works.

The scenic and landscape values of Orchard Hills are considered to be of considerable importance. They are well documented and reflected in current planning instruments and policies. The Northern Road itself is a designated tourist route with unique views towards the Blue Mountains. There is therefore a need to ensure the project retains and contributes to these values through careful design that integrates the upgraded corridor with the existing environment.

The project crosses five distinct landscape character zones and seeks to support the planned land use changes that will themselves lead to a transformation of the landscape character and visual qualities of the area in order to meet identified community needs over the next 20 to 25 years.

The project represents one of the first steps in this transformation and the identified visual and landscape character impacts will be highly noticeable in an area that as yet retains its rural character:

It would introduce a number of elements into the study area including:

- Widened carriageway including widened carriageways surface and depressed central medians, to provide between six and eight travelling lanes including two dedicated bus lanes
- A new road alignment to diver The Northern Road around the site of the Western Sydney Airport and as a bypass around Luddenham town centre.
- Upgrades to existing intersections including new traffic lights and turning lanes, u-turn facilities and new local link roads
- Earthworks including areas of substantial fill and cut
- A new bridge over Adams Road
- Modifications to existing creeks and water ways through the introduction of culverts under the road corridor and extensive infilling of farm dams
- Provision for shared paths and additional pedestrian footways.

These elements affect the existing character of the road, and surrounding areas, with landscape character impacts varying from moderate to high. These elements also alter existing views in the area. The assessment has found that the vast majority of views assessed would experience a high or high to moderate visual impact as a result of the project.

Based on these findings a series of visual impact mitigation measures have been identified. They build on the urban design objectives and principles that were developed in response to the analysis of the study area and Roads and Maritime policy. Implementation of the mitigation strategy will assist with

## CONCLUSION

the integration of the project with the surrounding context, taking into account the planned land use changes.

Based on the nature of the project, some landscape character and visual impacts will not be avoided or ameliorated through mitigation measures, resulting in the following long-term residual impacts:

- Alterations to the topography
- Loss of farm dams and disruptions to creeks as ecological corridors
- Loss of views and vistas
- The proposed upgrade itself as a major arterial through a rural landscape including greenfield areas
- An increase in light levels along the route, with the potential for spill.

While landscape and mitigation measures may assist the integration of the project with surrounding areas and people may adjust to the landscape character and visual changes, the impacts themselves are not likely to significantly reduce over time, especially in those areas retaining a large rural component or situated at the interface with rural lands.

On the other hand, the area south of Elizabeth Drive and east of the upgraded The Northern Road is earmarked for significant land use changes. They are planned to become progressively urbanised including for employment lands and the Western Sydney Airport.

In these areas the contrast between the upgraded road and surrounding areas will reduce over time, with the effect of reducing the long-term landscape character impacts.

Throughout the project area, the proposed mitigation measures seek to integrate the proposed upgrade with the existing landscape while taking into account planned changes to maximise the long-term fit of the project within its setting.

The refinement of the engineering concept design based on the urban design principles and mitigation measures will help achieve the desired future character of the The Northern Road and maximise the fit of the proposed upgrade within the context of a changing landscape, while providing for safe and efficient travel both along and across the corridor.

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