HAWKESBURY NEPEAN VALLEY FLOOD EVACUATION ROAD RESILIENCE PROGRAM

IMPROVEMENTS ON THE NORTHERN ROAD AND LONDONDERRY ROAD FLOOD EVACUATION ROUTES

Urban design report including landscape character and visual impact assessment

SD24223

July 2024

scape DESIGN

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Revision history

Date	Issue	Description	By	App
18 Sept 2023	01	Issue for 20% Concept Design	SC+AW	SB
03 Nov 2023	02	Issue for draft REF	SC+AW	SB
14 Nov 2023	03	Issue for 80% Concept Design	SC+AW	SB
19 Apr 2024	04	Issue for 100% Comments	SB+SC	CH
19 June 2024	05	Issue for 100% Comments	SB+EB	CH
18 July 2024	06	Final Issue	SB+EB	CH

Cover page image

The Northern Road intersection with Vincent Road looking North

Acknowledgement of Country

SCAPE Design acknowledge and respect Aboriginal and Torres Strait Islander Peoples across Australia as the Traditional Custodians of our lands, waters and skies.

We recognise their unique ability to care for Country and their deep spiritual connection with Country.

We honour Elders past, present and emerging, whose knowledge and wisdom will ensure the continuation of Aboriginal and Torres Strait Islander cultures, and the values which uphold them.

Existing site trees

Contents

List of figures

List of figures

List of tables

List of plates

Abbreviations

Acronym	Description
BFPL	Bush fire prone land
BFPV	Bush fire prone vegetation
C	Celsius
CE	Critically endangered
DAP	Disaster Action Plan
E	Endangered
EIA	Environmental Impact Assessment
EP&A Act	Environmental Planning and Assessment Act 1997
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
HNV	Hawkesbury Nepean Valley
ICOMOS	International Council on Monuments and Sites
KNC	Kelleher Knightingale Consulting
km	Kilometres
L	Litres
LALC	Local Aboriginal Land Council
LCVIA	Landscape character and visual impact assessment
LCZ	Landscape character zone
LEP	Local Environmental Plan
LGA	Local Government Area
m	Metres
mm	Millimetres
NSW	New South Wales
PCT	Plant Community Types
PMF	Probable Maximum Flood
RAAF	Royal Australian Air Force
REF	Review of Environmental Factors
RNE	Register of the National Estate
SEPP	State Environmental Planning Policy
SES	State Emergency Service
SUP	Shared user path
Transport	Transport for NSW (formerly Roads and Maritime)
UHI	Urban Heat Island
WSUD	Water Sensitive Urban Design
3D	3 dimensional

1 Introduction

1.1 Project overview

The NSW and Australian Governments have committed $33 million towards planning for more than 100 improvements that will make the Hawkesbury-Nepean Valley flood evacuation road network more resilient to flooding. Road infrastructure improvements have been identified across four Western Sydney Local Government areas: Penrith, Hawkesbury, Blacktown, and The Hills. The proposed improvements include road shoulder widening, culvert upgrades, new bridge structure, road raising, pinch point upgrades and drainage improvements. These improvements will make evacuation routes better able to withstand local flash flooding which can cause early closure of evacuation routes.

The Hawkesbury-Nepean Valley has the highest flood risk in NSW due to its unique landscape and large existing population. Floods in the Hawkesbury-Nepean Valley can and have had a notable impact on people's lives, livelihoods, and homes.

The key objective of Hawkesbury-Nepean Valley Flood Evacuation Road Resilience Program is to improve drainage on the road network to better withstand local flash flooding and to increase capacity to evacuate by road during major flood events.

The Hawkesbury-Nepean Valley Flood Evacuation Road Resilience Program has two components – State Road Improvements (on the Transport managed roads of The Northern Road and Londonderry Road) and Regional/ Local Road Improvements (on the mostly local council managed road network), this proposal refers to the State Road Improvements only, being The Northern Road and Londonderry Road flood evacuation routes.

1.2 Proposal description

The proposal area generally includes the road corridors of The Northern Road, Londonderry Road, Andrews Road and Vincent Road as follows:

- The Northern Road between the intersection with Richmond Road/Blacktown Road, Bligh Park in the north, and Borrowdale Way, Cranebrook in the south
- Londonderry Road from 270m south of Southee Road, Hobartville to the intersection with The Northern Road, Llandilo excluding about 270m north and 300m south of the existing intersection at The Driftway, Londonderry
- Route A9 (The Northern Road/Richmond Road) from 130m north of Andrews Road, Cranebrook to Boomerang Place, Cambridge Gardens in the south
- Andrews Road, Cranebrook from The Northern Road to the Andrews Road Baseball Complex west of Greygums Road, Cranebrook
- Vincent Road, Cranebrook, for about 70m west from The Northern Road
- Identified isolated areas along Route A9 (Richmond Road/Parker Street) between Gascoigne Street and Great Western Highway, Kingswood for the installation of flood evacuation signage.

The proposal area includes a buffer from the outer edge of the designed works to facilitate construction work. The buffer is generally 10m in width but is reduced to 6m or less in specific areas, to minimise impacts on sensitive areas.

Key features of the proposal include:

- Widening of the southbound shoulder pavement on the following roads, a total of about 20km, to provide a second outbound lane reserved for drivers to use during emergency flood evacuations. This would include culvert and drainage extensions to accommodate a wider road corridor, and connecting drainage along:
  - Londonderry Road between 270m south of Southee Road and The Northern Road, Londonderry
  - The Northern Road between Richmond Road and Borrowdale Way, in Londonderry, Berkshire Park, Cranebrook, Llandilo, and Jordan Springs.
- Drainage improvements including upgrades to culvert crossings, drainage channels, and pit and pipe networks at identified locations to improve resilience in localised flooding events. Work would include:

  Culvert upgrades, and associated drainage channel work:
  - Along sections of The Northern Road associated with raising of low points as outlined below
  - On Carrington Road at the intersection with The Northern Road, Londonderry
  - At two locations on The Northern Road about 50m and 130m north of the intersection of Carrington Road, Londonderry
  - On The Northern Road about 250m north of Toorah Road, Londonderry
  - On Vincent Road at the intersection with The Northern Road, Cranebrook
  - On Fifth Avenue at the intersection with The Northern Road, Llandilo.

  New roadside drainage channels (including vegetated and concrete of various widths):
  - Along Londonderry Road (next to the southbound shoulder), from 270m south of Southee Road, Hobartville to the intersection with The Northern Road, Llandilo
  - Along The Northern Road (next to the southbound shoulder), from the intersection with Blacktown Road/Richmond Road, Bligh Park to Ninth Avenue, Llandilo
  - Along The Northern Road (next to the northbound shoulder) at road raising areas (described in further detail below).

1 Introduction

Underground drainage network upgrades:
  - Along The Northern Road (southbound), Cleeve Place and Star Crescent, Cambridge Gardens from Trinity Drive to Boomerang Place, including about 60m along Trinity Drive, Cambridge Gardens
  - Along The Northern Road, Cranebrook (northbound) from about 115m north of Andrews Road, Cranebrook to Trinity Drive, Cambridge Gardens including new drainage crossings underneath The Northern Road
  - Along Andrews Road from The Northern Road up to the Andrews Road Baseball Complex in Cranebrook.
- Raising of low points along sections of The Northern Road, affecting all road lanes located:
  - Starting from around 120m North of Whitegates Road, Londonderry heading northwards (about 345m length)
  - Starting from around 200m North of Spinks Road, Llandilo heading northwards (about 920m length)
  - Starting from around 270m north of Fifth Avenue to around 435m south of Fifth Avenue, Llandilo
  - Starting from around 185m north of Vincent Road to around 105m south of Vincent Road, Cranebrook
  - Starting from around 50m south of Ninth Avenue, Cranebrook to about 365m south of Ninth Avenue, Cranebrook.
- Extend, replace or add new culverts at selected locations along Londonderry Road and The Northern Road to maintain property access (e.g. driveways) as required.
- Realignment of The Northern Road, Cranebrook (within the road corridor), between around 330m north of Seventh Avenue, Llandilo to around 280m south of Vincent Road, Cranebrook to reduce project impacts on near by sensitive receivers and improve road safety.
- Adjustments to the following intersections to facilitate a secondary outbound lane for drivers to use during a flood evacuation event. These may include changes to existing median, traffic islands, kerbs and line marking at:
  - The Northern Road and Richmond Road and Blacktown Road, Bligh Park
  - Londonderry Road and The Northern Road and Cranebrook Road, Cranebrook
  - The Northern Road and Vincent Road, Cranebrook
  - The Northern Road and Ninth Avenue, Jordan Springs.
- Installation of new signage to be displayed during emergency flood evacuations to facilitate a second left turn at the existing Parker Street/Great Western Highway intersection in Penrith under traffic control.
- Adjustments as required to connect Londonderry Road and The Northern Road to local roadways, side roads and access roads.
- Relocation and/or adjustments of various road furniture (such as signage, road safety barriers, street lighting, kerb and island adjustment etc.) throughout the proposal area.
- Relocation of bus stops at:
  - The Northern Road (northbound) about 30m south of Vincent Road. To relocate this bus stop about 130m to the south
  - The Northern Road (southbound) about 210m south of Ninth Avenue. To relocate this bus stop about 20m to the north.
- Utility and driveway adjustments as required within the proposal area.
- Landscaping as required.
- Provision of temporary ancillary facilities to support the construction works including office and staff amenities, site compound and laydown areas:
  - Road reserve next to the Francis Greenway Correctional Complex, Berkshire Park (site 1)
  - Road reserve next to 245 The Northern Road, Berkshire Park (site 2)
  - 557 The Northern Road, Berkshire Park (site 3)
  - Road reserve next to 107 Fifth Avenue, Llandilo (site 4)
  - Road reserve next to 902 The Northern Road, Llandilo (site 5)
  - 1042 The Northern Road, Llandilo (site 6)
  - Council reserve, Greenwood Parkway, Jordan Springs (site 7)
  - Part of the Richmond Race Club, Londonderry Road, Londonderry (site 8)
  - Council reserve, Andrews Road, Penrith (site 9)
  - Council reserve, Parker Street, Penrith (site 10).

Refer to Figure 1-1 for the proposal area, including ancillary facility areas. For further discussion of ancillary facility areas refer to page 80.

The final construction staging of the proposal would be determined by Transport and the construction contractor. However, it is anticipated that the permanent works would be carried out in stages, with an early works component. Subject to funding availability, the construction is expected to commence in 2026 and be completed in 2030.

1 Introduction

Refer to Section 4 on page 23 of this report for a more detailed description of the urban design elements of the proposal.

Refer to Refer Section 5 on page 32 of this report for a detailed description of the landscape character zones (LCZ) methodology and Section 7 on page 49 for a detailed description of the visual impact methodology.

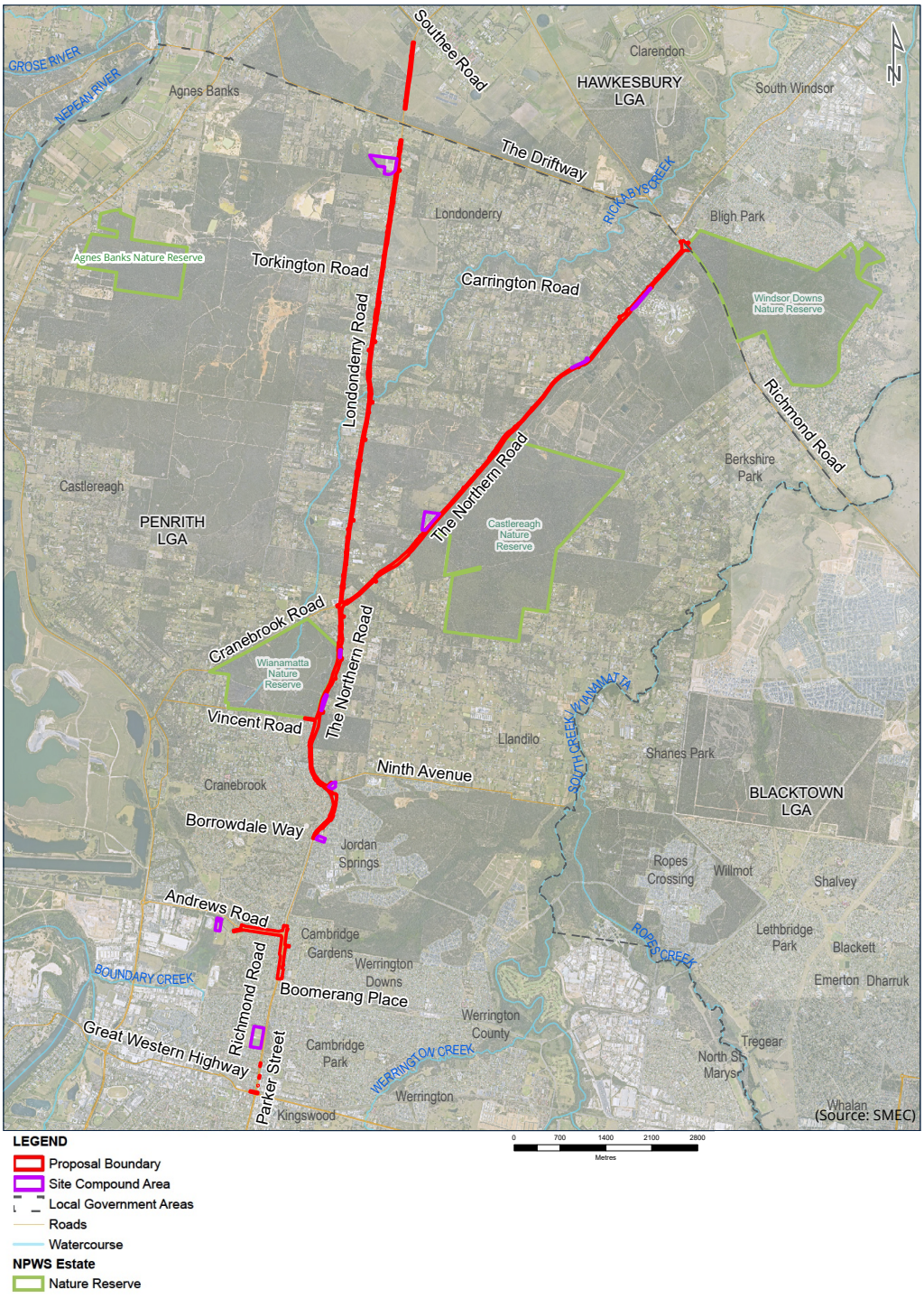


Figure 1-1: Proposal area extract (provided by SMEC)

1 Introduction

1.3 Study area

Figure 1-2 captures the extent of the HNV State Roads proposal along the arterial roads of Londonderry Road and The Northern Road, from Richmond in the North to Great Western HWY Penrith in the South. The proposal is based in Sydney's West, within the Penrith and Hawkesbury Local Government Areas (LGA) (refer to Figure 1-2). The proposal runs through the suburbs of Richmond, Londonderry, Berkshire Park, Cranebrook, Llandilo, Jordan Springs and Cambridge Gardens.

The study area comprises peri-urban estates, rural-residential areas, agricultural, industrial, commercial lots, and private farming lots.

There are three activity nodes highlighted within the vicinity of the study area in Figure 1-2:

- Industrial estates at Penrith
- Western Sydney University, Kingswood
- Industrial estate near Jamison.

There are three localised light commercial activity nodes within the study area (refer Figure 2-6):

- Richmond, to the north of the proposal area
- The Northern Road intersecting Richmond Road and Blacktown Road, Bligh's Park
- Cranebrook, to the southwest of the proposal area.

The following educational facilities are located within the study area:

- TAFE NSW
- Western Sydney University, Hawkesbury Campus
- Londonderry Public School
- St Paul's Grammar School
- Llandilo Public School.

There are two train lines located within the study area, the T1 North Shore and Western and the T5 Cumberland Line, their combined routings are diagrammatically illustrated in Figure 1-2. To the north of the study area, both T1 & T5 lines terminate at Richmond. A separate routing of the T1 line is also located to the south of the study area, linking Emu Plains with Penrith and Blacktown.

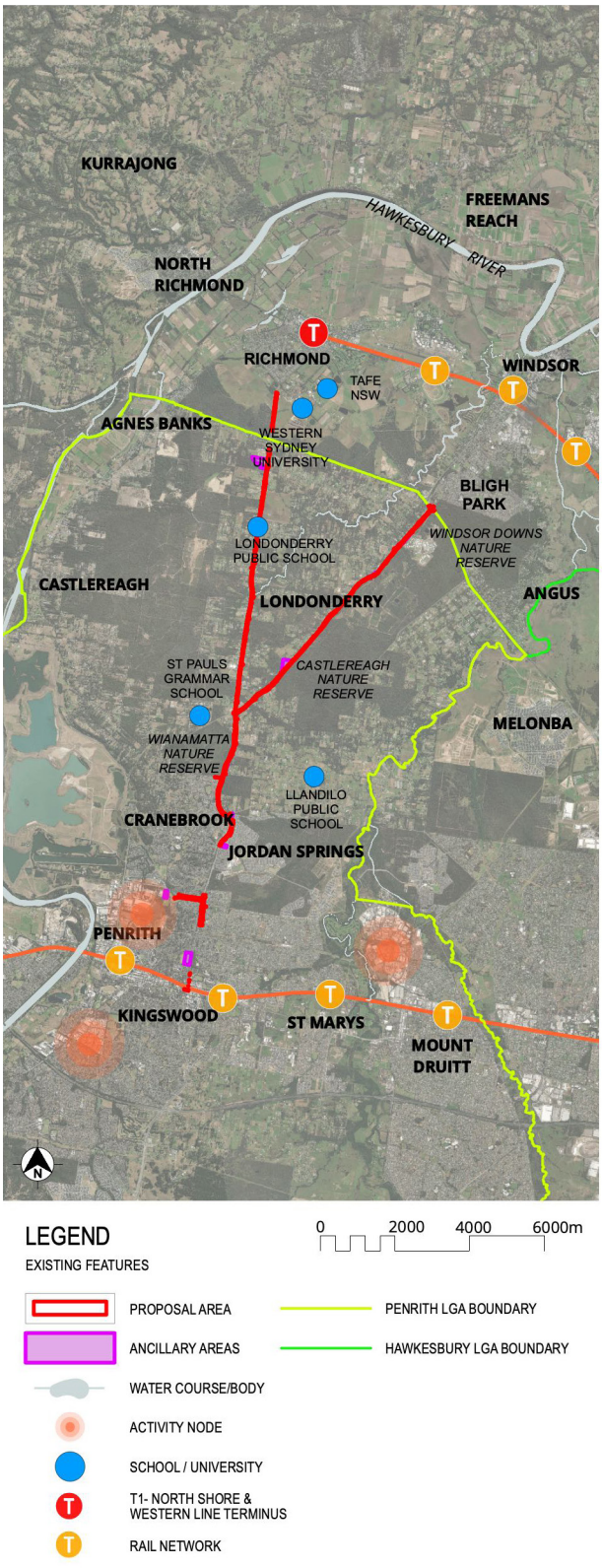


Figure 1-2: Study area

1 Introduction

1.4 Planning framework

The proposal is subject to environmental assessment under Division 5.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act), which requires Transport for NSW (Transport) to prepare a review of environmental factors (REF) for the proposal. This urban design report and LCVIA has been prepared to support the REF.

1.5 Strategic planning policy context

A number of state wide legislative and policy guideline documents have been referred to in order to guide the proposal and these include:

- *A Plan for Growing Sydney, NSW Planning and Environment, December 2014*
- *Future Transport Strategy 2056*
- *NSW Freight and Ports Strategy, NSW Government, 2013*
- *NSW Infrastructure Strategy 2018-2038*
- *SEPP (Western Sydney Employment Lands) 2009.*

Other documents that have provided background reference information for the study area include:

- *Australia International Council on Monuments and Sites (ICOMOS)*
- *Charter for Conservation of Places of Cultural Significance 2013 (The Burra Charter)*
- *State Environmental Planning Policy 2021.*
- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Biodiversity Conservation Act 2016.*

1.6 Urban design guidance

NSW guidance

The following guideline and policy documents define best practice for road infrastructure proposals across NSW, these documents include:

- *Beyond the Pavement,* Transport, 2023
- *Biodiversity Guidelines,* The Roads and Traffic Authority Services, 2011 To be read in conjunction with *Biodiversity Policy 2022*
- *Guideline for Batter Surface Stabilisation using vegetation,* Roads and Maritime Services, 2015
- *Guidelines for landscape character and visual impact assessment,* Transport, *2023*
- *Landscape Design Guide, Transport, 2023*
- *Reconciliation Action Plan*, Transport, 2022-2025.
- *Water sensitive urban design guideline,* Transport, 2023.

At a state level *Beyond the Pavement* is the over-arching document that provides guidance for the development of infrastructure proposals ensuring that urban design is considered early, integrated from the initial phase and continued through to the finalisation and operation phases.

Proposal specific urban design principles are listed in Table 3-1 on page 19 and have been adapted from the following urban design objectives listed in *Beyond the Pavement*:

- Fitting with the built fabric
- Fitting with the landform
- Contributing to green infrastructure and responding to natural systems.

Western Sydney urban design guidance

The following guideline and policy documents define best practice for road infrastructure upgrade proposals across western Sydney, these documents include:

- *Draft Cumberland Plain Conservation Plan, NSW Department of Planning, Industry and Environment, August 2020*
- *Sydney Green Grid Spatial Framework and Proposal Opportunities, Government Architect NSW, Final report, 2017.*

Penrith City Council urban design guidance

The following strategy and policy documents define the best practice for works within the Penrith City Council LGA and include:

- *Penrith Local Environmental Plan 2010*
- *Penrith Biodiversity Strategy*
- *Penrith Cooling the City Strategy 2015*
- *Penrith Public Domain Manual*
- *Water Sensitive Urban Design (WSUD) Policy and Technical Guidelines*
- *PCC Water Sensitive Urban Design (WSUD) Policy*
- *Street and Park Tree Management Plan.*

Hawkesbury City Council urban design guidance

The following strategy and policy documents define the best practice for works within the Hawkesbury City Council LGA and include:

- *Hawkesbury Local Environmental Plan (LEP) 2012*
- *Hawkesbury Environmental Sustainability Strategy 2023-33*
- *Hawkesbury Community Strategic Plan 2022-2042.*

1.7 Reference documents

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

- Various specialist sub-consultant reports (refer REF appendices)
- Published REF and concept design.

1 Introduction

1.8 Report methodology

Preparation of this urban design and landscape character and visual impact assessment report has been an iterative process with the whole design team. Urban design opportunities and constraints have been fed into the design development process to ensure integration and cost efficiencies, including:

- Visual inspection of the study area and surrounding broader context on 08 March 2023 with photographic records
- Desktop studies of the regional context and site analysis of the local natural and built environment, human intervention and the shaping of the landscape and the interaction between place and community
- Desktop review of background reports and relevant planning policies
- Development of urban design objectives and principles
- Development of the urban design concept
- Assessment of the potential landscape character impacts of the proposal
- Assessment of the potential visual impacts of the proposal
- Development of mitigation strategy, which includes principles and strategies to mitigate landscape character and visual impacts in the ongoing development of the design.

This process has occurred in collaboration with the proposal team and their coordination with Transport urban designers with the aim of achieving an integrated urban design and engineering outcome that realises the design outcomes described in Transport's urban design guideline and policy documents listed in Section 3 on page 18.

1.9 Report structure

The LCVIA report is structured into nine sections:

1. Introduction

Provides a brief overview, report purpose, assessment requirements, the legislative context, the report structure and our core values.

2. Existing environment

Describes the urban and landscape setting and character, and how they have informed the design and assessment process. Defines distinct landscape character zones according to topography, drainage and urban form etc.

3. Urban Design strategy

Presents the urban design strategy for the proposal including an urban design vision, objectives and principles that are derived from the contextual analysis

4. Urban Design concept

Describes the major elements of the proposal and offers design approaches for the future development of these elements

5. Landscape character impact assessment

Assesses impacts from the proposal on the identified landscape character zones by analysing how well the proposal fits into the natural and built landscape

6. Visibility of the proposal

Identifies the areas where the proposal would be visible, also known as the visual envelope and determines a range of representative viewpoints within that catchment

7. Visual impact assessment

Assesses impacts of the proposal on each of the selected viewpoints and leads to the identification of mitigation measures

8. Mitigation measures

Outlines recommended mitigation measures to be incorporated into future planning and design of the proposal. These measures would be discussed with the design team and would be reviewed for consideration in the future design stages

9. Summary of Urban Design Findings

Provides a summary of the outcomes the community can expect including urban and landscape design outcomes, the likely level of landscape character and visual impacts of the proposal, and how they be further reduced through the application of mitigation measures in future stages.

2 Existing environment

2.1 Chapter overview

The following section of the report provides a summary of the existing landscape context and cultural influences on the study area. This background information has informed the development of the concept design and ultimately the mitigation measures that respond to any residual impacts. Further detail on each sub-section can be obtained by reviewing the relevant specialist reports provided in the appendix of the REF.

2.2 Regional context

Figure 2-1 illustrates the locality of the study area within the wider context of Sydney, falling within the Penrith and Hawkesbury LGAs, on the north western edge of Sydney.

The arterial roads of the Hawkesbury Valley Way/ Bells Line of Road (B59) and M4 Western Motorway are located to the north and south of the study area respectively, for roads that are within study area refer to Figure 2-2.

The existing train lines, T1 Western Line and T1 Richmond Line, are to the north and south of the study area respectively. There are no existing or proposed Metro lines in close proximity to the study area but the future Sydney Metro Western Sydney Airport Line will connect St Marys with Western Sydney Airport.

Bankstown and Sydney airports are both located to south east of the study area.

Major institutions within the study area are listed below:

- Western Sydney University
- Francis Greenway Correctional Complex.

Several of the major open space areas, National Parks and Nature Reserves within the wider regional area are shown in Figure 1-1. Those included within the study area are listed below:

1. Agnes Banks Nature Reserve
2. Castlereagh Nature Reserve
3. Windsor Downs Nature Reserve
4. Wianamatta Nature Reserve.

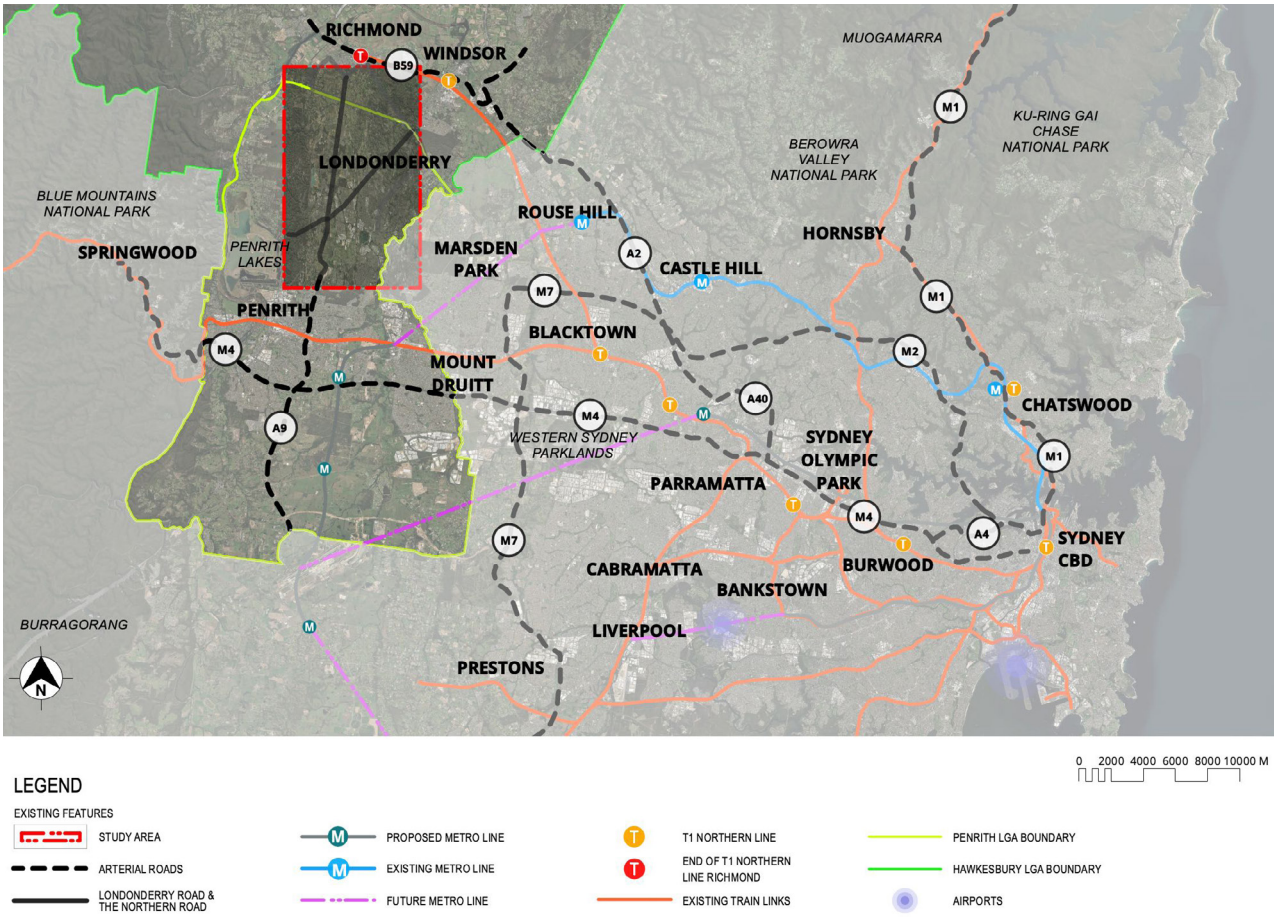


Figure 2-1: Regional context of the proposal

2 Existing environment

2.3 Local context

Figure 2-2 illustrates the local context of the proposal area, surrounding the existing roads of Londonderry Road and The Northern Road, where works are proposed to these roads. Sub-arterial and local roads are indicated within the locality.

HNV State Roads can be accessed by the following roads:

- The Driftway
- Torkington Road
- Cranebrook Road
- Andromeda Road
- Ninth Avenue
- Seventh Avenue
- Fifth Avenue
- Fourth Avenue
- Smeeton Road
- Whitegates Road
- NorthTrail.

Existing bus stops are shown, some of these bus stops may require relocation as a result of the proposal works. These locations would be developed further at the detailed design stage.

The combined location of both the T1 North Shore and Western and T5 Cumberland Line train lines are shown to the north of the study area.

Sites of local heritage under the NSW Local Environmental Plan for Penrith are highlighted in brown in Figure 2-2. There are two European sites highlighted located in close proximity to the proposal:

- Londonderry cemetery (H1)
- Cottage.

The Cottage is south of the main proposal area shown in Figure 2-2 and not impacted by the proposal works.

These sites are discussed further in Section 2.9 on page 14, in a detailed review of Non-Aboriginal Heritage and also Aboriginal Heritage, as referenced from specialist reports.

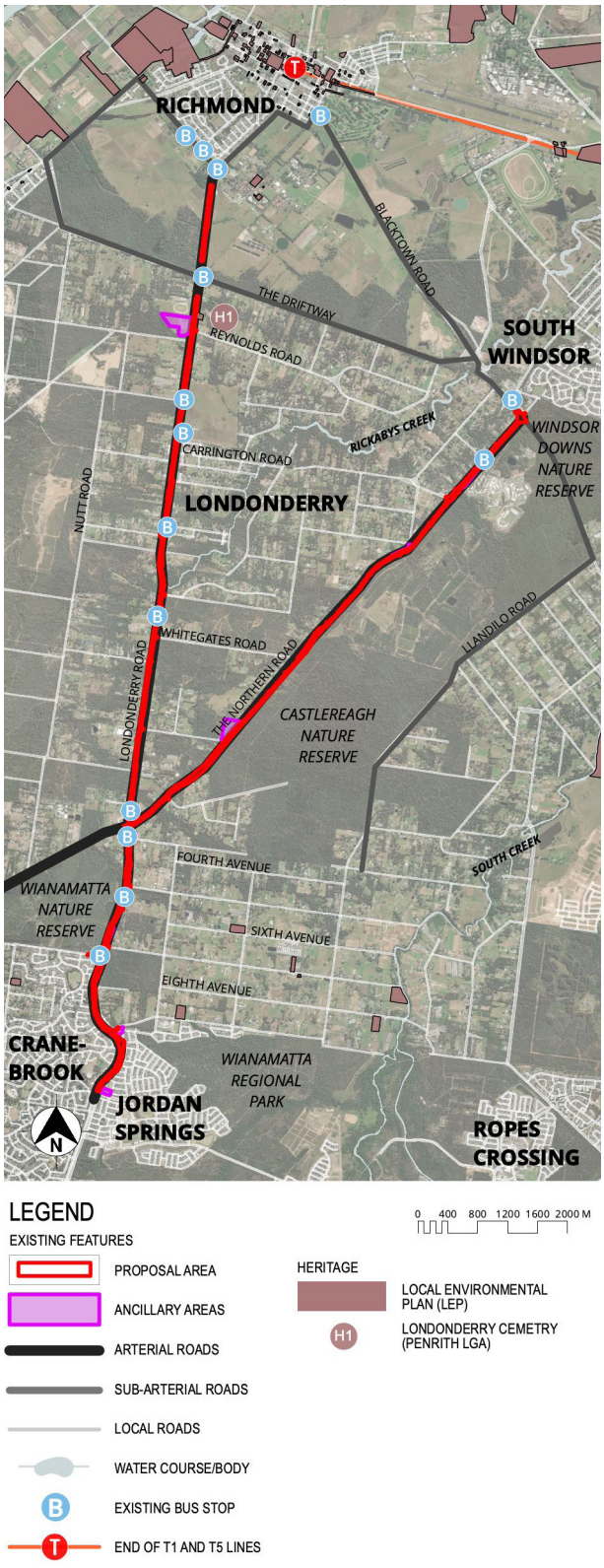


Figure 2-2: Local context of the proposal

2 Existing environment

2.4 Land use

Existing urban form

Figure 2-3 illustrates the land use zones across the study area, which are regulated by the Hawkesbury Local Environmental Plan (LEP) 2012 and the Penrith LEP 2010.

Land uses found within the study area are as follows:

- C1 – National Parks and Nature Reserves
- C2 – Environmental Conservation
- E4 – General Industrial
- R2 – Low Density Residential
- R3 – Medium Density Residential
- R4 – High Density Residential
- RE1 – Public Recreation
- RE2 – Private Recreation
- RP – Regional Park
- RU4 – Primary Production Small Lots
- RU5 – Village
- SP1 – Special Activities
- SP2 – Infrastructure
- DM – Deferred Matter
- UR – Urban.

Most of the study area comprises RU4 - Primary production small lots, which surround the central study area land uses of C1-National parks and nature reserves, C2-Environmental conservation (and SP2 - Infrastructure). It is these land uses that shape the character of the area surrounding the proposal.

In the north of the study area SP1- special activities zoning for agricultural activities surround R2-Low density and R3 -Medium density residential areas.

Examples of some of these land uses are illustrated by Plate 2-1 to Plate 2-4.

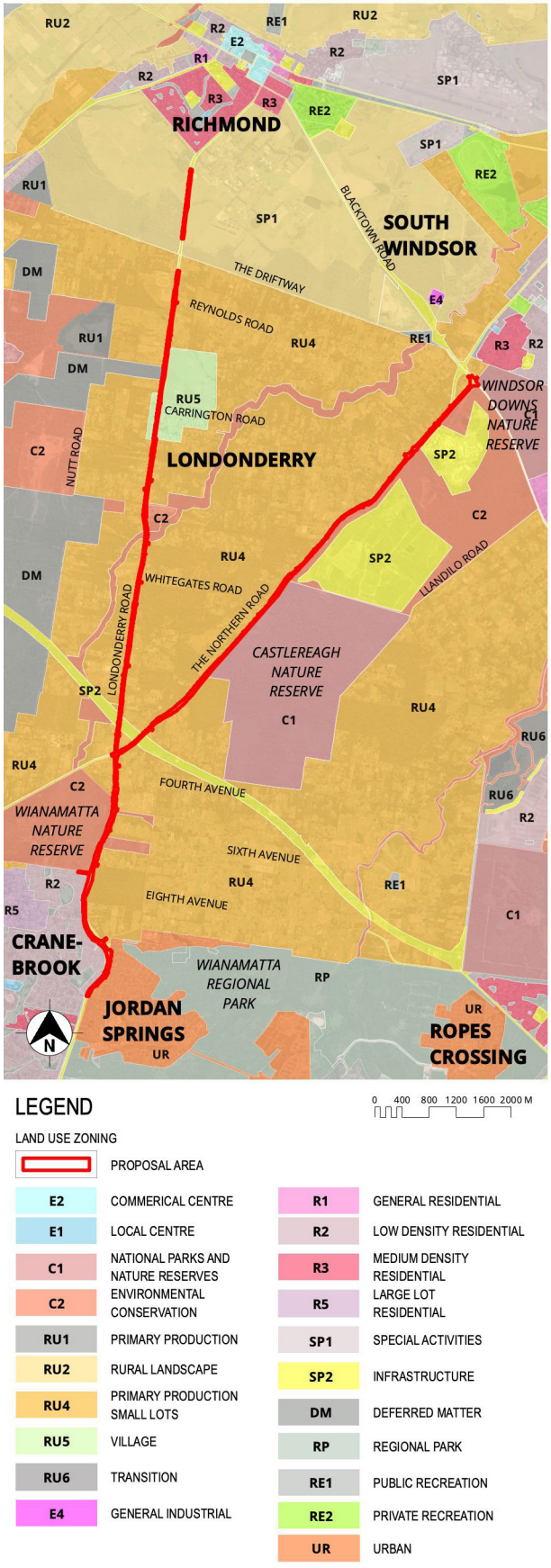


Figure 2-3: Land use diagram

2 Existing environment

2.5 Stakeholders

The following stakeholders have been identified as having a potential interest in the upgrade:

- Penrith City Council
- Hawkesbury City Council
- Deerubbin Local Aboriginal Land Council (LALC)
- NSW Department of Climate Change, Energy, Environment and Water
- NSW Environmental Protection Authority
- Heritage NSW
- Sydney Water NSW
- Utility providers
- Landowners, residents, and local businesses
- State Emergency Service
- Community involvement
- Aboriginal Community involvement
- Reconstruction Authority.

Co-ordination with relevant stakeholders and the local community would be undertaken during the development of the proposal to ensure that the final design meets expectations and ensures that long term planning for HNV State Roads Proposal are not compromised and the impacts on the surrounding community and environment are minimised as much as possible.

Plate 2-1: RU4 - Primary production small lots

Plate 2-2: C1 - National parks and nature reserves

Plate 2-3: R2 - Low density residential

Plate 2-4: R3 - High density residential

2 Existing environment

2.6 Land form and drainage

The Hawkesbury-Nepean River is the largest and one of the most important river systems in NSW. It supplies freshwater for drinking, habitats for a diverse range of flora, fauna and aquatic species and supports Sydney's agriculture and aquaculture industries. The river provides 97% of the fresh drinking water for more than 4.8. million people within Sydney. It is still the dominant resource supporting industries such as mining, recreation, manufacturing, and tourism industries.

Water catchment areas within the vicinity of the study area include:

- Rickabys Creek
- Penrith Lakes
- Nepean River
- Hawkesbury River
- Prospect Reservoir.

Figure 2-4 illustrates high and low lying land as shown by a concentration of contours with an overlay of flooding occurrence predictions (as referenced from the SES website), illustrating the following:

- 1 in 5 chance per year of flooding
- 1 in 100 chance per year of flooding
- Probable maximum flood (PMF).

This flood occurrence illustrates the importance of the flood evacuation road resilience HNV State Roads Proposal.

Reference can be made to the *Hydrologic and Hydraulic Assessment Report* prepared by Lyall & Associates for Transport as part of the REF, for a more detailed analysis of flood occurrence and mapping.

Geology and soils

Three existing geology types are likely to be found in the study area, which would have some influence of the natural soil types

- Londonderry clay
- Tertiary period conglomerate
- Bringelly shale.

Areas within the study area near watercourses and drainage lines may lead to an occurrence of acid sulphate soil susceptibility.

Considerations for the proposal

- Plant species are to be suitable to the different soil landscapes across the region
- Across the site determine the soil pH, nutrient deficiencies and apply nutrient quantities to improve the growing conditions especially for trees.
- Manage the risk of acid sulphate soils
- Remnant Native Vegetation deemed under threat to clearing for development to be retained where possible.

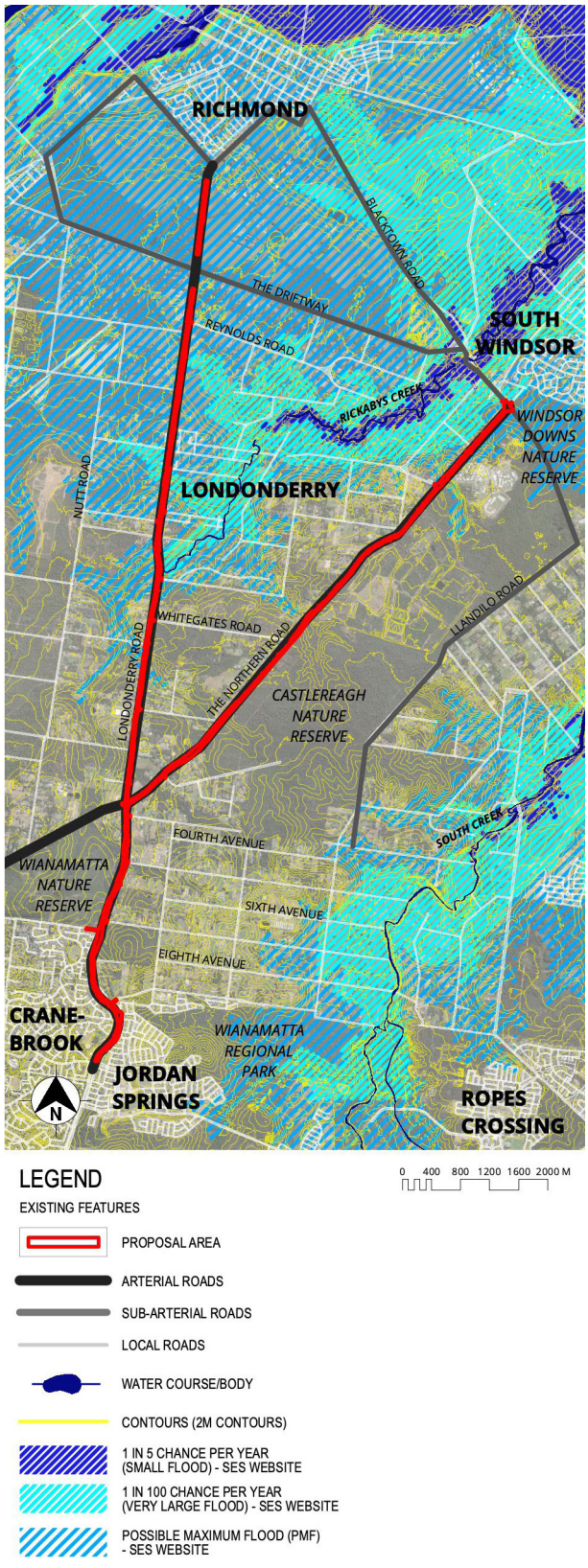


Figure 2-4: Landform and drainage diagram

2 Existing environment

2.7 Biodiversity

Vegetation communities

The Biodiversity Assessment Report, conducted for Transport (March 2024) identified five threatened flora species and one threatened flora population within the study area. The study area also includes conservation areas and a key fish habitat at Rickabys Creek. A biobanking agreement is proposed for biodiversity offsets that have been triggered under 'No Net Loss Guidelines'. It has been estimated that over 20 hectares of native vegetation would be cleared for construction and operation of the proposal.

The threatened flora species/ flora population comprise:

1. *Dillwynia tenuifolia*
2. *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea)
3. *Marsdenia viridiflora* subsp. *viridiflora*
4. *Micromyrtus minutiflora*
5. *Persoonia nutans* (Nodding Geebung)
6. *Pultenaea parviflora.*

Five threatened (NSW) plant community types (PCTs) have been recorded within or next to the proposal area. These five PCTs are:

- Cumberland Shale Plains Woodland
- Castlereagh Ironbark Forest
- Castlereagh Shrubby Swamp Woodland
- Castlereagh Scribbly Gum Woodland
- Cumberland Red Gum Riverflat Forest.

Within these PCTs, at least two Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) listed vegetation communities were identified as being impacted by the proposal:

- Cooks River Castlereagh Ironbark Forest
- Castlereagh Scribbly Gum and Agnes Banks Woodland.

Figure 2-5 illustrates the PCTs found within the vicinity of the study area and highlights the four EPBC threatened ecological communities within (as either CE - critically endangered or E - endangered). This mapped data has been sourced from the NSW Government SEED portal_2023. The most dominant vegetation community within the study area is the Castlereagh Scribbly Gum woodland (highlighted in green).

Threatened fauna

The four threatened fauna species found within the study area are listed below:

Endangered species:

- *Meridolum corneovirens* - Cumberland Plain land snail (E)
- *Phascolarctos cinereus* – Koala (E).

Vulnerable species:

- *Myotis Macropus* – Southern Myotis (V)
- *Ninox strenua* – Powerful owl (V).

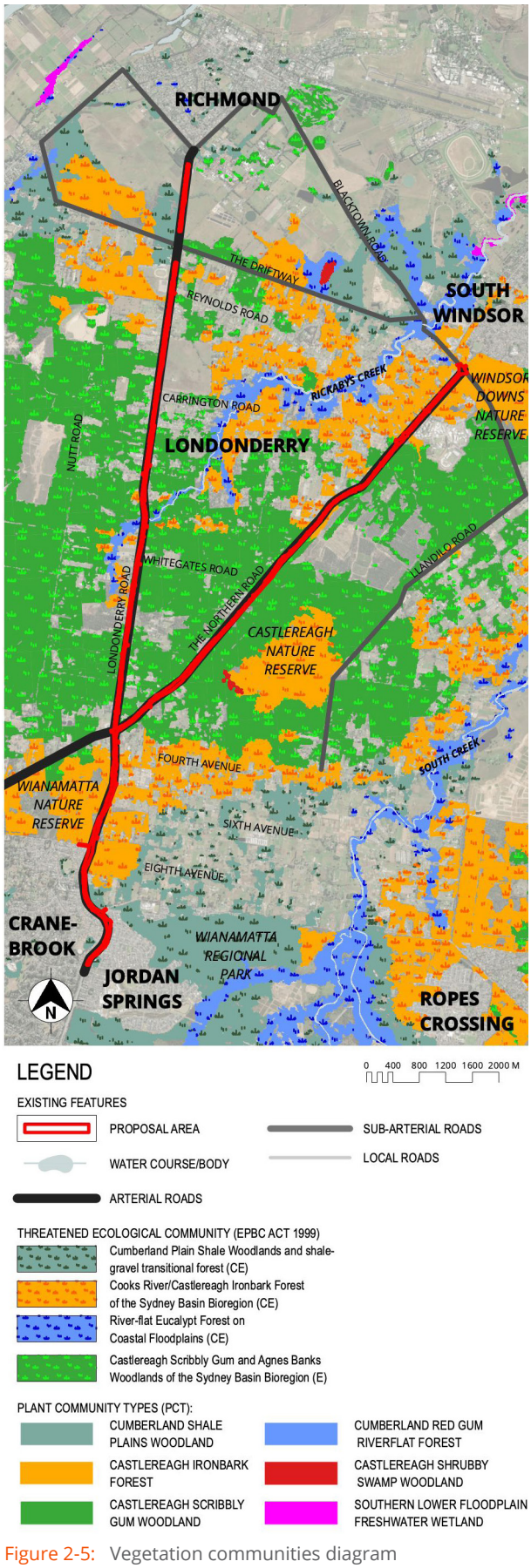


Figure 2-5: Vegetation communities diagram

2 Existing environment

2.8 Access and circulation

Pedestrian and cyclist access

There are currently limited pedestrian footpaths, cycle paths or shared user paths (SUP) along most of the Londonderry Road and The Northern Road alignments. The proposal covers main arterial roads which are predominantly used for vehicular access with few formalised pedestrian crossings.

Active transport within the study area is generally limited to footpaths or SUPs beside roads south of Borrowdale Way, where there is more demand from nearby residential areas.

Pedestrian crossings are provided at signalised intersections. There are several un-signalised and signalised intersections within the study area. Most sections of The Northern Road, south of Vincent Road are restricted by No Parking or No Stopping signage.

For the majority of the proposal there are no formal kerbs and wide turf verges along the arterial roads, aligning with the character of rural-residential and agricultural land zones.

Within residential areas, there can be found more typical road kerbs and turf verges with scattered street trees.

Public transport

T1 North Shore and Western and T5 Cumberland rail services are available on the Western Line and the Richmond Line in the study area.

The Kingswood and Penrith railway stations are the closet stations to the south of the study area and Richmond railway station is the closet to the north of the study area.

Bus stops are illustrated on Figure 2-2, with a higher frequency of stops on Londonderry Road between Cranebrook and Richmond to those on The Northern Road between Cranebrook and South Windsor.

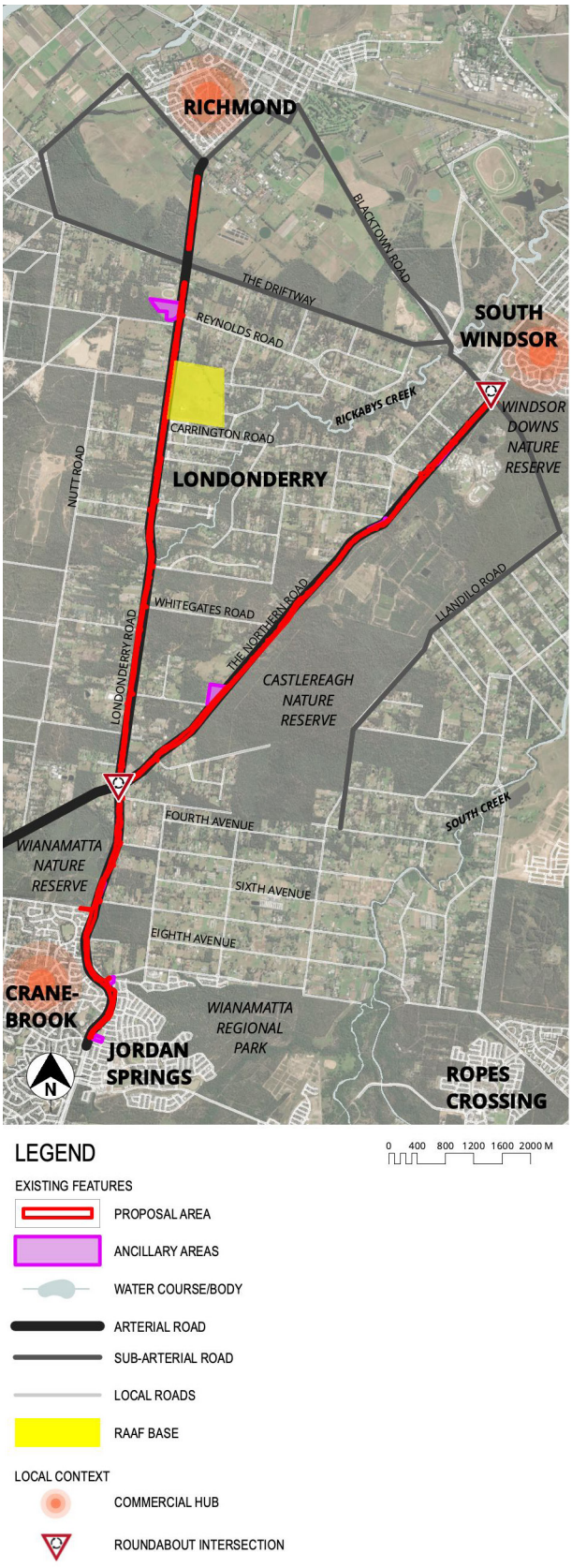


Figure 2-6: Access and circulation diagram

2 Existing environment

2.9 Heritage

Aboriginal cultural heritage

Kelleher Nightingale Consulting (KNC) prepared an *Aboriginal Archaeological Survey Report* for Transport in July 2024. KNC worked with Deerubbin LALC to discuss the proposal works. Eight Aboriginal archaeological sites were identified within the study area.

Through a significance assessment, five of the aboriginal sites were determined to have moderate archaeological significance, whilst the remaining three exhibited low-moderate archaeological significance. These sites comprise artefact scatters and isolated finds. Remaining parts of the study area were identified to have been disturbed by historic and contemporary land use practices. Reference can be made to KNC *Aboriginal Archaeological Survey Report* for further details of each site.

KNC has identified the drainage depression landforms associated with Rickabys Creek, its tributaries and the tributaries of South Creek as key landscape elements which dissect the study area. Both watercourses have been archaeologically proven to be a focal point for Aboriginal land use activity and are likely to have provided a stable source of water and raw materials suitable for toolmaking. Archaeological sites have been acknowledged regionally to occur as surface artefact scatters and isolated artefacts. Typically, they are located on elevated landforms along margins of creeks, particularly in locations which offer a permanent water and associated environmental resource. These locations have been identified as favourable places of occupation by Aboriginal people.

KNC has advised it is best practice to avoid all impact to identified Aboriginal archaeological sites where possible.

Non-Aboriginal cultural heritage

The Heritage working paper produced by Austral Archaeology for SMEC in July 2024 has identified the proposal area as generally being highly disturbed since the 20th century because of modernisation through, widening, upgrades and maintenance to the roads and nearby developments. Prior to this, the road alignment was representative of an early 19th Century stock route from Cowpastures in the south to Richmond in the north, supplemented by a further route in the mid 19th Century from Cranebrook to Richmond Road.

Near by land was either undeveloped or used for agriculture until the 20th Century where it started to become more developed. The combination of road widening and associated development has resulted in any physical evidence of the original road routes or earlier land uses being destroyed.

Plate 2-5: Londonderry cemetery, Londonderry Road

Plate 2-6: Londonderry cemetery, Londonderry Road

Plate 2-7: 'Cottage', 71 Parker Street, Penrith

Plate 2-8: 'Cottage', 71 Parker Street, Penrith

There are no heritage items listed in the NSW Local Environment Plan (LEP) for Penrith within the proposal area. There are however two European heritage sites identified in close proximity to the proposal area. These are:

- Londonderry Cemetery (LEP No. 115) - referenced as H1 in Figure 2-2 on page 8
  - Located 6m east of Londonderry Road alignment, situated on the eastern side of the study area 325-331 Londonderry Road, Londonderry. This heritage item consists of 12 sandstone memorials which mostly date to the 1860s.
- 'Cottage' (LEP No. 175)
  - Located at 71 Parker Street, Penrith near the intersection with the Great Western Highway, north of the railway line. The heritage item has been restored with modern materials which imitate the original design of the house. The property boundary is located about 3m from proposed signage on Parker Street and would not be impacted by the proposal.

Examples of these listed heritage European sites are illustrated by Plate 2-5 to Plate 2-8.

The following items have been identified by Austral Archaeology for their ecological importance rather than their historical heritage value. They have been listed within the Register of the National Estate (RNE) and have been acknowledged to have a direct visual relationship with the study area. The current road alignment of the project encroaches close to most of these:

- Castlereagh State Forest and Adjacent Area
- Riverstone Natural Area
- University of Western Sydney Hawkesbury Native Vegetation
- Western Sydney Shale Woodland, St Marys
- Castlereagh Jewel Beetle Habitat and Movement Corridor.

The areas of close proximity are illustrated on Figure 3-1 on page 21 and Figure 3-2 on page 22.

2.10 Climate

Penrith City Council has developed a Greening our City Program in response to the shifting climate to improve liveability for urban growth within Penrith. The council is invested in green infrastructure to improve liveability for residents and actively engages the community. The benefits of trees in urban environments help to capture air pollution and stormwater runoff, increase chances for the development of habitat for wildlife, provision of cooling through increase of shade, scientific processes of evapotranspiration and can lead to an increase in property value.

In attempts to mitigate urban heat island (UHI), the council has introduced the Cooling the City Strategy to increase cooling across the LGA. Actively working to protect the district from rising temperatures, the council has increased the planting of trees to help reduce average temperatures over time.

NSW Government's Greening our City Grant

In 2022, Penrith City Council was the recipient of the NSW Government's Greening our city grant, receiving $705 000 funding which provided the opportunity to expand the rate of tree planting in proposals encompassing streets, parks, industrial estates, and major corridors across several industrial estates and transport corridors within the LGA.

Community Strategic Planning

Hawkesbury City Council has created a 10-year plan vision which contains a set of objectives in collaboration with community engagement to ensure their goals are representative of the aspirations of the people of the Hawkesbury. The LGA would be held accountable with ongoing feedback, reporting and community feedback. These objectives will be the drive to decision making for Council to make on behalf of the community to develop detailed strategies and plans for delivery of projects and services.

The 4 objectives listed within the Community Strategic Plan are:

- Great Place to live
- Protected environment and valued history
- Strong economy
- Reliable council.

Considerations for the proposal

- Retain as much as possible of the existing tree canopy on site
- Proposed replacement tree planting to off-set existing trees removed

2 Existing environment

2.11 Bushfire prone land

According to Penrith City Council, Resilient Penrith Action Plan 2021–2030:

• 2619 households are located within a high-medium bushfire risk area.

Figure 2-7 illustrates the existing vegetation within the study area as classified into the following categories based on vegetation types and potential risk:

Vegetation Category 1

This category is considered to be the highest risk for bush fire. It is represented as red on the bush fire prone land map and should be given a 100m buffer. This vegetation category has the highest combustibility and likelihood of forming fully developed fires including heavy ember production.

Vegetation Category 2

This category is considered to be a lower bush fire risk and should be given a 30 metre buffer. This vegetation category has lower combustibility and/or limited potential fire size compared to Category 1 due to the vegetation area shape and size, land geography and management practices.

Vegetation Buffer

Once areas of vegetation have been defined and the appropriate bush fire vegetation categories have been applied, it would be necessary to apply the buffering criteria.

The method for the determination of bush fire vegetation buffering is as follows:

- BFPV Category 1 – apply a 100 metre external buffer to each vegetation polygon
- BFPV Category 2 – apply a 30 metre external buffer to each vegetation polygon.

Considerations for the proposal

- Plant species selection to include fire resistant and fire retardant plants where possible
- Observe guidelines for the set out of plants to ensure both the vertical and horizontal separation is maintainable
- The separation between canopy and shrub clusters would to be retained so as to reduce the potential for fire to spread.
- Maintain the required maintenance access to bushfire prone land within the study area
- Create necessary breaks in the continuity of vegetation and ensure buffer areas are maintained to prevent a potential link between existing bushfire prone land (BFPL) areas.

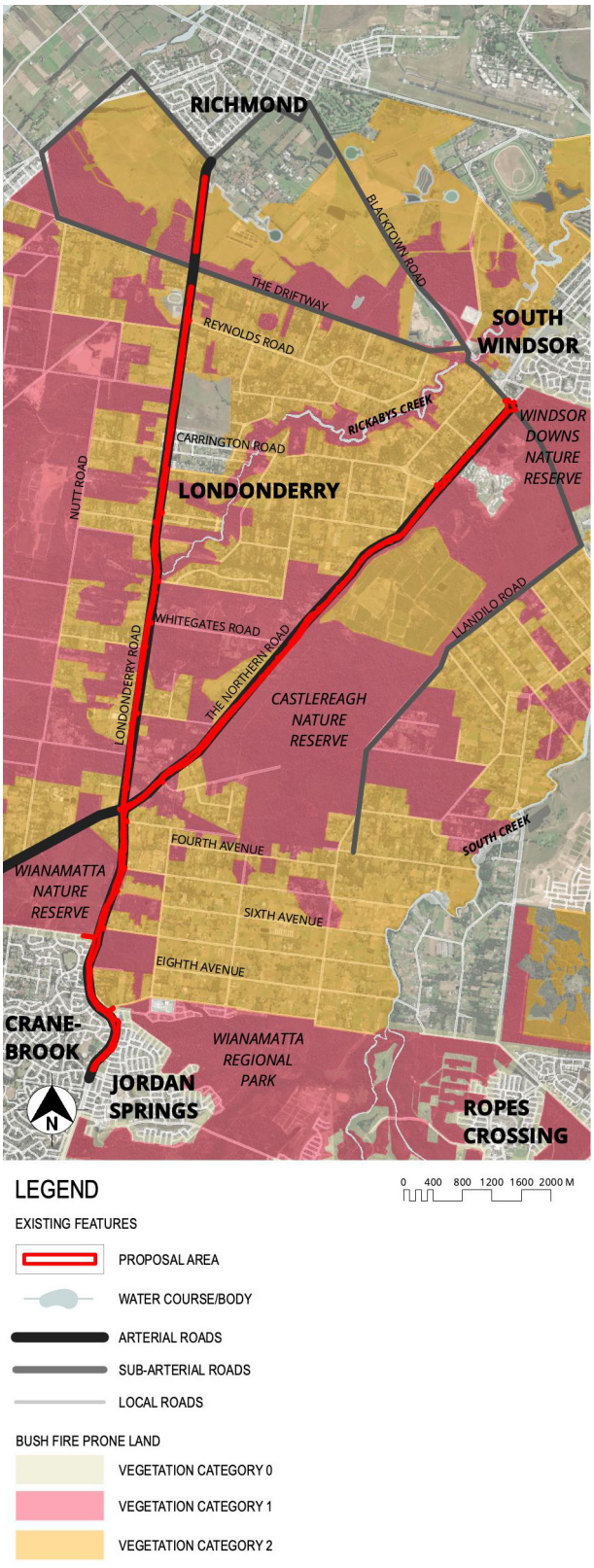


Figure 2-7: Bushfire prone land diagram

Londonderry Road

3 Urban design strategy

3.1 Chapter overview

This chapter presents the urban design strategy for the proposal, which is based on a review of the proposal in terms of overarching urban design principles and considerations.

Reference has been made to state relevant guideline documents, supplemented by contextual analysis in Section 2 on page 7 and complemented by the experience of travelling along the proposal roads of Londonderry Road and The Northern Road.

Plate 3-1: Urban design guideline documents, Transport

3 Urban design strategy

3.2 Proposal specific urban design objectives and principles

In order to ensure that both corridor wide and state wide expectations for the HNV State Roads Proposal are met, a set of proposal specific urban design objectives and principles have been adapted from guideline documents, including Transport's *Beyond the Pavement*.

These objectives and principles are listed below in Table 3-1, and are based on an understanding of the unique existing landscape and urban values of the study area and the issues that affect, or are affected by, the proposal. These objectives and principles, alongside the opportunities and constraints, would continue to guide the ongoing development of the proposal in future stages and would be used in conjunction with the other safeguarding and mitigation measures featured on page 80.

Objectives	Principles
1. Fitting with the built fabric	1.1 Limit the extension of the road footprint, through small locally steep embankments 1.2 Consider the interface with adjoining land uses when formulating design proposals 1.3 Limit new signage to assimilate within the framework of existing signage 1.4 Limit road width extension through the retention of existing road structure 1.5 Consider accessibility for existing isolated properties with private driveways intersecting evacuation shoulders or arterial roads.
2. Fitting with the landform	2.1 Integrate road design landform modifications such as embankments and swales through planting and land grading 2.2 Reduce the impact on existing vegetation through replacement planting and making good areas disturbed by the construction footprint 2.3 Restore road edge conditions nearby to nature reserves and bushland 2.4 Select appropriate replacement vegetation species to restore remnant vegetation communities 2.5 Use tree planting to help reduce the visual bulk of the road extension, embankments and swales 2.6 Avoid disturbing existing topography where necessary to reduce restoration required.
3. Contributing to green infrastructure and responding to natural systems	3.1 Minimise the extent of trees to be removed and carry out replacement tree planting to enhance and strengthen green corridors 3.2 Use endemic species to strengthen stands of existing vegetation 3.3 Coordinate stormwater run-off through swales, allowing potential filtration prior to entering surrounding soils 3.4 Provide planting to swales to increase blue-green infrastructure and biodiversity 3.5 Carry out replacement tree planting to offset trees and reduce the UHI effect 3.6 Link existing planting to provide green corridors surrounding urban environments.

Table 3-1: Objectives and Principles

3 Urban design strategy

3.3 Opportunities and constraints

Figure 3-1 on page 21 and Figure 3-2 on page 22 illustrate the potential opportunities and constraints across the study area, identified throughout the concept phase of the proposal and incorporated into the development of the urban design concept. These would continue to guide the detailed design of the proposal.

The opportunities are:

01 Preserve and strengthen existing remnant roadside tree stands

02 Re-instate roadside fringes of important existing nature reserve areas

03 Maintain clear sight lines to long range vistas

04 Replacement tree planting to off-set trees removed and reduce the heat island effect

05 Introduce robust planting mixes between the residential areas and the road corridor to provide visual separation and screening

06 Planting of embankments and swales to reduce the visual impact of the proposal

07 Planting of swales with endemic species to reinforce and increase blue-green corridors

08 Establish a succinct signage strategy for emergency evacuation

09 Improved drainage and increased road levels to reduce the incidence of flooding and damage to existing ecosystems

10 Use of native endemic plant species to support local ecology and biodiversity.

Constraints as follows:

01 Proposed shoulder widening (currently 20km length of road being widened)

02 Heritage items/ curtilage areas

03 Adjacent environmentally sensitive land including nature reserves

04 Utility restrictions to tree planting

05 Clear zone restrictions to tree planting.

Note - For further guidance for design development refer to the mitigation measures outlined in Section 8 on page 79 of this report.

3 Urban design strategy - opportunities and constraints

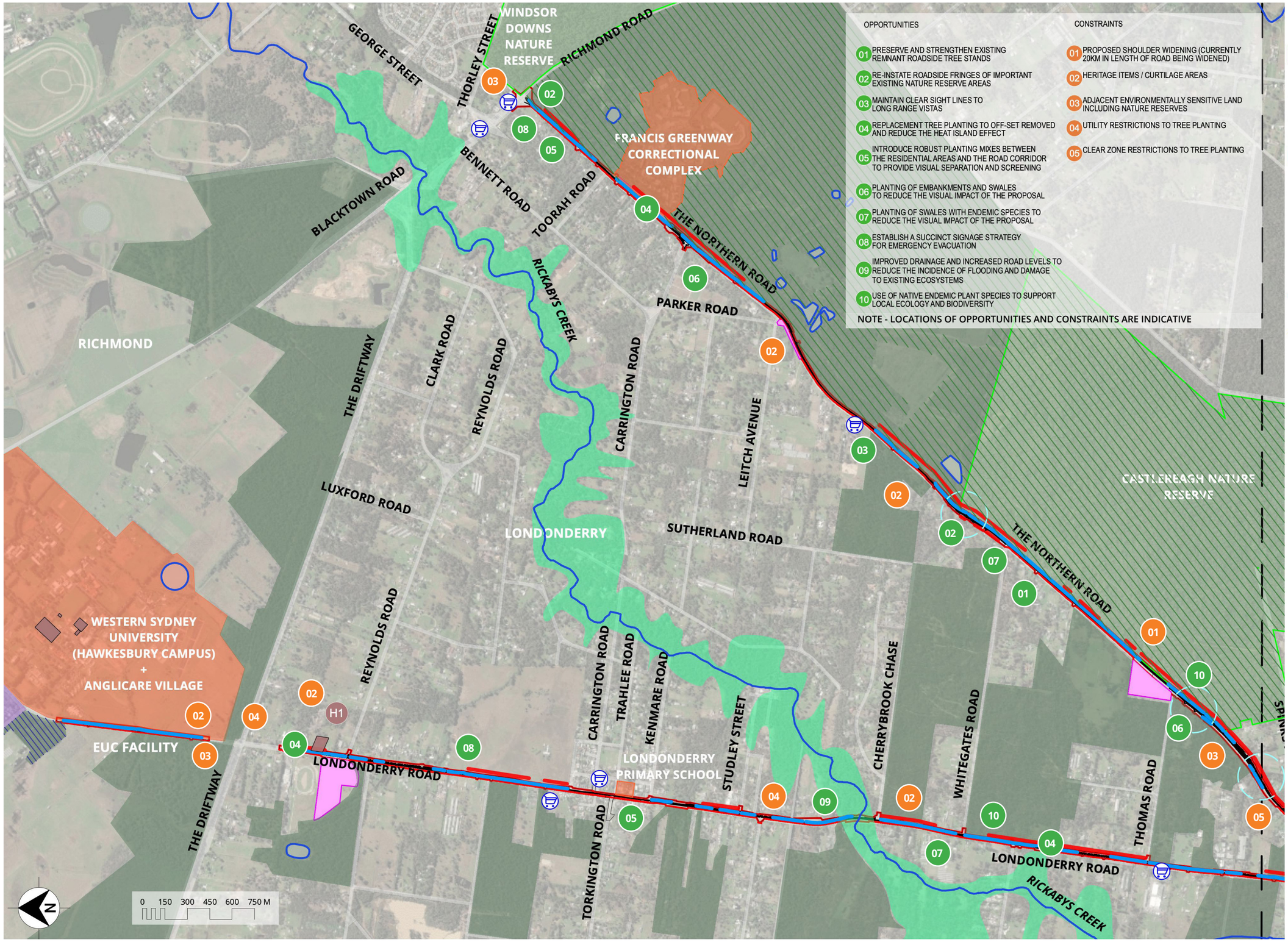


Figure 3-1: Opportunities and constraints sheet 1

3 Urban design vision - opportunities and constraints

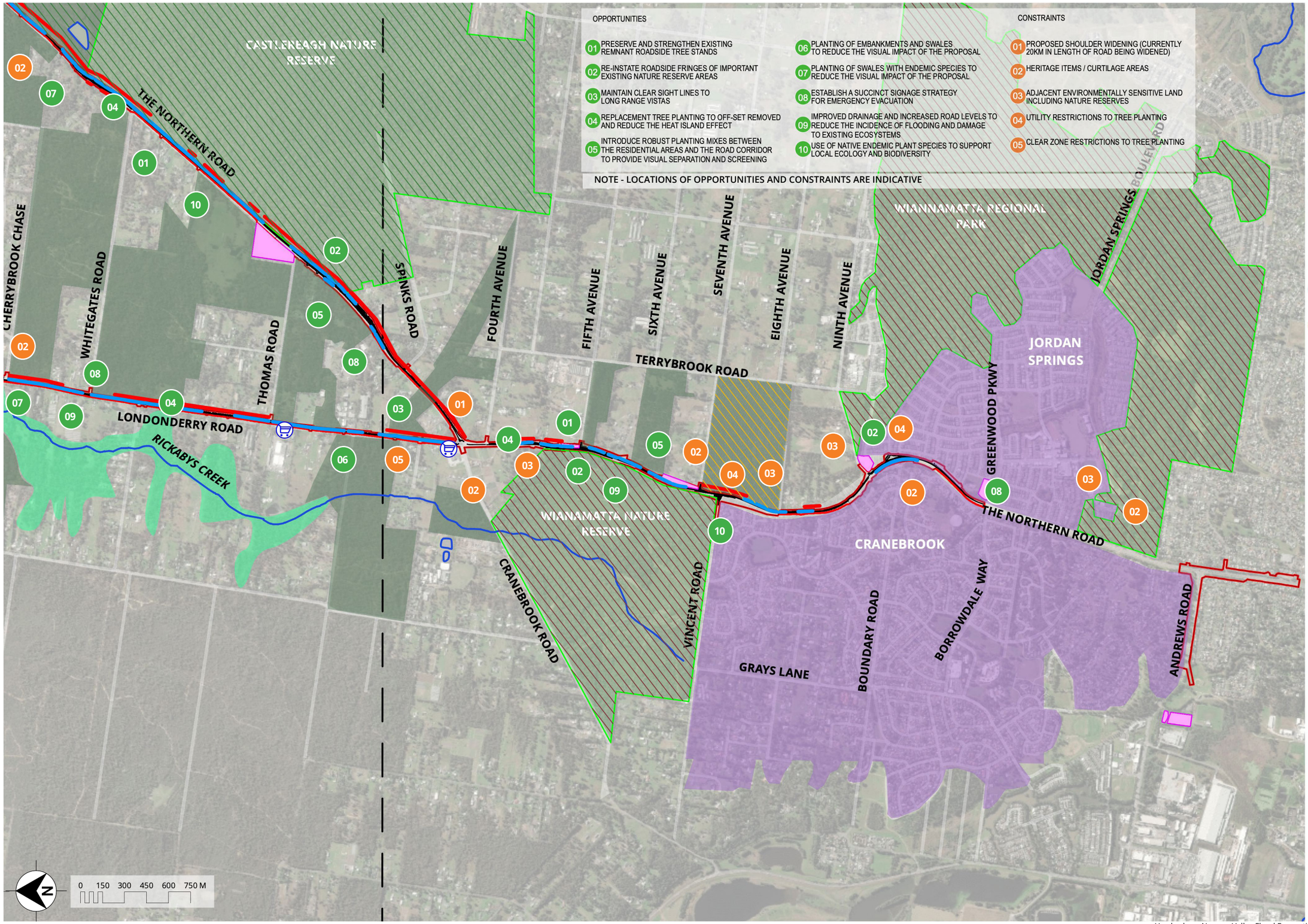


Figure 3-2: Opportunities and constraints sheet 2

4 Urban design concept

4.1 Chapter overview

This chapter describes the design approach that is reflected in the urban design concept for the proposal.

Designed elements that were considered include:

- Drainage and water quality
- Road furniture
- Landscape treatments.

Drainage and water quality

Culverts

The HNV State Roads proposal comprises a large number of proposed culverts. Appropriate scour protection would be provided to structures where increased velocities have the potential to cause scour.

- The approach to Water Sensitive Urban Design (WSUD) features would be informed by Transport guidelines
- There would be no proposed replacement tree planting at culvert outlets or close to culvert structures.

Road furniture

Kerbside bus stops

The 80% concept design drawings indicate where existing bus stop locations potentially require relocation. These proposals would be refined and developed in more detail at the detailed design stage of the proposal.

Safety barriers

W- beam crash safety barriers would be installed where batters are steeper than 4H:1V or a at culvert crossings against headwalls.

- Where possible, dense shrub vegetation would be implemented to at least one side of barriers to soften the visual appearance.

Signage

A signage strategy would be provided for the proposal, for the use of the Evacuation shoulder in times of flood emergency only.

- An integrated engineering and urban design approach should reduce the reliance on separate signage structures and minimize visual clutter and obstructions.

Lighting

Street lighting would be relocated where existing lighting is impacted by the proposal.

Landscape treatments

The proposed landscape treatment is best illustrated by indicative urban design typical road sections. Refer to Figure 4-1 on page 28 to Figure 4-3 on page 30.

Fundamentally, the landscape treatment is designed to mitigate the visual impacts of the proposal, through the following:

- Replacement tree planting for trees removed
  - These are proposed in short broken stands set back from the road (refer Clear Zones) beyond any proposed swales
  - The proposed trees would reinforce the edges of stands of mature trees removed and help to re-instate isolated trees removed
  - Tree planting is aimed to be a compensatory measure, whilst also contributing to reducing the UHI effect
- Planting of swales and embankments
- Turfing verges next to the newly constructed evacuation shoulder
- Making good existing landscape areas that are disturbed during construction works or by ancillary facilities.

3D viewpoint montages are shown in Section 7 on page 49. These 3D viewpoint montages are produced as part of the Visual Impact assessment and help to illustrate the impact of the proposal elements, before mitigation with landscape treatments and tree planting. These elements include:

- Proposed southbound carriageway width extension to accommodate an evacuation shoulder
- New and upgraded culverts
- Proposed swales and embankments.

The associated individual viewpoint location plans for each 3D viewpoint, provide a snapshot of the urban design proposals in plan view. These plan extracts illustrate the overlay of landscape proposals to the civil design elements.

4 Urban design concept

Replacement Tree Planting

A desktop study was carried out to provisionally determine the number of trees to be removed, this was supplemented by the provision of some additional tree survey information.

Any changes in ground levels to the base of existing trees, as a result of the construction of swales or embankments, would necessitate the removal of existing trees.

This combined assessment shows that a large number of existing trees would potentially be removed on both Londonderry Road and The Northern Road.

The urban design concept documentation proposes replacement planting where possible at or close to the locations of tree removal. There are a number of areas however, where utilities present a restriction to replacement tree planting.

The concept design typically proposes tree planting to be in short broken stands, to better integrate with the layout of existing vegetation.

It is considered important to replace isolated existing trees removed as part of the proposal, since if they are lost, there is no shade or visual screening protection for isolated properties.

Ideally these replacement trees are installed at a size of 45-75L, although 25L trees may be acceptable, given that they are likely to be fast establishing native trees species and given the large number of proposed trees proposed.

Planting of more mature tree sizes would have the following benefits:

- Better likelihood of survival given their root & leaf development and stability
- Less maintenance required in the form of staking, pruning and establishment
- More immediate benefits of reducing the UHI effects
- Reduced visual impact of tree removal where replacement trees are of a reasonable size.

Tree species are typically proposed as large native trees. Refer to Table 4-1 on page 26 to Table 4-6 on page 27.

Clear zones

Clear zone restrictions to tree planting are illustrated on urban design typical road sections. Refer to Figure 4-1 on page 28 to Figure 4-3 on page 30. A 'tree planting clear zone' refers to the area where new tree planting is not to be carried out, since the presence of a mature tree may provide a potential hazard to vehicles that leave the carriageway, in the event of an accident.

For the proposal, this excluded area (Clear Zone) is measured from the edge of the existing travel lane (marked by the carriageway line marking and does not include the existing hard shoulder). The evacuation shoulder, next to the existing southbound carriageway is only to be used by vehicles in the event of emergency evacuation, at which time the travel speed would be reduced from the normal road speed.

For the proposal, the majority of existing road is without road kerbs, which would otherwise reduce the tree planting clear zone extent.

Where road barriers, typically 'W beam', are installed as part of the proposal, the excluded area for tree planting is substantially reduced, due to the presence of the barrier. A maximum exclusion distance to tree planting has been illustrated as the 'tree planting Deflection Zone', although in practice a minimum distance of 1.7m could apply.

At the detailed design stage, these exclusion distances for tree planting for both Clear Zones and Deflection Zones would be reviewed in more detail.

In these tree planting exclusion zones, 'frangible' tree and shrub mixes may be used. A frangible tree of shrub refers to one with a thin trunk or multiple thin stems, which should bend or snap upon impact, causing limited damage in the event of a vehicle leaving the carriageway. Refer to Table 4-6 on page 27.

Embankment & Swale planting

It is proposed to plant new embankments under the proposal. These embankments are typically low and it is proposed that this planting would largely comprise native grasses and groundcover planting, with some small shrubs.

- Fill embankments of 4H:1V are typically proposed and would be planted into a soil layer with mulch at the surface, for planting-
- Fill embankments of 2H:1V are proposed in areas where the road level increase is substantial. These embankments are also proposed to have a soil layer with mulch at the surface, for planting.

4 Urban design concept

WSUD planting

Planted swales would:

- Support the local ecology and biodiversity and contribute to the maintenance of existing natural hydrological processes
- Planting would enhance biodiversity through developing habitat corridors and linkages to creek systems.
  - Typically, 'no mow' grass species are proposed at the base of swales and to sides of swales next to the road, as a continuation of the turf verge, with native grasses proposed to outer slopes away from the road. This treatment would be developed to be more site specific at the detailed design stage of the proposal.

Make Good landscape works

The area between planted swales and embankments and the limit of disturbed works is proposed to be 'made good', to re-instate and reinforce the existing landscape.

Typically the 'make good' landscape works would involve new turfing, with species to match existing, depending on the scale of the area, grass seeding measures may be employed.

Lay down/site compound areas

- Planting would aim to reinstate and reinforce the existing environment prior to use during the construction of the upgrade, similar to the 'make good' areas.

Plant species

Species selection is to be in accordance with the following:

- Transport Landscape Design Guideline
- Identified existing vegetation plant communities
- Proposed plant type lists.

Typically, species would include low maintenance and drought tolerant plants in order to reduce maintenance requirements. The species and their location and function are outlined in Table 4-1 on page 26 to Table 4-6 on page 27.

The design approach for planting is:

- Use of largely native plant species to reinforce the endemic plant communities of the area
- Carry out replacement tree planting to off-set trees removed under the proposal, using species to match existing.

There may be isolated areas approaching intersections or next to existing residential developments where the proposed landscape may include some feature tree or shrub species for visual or screening purposes, however the aim of the landscape proposals is for re-instatement and reinforcement of the existing landscape. The plant species nominated in Section 4.2 on page 26 are recommendations only. These species are to be reviewed at the Detailed Design stage with Transport and local councils. The final choice of plant species for the proposal would be subject to the availability of plant stock at the time of construction.

4 Urban design concept

4.2 Plant species

Table 4-1: TM1 Native trees

Native tree planting would be used in stands along edge of road. Species have been selected that are commonly found within Castlereagh Scribbly Gum Woodland or Cumberland Plain Woodland vegetation communities.

Plant Species	Common Name	Height	Spread
Angophora bakeri	Narrow-leaved Apple	10m	6m
Eucalyptus crebra	Narrow-Leaf Ironbark	35m	15m
Eucalyptus fibrosa	Red Ironbark	35m	10m
Eucalyptus longifolia	Woollybutt	35m	15m
Eucalyptus moluccana	Grey Box	25m	10m
Melaleuca decora	White Feather Honeymyrtle	7m	8m

Angophora bakeri

Eucalyptus crebra

Eucalyptus fibrosa

Eucalyptus longifolia

Eucalyptus moluccana

Melaleuca decora

Table 4-2: TM2 Frangible tree mix

A frangible tree mix would be used where clear zones restrict larger trees or to small batter embankments for proposed smaller sized trees

Plant Species	Common Name	Height	Spread
Backhousia myrtifolia	White Cedar	3m	4m
Bursaria spinosa	Sweet Bursaria	4m	3m
Callistemon salignus	Willow Bottlebrush	10m	5m
Melaleuca nodosa	Prickly-leaved Paperbark	9m	2.5m
Melaleuca styphelioides	Prickly Paper Bark	7m	3m
Syzygium australe	Tucker Bush Cherry	5m	2m

Backhousia myrtifolia

Bursaria spinosa

Callistemon salignus

Melaleuca nodosa

Melaleuca stypheloides

Syzgium australe

Table 4-3: PM1 Frangible screening shrubs

A frangible screening shrub tree mix would be used where clear zones restrict trees or to small batter embankments for proposed smaller sized trees

Plant Species	Common Name	Height	Spread
Banksia spinulosa	Hairpin Banksia	3m	3m
Breynia oblongifolia	Coffee Bush	3m	2m
Hakea dactyloides	Broad-leaved Hakea	4m	1.5m
Hakea sericea	Silky Hakea	3m	4m
Leptosporum squarrosum	Peach Blossom Tea-tree	4m	1m
Ozothamnus diosmifolius	Rice Flower	2m	1.2m

Banksia spinulosa

Breynia oblongifolia

Hakea dactyloides

Hakea sericea

Leptosporum squarrosum

Ozothamnus diosmifolius

4 Urban design concept

Table 4-4: PM2 - Native shrubs and groundcovers on embankment

Plant Species	Common Name	Height	Spread
Carex appressa	Tall Sedge	1m	1m
Dianella revoluta	Blue Flax-lily	1m	1.5m
Hibbertia scandens	Guinea Flower	0.3m	2m
Lomandra hystrix 'Katie Belles'	Mat Rush	1.8m	1.5m
Ozothamnus diosmifolius	Rice Flower	2m	1.2m
Stylidium graminifolium	Trigger Plant	0.5m	0.3m


Carex appressa


Dianella revoluta


Hibbertia scadens


Lomandra hystrix 'K.B'


Ozothamnus diosmifolius


Stylidium graminfolium

Table 4-5: PM3 - Native grasses in verges

Plant Species	Common Name	Height	Spread
Dianella caerulea 'Breeze'	Blue Flax-lily	0.7m	0.7m
Dianella revoluta	Native Flax	1m	1.5m
Ficinia nodosa	Knobby Club-rush	1m	0.8m
Lomandra longifolia 'Tanika'	Mat-rush	0.6m	0.6m
Lomandra multiflora	Many-flowered Mat-rush	0.9m	0.5m
Themeda australis	Kangaroo Grass	1.5m	0.5m


Dianella caerulea


Dianella revoluta


Ficinia nodosa


Lomandra longifolia


Lomandra multiflora


Themada australis

Table 4-6: PM4 - Native shrubs, grasses and sedges in swales

Plant Species	Common Name	Height	Spread
Carex appressa	Tall Sedge	1m	1m
Dianella longifolia	Pale Flax lily	1.2m	0.6m
Juncus usitatus	Common Rush	1.2m	0.5m
Kunzea ambigua	Tickbush	5m	3m
Melaleuca nodosa	Prickly-leaved Paperbark	10m	4m
Philydrum lanuginosum	Frogsmouth	1.8m	1m

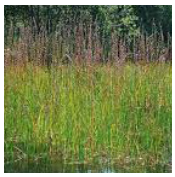

Carex appressa


Dianella longifolia


Juncus usitatus

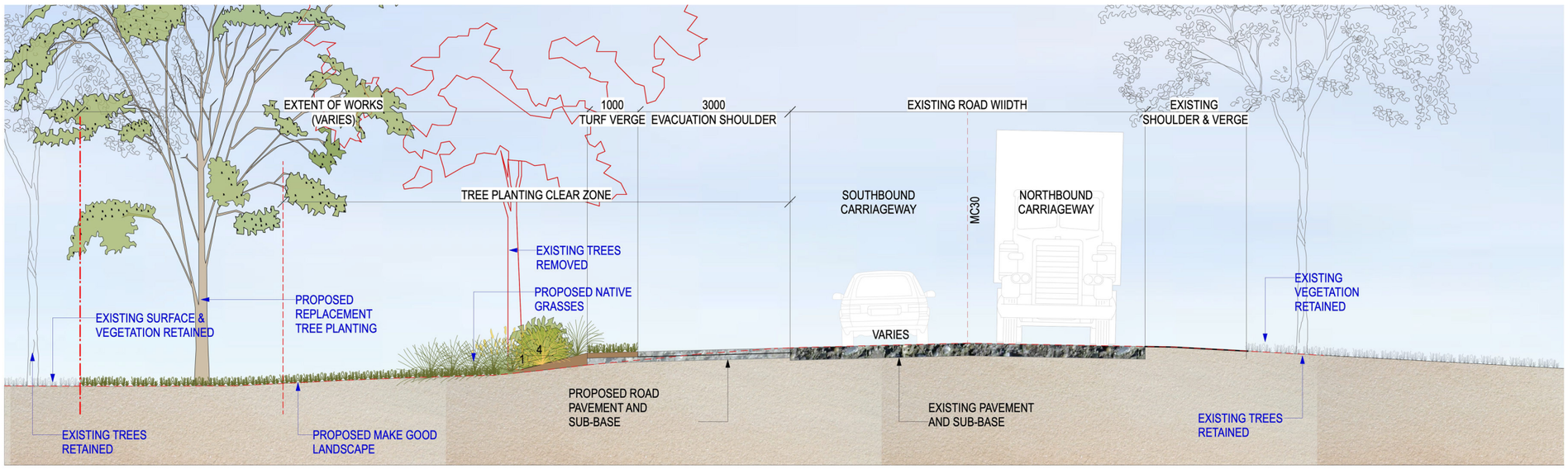

Kunzea ambigua


Melaleuca nodosa


Philydrum lanuginosum

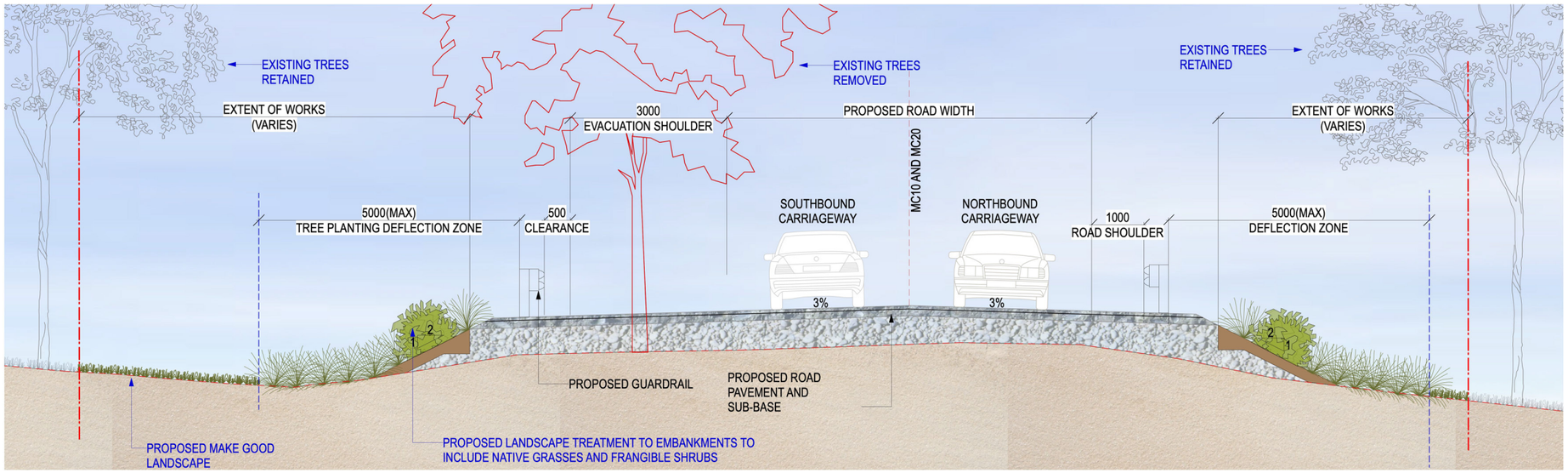
4 Urban design concept

4.3 Typical sections sheet 1



01 THE NORTHERN ROAD - RICHMOND ROAD TO GREENWOOD PARKWAY (FILL)
TYPICAL CROSS SECTION - SCALE 1:50

0 1 2 3 4 5 M



02 THE NORTHERN ROAD - ROAD RAISING
TYPICAL CROSS SECTION - SCALE 1:50

0 1 2 3 4 5 M

NOTES:

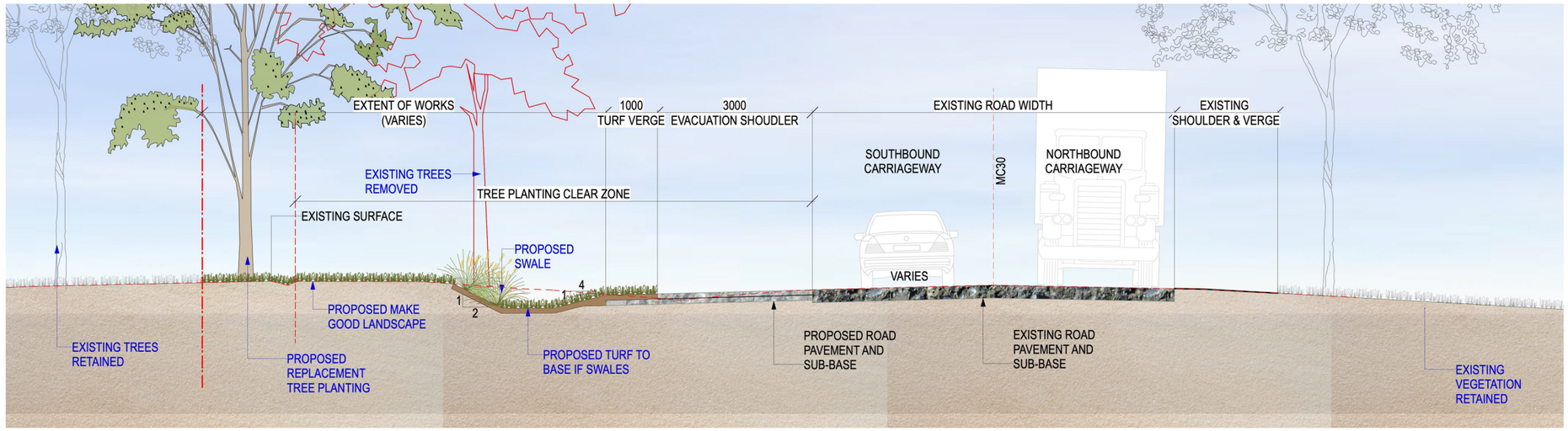
1 ALL SECTIONS ARE INDICATIVE ONLY, NOTABLY FOR EXISTING VEGETATION AND EXTENT OF WORKS AND ARE BASED ON TYPICAL ENGINEERING SECTIONS

2 CLEAR ZONE FOR ANY PROPOSED TREE PLANTING ADJACENT TO CARRIAGEWAYS IS MEASURED FROM EDGE OF EXISTING LINE MARKED CARIAGEWAY

Figure 4-1: Urban design typical sections sheet 1

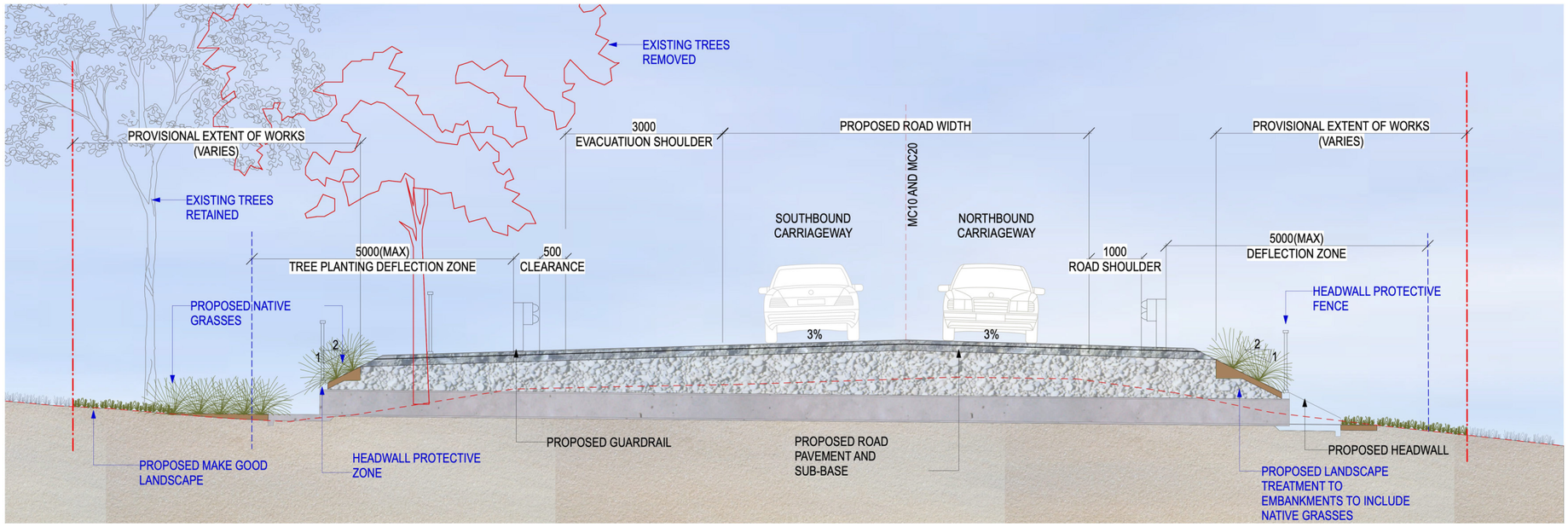
4 Urban design concept

4.4 Typical sections sheet 2



03 THE NORTHERN ROAD - RICHMOND ROAD TO GREENWOOD PARKWAY (CUT)
TYPICAL CROSS SECTION - SCALE 1:50

0 1 2 3 4 5 M



04 THE NORTHERN ROAD - NEW CULVERT UPGRADE
TYPICAL CROSS SECTION - SCALE 1:50

0 1 2 3 4 5 M

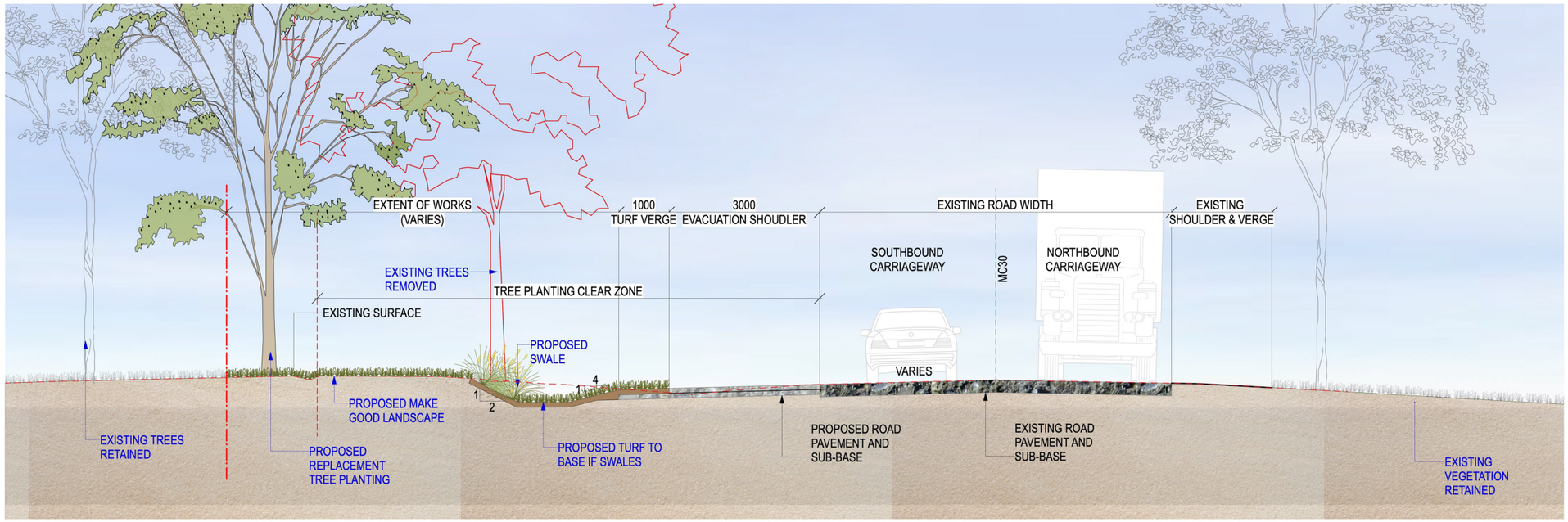
NOTES:

1 ALL SECTIONS ARE INDICATIVE ONLY, NOTABLY FOR EXISTING VEGETATION AND EXTENT OF WORKS AND ARE BASED ON TYPICAL ENGINEERING SECTIONS

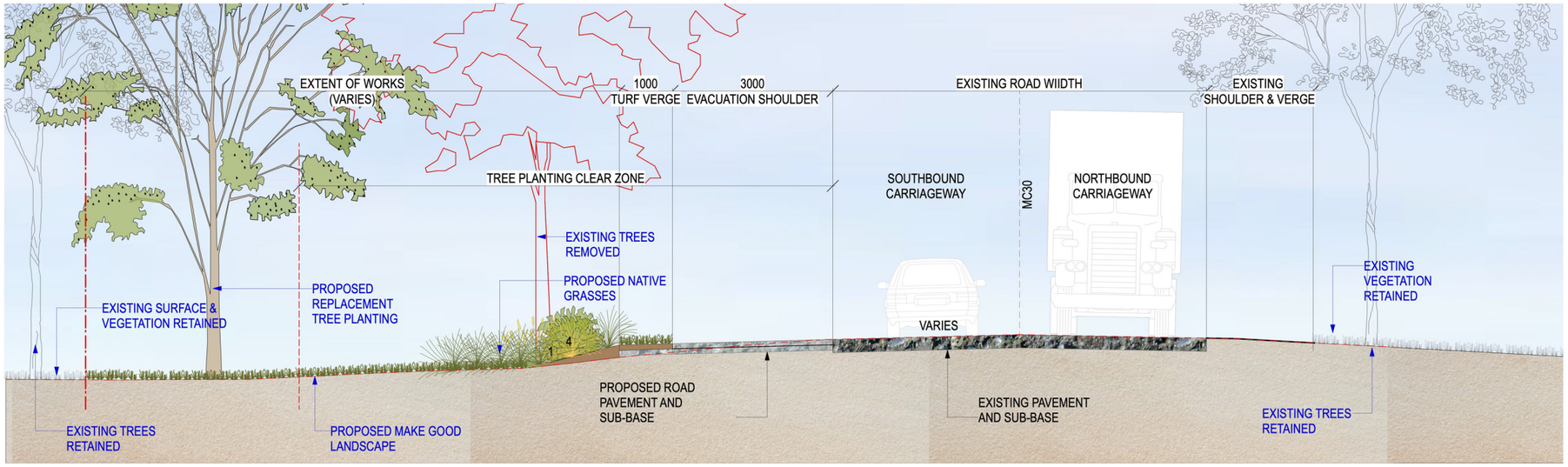
2 CLEAR ZONE FOR ANY PROPOSED TREE PLANTING ADJACENT TO CARRIAGEWAYS IS MEASURED FROM EDGE OF EXISTING LINE MARKED CARIAGEWAY

Figure 4-2: Urban design typical sections sheet 2

4.5 Typical sections sheet 3



05 LONDONDERRY ROAD - VINES DRIVE TO CRANEBROOK ROAD (CUT)
TYPICAL CROSS SECTION - SCALE 1:50 0 1 2 3 4 5 M



06 LONDONDERRY ROAD - VINES DRIVE TO CRANEBROOK ROAD
TYPICAL CROSS SECTION - SCALE 1:50 0 1 2 3 4 5 M

NOTES:

1 ALL SECTIONS ARE INDICATIVE ONLY, NOTABLY FOR EXISTING VEGETATION AND EXTENT OF WORKS AND ARE BASED ON TYPICAL ENGINEERING SECTIONS

2 CLEAR ZONE FOR ANY PROPOSED TREE PLANTING ADJACENT TO CARRIAGEWAYS IS MEASURED FROM EDGE OF EXISTING LINE MARKED CARIAGEWAY

Figure 4-3: Urban design typical sections sheet 3

The Northern Road, near Jordan Springs

5 Landscape character impact assessment

5.1 Chapter overview

To enable the assessment of impacts from the proposal on the surrounding landscape, the study area has been classified into distinct character areas or landscape character zones (LCZ). These zones are defined as having a distinct, recognisable and consistent pattern of elements, be it natural (soil, vegetation, landform) and/ or human built form, distinguishing one zone as different from another.

5.2 Methodology

Transport guidelines for landscape character and visual impact assessment, *Environmental impact assessment practice note EIA-N04* provides the following definition of landscape character:

Landscape character is the aggregate of built, natural and cultural aspects that make up an area and provide its unique sense of place. Landscape in this context is taken to include all aspects of a tract of land - the built, planted and natural topographical and ecological features.

In applying this definition to the specific conditions within the study area and the features of the proposal, the landscape character assessment also considers how the Proposal would be used and how it would function as a part of the region. The assessment has considered both existing landscape character and desired future character (where relevant).

Landscape character zones

To enable the assessment of impacts on the landscape character of each assessment zone, landscape elements including landform, hydrology, vegetation, land use and built form were identified during site visits.

Two primary factors are used to determine impacts:

- **Sensitivity** of the character within the zone
- **Magnitude** of the proposal in that zone.

Sensitivity

The degree to which a particular landscape type can absorb and accommodate change arising from a proposal. Sensitivity refers to how sensitive the character of the setting is to the proposed change, which may also include the sensitivity of regular users and viewers of the zone. For example a pristine natural environment would be more likely to be sensitive to change than an industrial area.

It considers the perceived cultural, natural and heritage values of the visual environment and the elements within it.

Magnitude

Magnitude is a study of the bulk scale and form. It reflects the degree of physical change between the proposal and the landscape setting. In the case where future development is already approved, for example rezoning, this context is used in the assessment. Consideration is given to existing built form in the landscape and how closely the proposal matches this in bulk, scale and form. This is categorised as follows:

- The proposal would be the dominant feature in the landscape and would affect and change its character
- The proposal would form a readily visible and new feature in the landscape that changes its character
- The proposal would constitute a minor feature in the landscape with minor changes.

Refer to Figure 5-1 on page 34 and Figure 5-2 on page 35 for landscape character zone identification.

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Table 5-1: Landscape character impact rating matrix (Source: Transport EIA-N04)

5 Landscape character impact assessment

5.3 Landscape character zones

Five landscape use zones based on land use were identified during desktop studies and confirmed following a site visit, these are shown below and referenced in Figure 5-1 on page 34 and Figure 5-2 on page 35:

1. Peri-urban (and residential estates)
2. Mixed commercial / agriculture
3. Existing road corridor
4. Recreation and open space
5. Institutional facilities

Plate 5-1: Peri-urban residential

Plate 5-2: Mixed commercial

Plate 5-3: Existing road corridor

Plate 5-4: Recreation and open space

Plate 5-5: Institutional facilities

The relative mixes of these land use zones have been used to inform the landscape character zones (LCZs). Three broad LCZs have been identified across the proposal:

- LCZ1 - The Northern Road from Richmond Road to Spinks Road and Fifth Avenue to Eighth Avenue
  - Characterised by nature reserves and rural residential, with some mixed commercial
- LCZ2 - Londonderry Road from The Driftway to Cranebrook Road and The Northern Road, from Spinks Road to Fifth Avenue
  - Characterised by rural residential and open space
- LCZ3 - The Northern Road from Eighth Avenue to Andrews Road
  - Characterised by medium density residential.

The three LCZs are illustrated in Figure 5-1 on page 34 and Figure 5-2 on page 35.

5 Landscape character impact assessment - landscape character zones

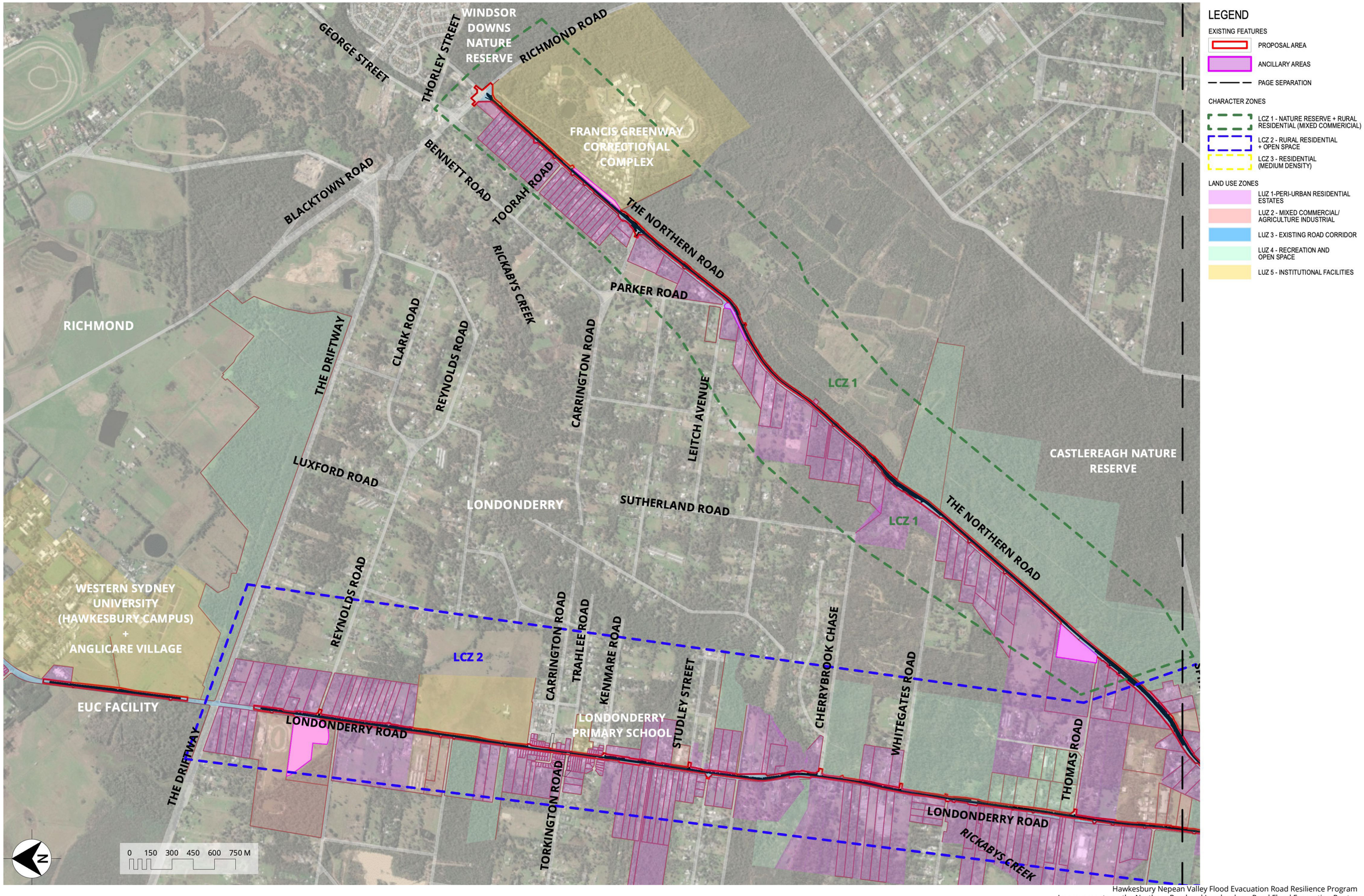


Figure 5-1: Landscape character zones sheet 1

5 Landscape character impact assessment - landscape character zones

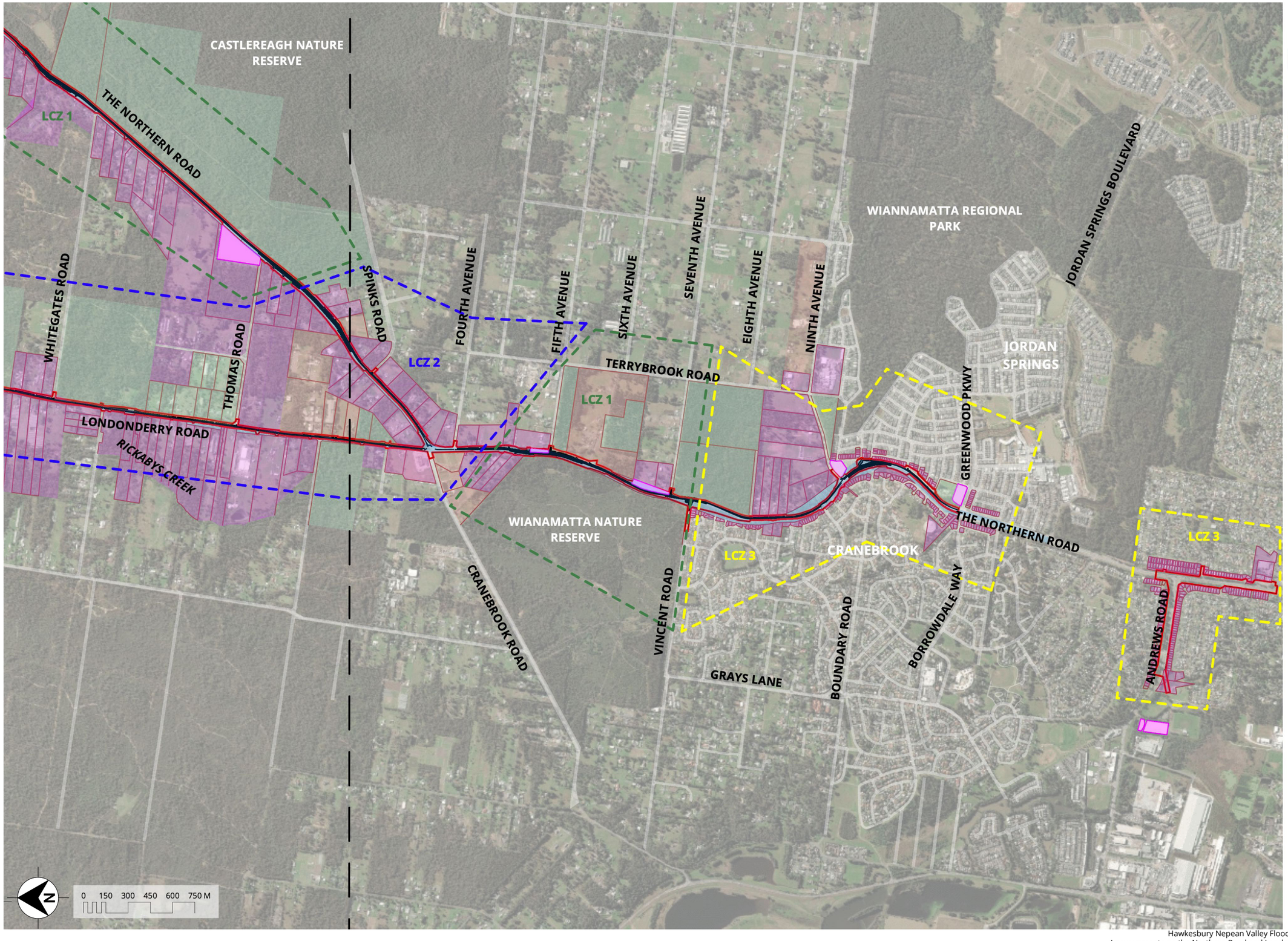


Figure 5-2: Landscape character zones sheet 2

5 Landscape character impact assessment

LCZ		Summary of landscape setting	Proposal elements causing change
1	The Northern Road from Richmond Road to Spinks Road and Fifth Avenue to Eighth Avenue	This zone is characterised by nature reserves and bushland open space to the eastern side on The Northern Road and rural residential / peri-urban residential lots to the western side of the road. The Francis Greenway Correctional Complex is located at the northern portion of this LCZ and forms the only large scale development within this LCZ. Although the centre has a frontage to The Northern Road, is separated from the road by both tree planting within the centre boundary and also native bushland tree planting alongside The Northern Road. Whilst there is a commercial / industrial building between Fifth and Eight Avenue, this is set back from the road and does not affect the overall character. The landscape setting of this LCZ is of a rural nature. Existing residential lots to the western side of the road are characterised by isolated mature trees. The eastern side of the road has a dominant bushland and nature reserve setting.	The proposal would include: • An extension to the southbound carriageway width to accommodate an evacuation shoulder, with associated embankments constructed to tie into the existing ground level. There would be an area of disturbed landscape between the constructed earthworks and the acquisition boundary that would be 'made good' • At certain locations, the existing road level would be raised and culverts installed or upgraded • An extensive system of swales would be constructed next to the southbound road carriageway to improve the drainage • As a result of the construction works, particularly the construction of swales, existing trees nearby to the road corridor would be removed.
2	Londonderry Road from the Driftway to Cranebrook Road and The Northern Road, from Spinks Road to Fifth Avenue	This zone is characterised by a mixture of rural residential / peri-urban lots and bushland open space areas to both sides of Londonderry Road. There are also some isolated commercial facilities. The landscape setting is less rural or undeveloped, compared to LCZ1 on The Northern Road, with residential properties comprising a large percentage of the LCZ and occupying smaller lots, increasing the density of the residential areas. The open space bushland areas are less extensive compared to LCZ1 and are also isolated by the residential or commercial developments.	The proposal would include: • An extension to the southbound carriageway width to accommodate an evacuation shoulder, with associated embankments constructed to tie into the existing ground level. There would be an area of disturbed landscape between the constructed earthworks and the acquisition boundary that would be 'made good' • At certain locations, existing culverts would be installed or upgraded • A number of swales would be constructed next to the southbound road carriageway to improve drainage • As a result of the construction works, a number of existing trees nearby to the road corridor would be removed.
3	The Northern Road from Eighth Avenue to Andrews Road	This zone is characterised by the extensive medium density residential developments of Cranebrook and Jordan Springs. The landscape setting is of a more urban character compared to LCZ1 or LCZ2. There are some isolated mature trees within the residential streets, however most mature trees are retained along the edges of The Northern Road road corridor.	The proposal would include: • An extension to the southbound carriageway width to accommodate an evacuation shoulder, with associated embankments constructed to tie into the existing ground level. There would most notably be a system of swales constructed alongside the southbound carriageway to improve drainage • Disturbed landscape between the constructed earthworks and the acquisition boundary would be 'made good'. This would be applicable up to Greenwood Parkway • Between Greenwood Parkway and Andrews Road, on The Northern Road, and south of Andrews Road up to Boomerang Place, the proposal would involve the construction of underground road drainage. This would involve tree removal, excavation works and making good the disturbed landscape.

Table 5-2: Landscape character zones summary

5 Landscape character impact assessment

LCZ 1:

Existing landscape character

This zone comprises nature reserve and bushland open space areas nearby the southbound carriageway and mix of peri-urban / rural residential properties nearby the northbound carriageway. This zone includes The Northern Road, between Richmond Road and Spinks Road and also between Fifth and Eighth Avenues.

The bushland open space areas are typically set back from the existing carriageway with informal turf verges, the nature reserve areas are typically set closer to the existing road carriageway, but also with informal turf verges. The tree canopy is comprised of mature native trees to both.

The residential lots vary in road frontage width, with the scale of the dwellings varying with the lot frontage, from small post war houses to larger, typically 1970's or more recent bungalows and some small scale business developments. Dwellings are predominantly always single storey.

All properties tend to be set back from the existing road carriageway with wide turf verges. Existing mature trees are usually located between the smaller frontage lots and the existing road corridor.

Refer to Plate 5-6 to Plate 5-8 for existing character images.

Landscape character changes

Changes to this landscape setting would be restricted to the existing landscape nearby the southbound carriageway (eastern side of the road). The road width would be extended to accommodate an evacuation shoulder with associated embankments to tie into existing ground levels, resulting in the removal of existing trees.

At some locations the road level would be raised and culverts installed. A network of swales would also be constructed next to the road corridor to improve drainage.

Landscape character impact assessment

The impact of the proposal on the existing landscape character would be to increase the dominance of the road and lessen the rural character of the eastern side of the road.

Typically the proposed embankments would be of low height and extent and would be planted with native grasses. The network of newly proposed swales would be most noticeable in extent and therefore impacting the existing landscape character. Existing mature trees currently located nearby the southbound carriageway would be removed and replaced by planted swales.

The most noticeable character impacts would be the constructed swales and the loss of existing mature trees, although the proposal includes new tree planting to offset this loss.

Whilst the magnitude of character impact is considered moderate, the high sensitivity of this zone to change would result in an overall impact rating of high to moderate.

The impact on landscape character is summarised in Table 5-3.

Plate 5-6: View of LCZ1 - 51 The Northern Road, near Toorah Rd (facing south)

5 Landscape character impact assessment

Plate 5-7: LCZ1 - Eastern side of The Northern Road, view of Castlereagh Nature Reserve

Plate 5-8: LCZ1 - Western side of The Northern Road, view of residential lots

Sensitivity	Magnitude	Impact
High The sensitivity to change is high, based on the proximity of native reserves and bushland areas.	**Moderate** The magnitude of impact would be moderate, based on the removal of existing trees, but also the construction of a system of swales next to the southbound carriageway and the elements of road that would be raised with new or upgraded culverts.	**High-Moderate**
Summary		
The impact on this character zone is considered high to moderate. This is based on the moderate physical impacts to the highly sensitive bushland and nature reserve areas on the eastern side of the The Northern Road.		

Table 5-3: LCZ1 impact rating summary

5 Landscape character impact assessment

LCZ 2:

Existing landscape character

This zone is characterised by a mixture of land uses to both sides of Londonderry Road, between the Driftway and Cranebrook Road and also The Northern Road between Spinks Road and Fifth Avenue.

The land uses are predominantly peri-urban residential, but are interspersed with bushland open spaces areas. There are also some commercial properties. The overall landscape character is less rural than LCZ1, but more rural than LCZ3.

The overall character of this zone is less varied than LCZ1, with properties set back from the road by a wide turf verge, typically with large frontages, estate fencing, and large existing mature native trees within the lots. Dwellings are still single storey, but more expansive and generally constructed post 1970's, compared to LCZ1. There are also however some narrower frontage lots and post war single storey dwellings.

Bushland areas separate these residential lots, with large stands of native mature trees.

Refer to Plate 5-9 to Plate 5-11 for existing character images.

Landscape character changes

Changes to this landscape setting would be restricted to the existing landscape next to the southbound carriageway (eastern side of the road). The road width would be extended to accommodate an evacuation shoulder with associated embankments to tie into existing ground levels. At certain locations, culverts would be installed or upgraded.

Compared to LCZ1 a smaller swales would be constructed next to the southbound road carriageway to improve the drainage. However, the extent of new swales is still considered notable, particularly the northern portion of Londonderry Road. The construction of swales would typically result in a existing mature trees close to the southbound carriageway being removed.

Landscape character impact assessment

The impact of the proposal on the existing landscape character would be to increase the dominance of the road and reduce the number of existing trees, although the proposal includes new tree planting to offset this loss.

Typically the proposed embankments would be of low height and extent and would be planted with native grasses. The network of newly proposed swales would be most noticeable in extent and therefore impacting the existing landscape character. Existing mature trees currently located nearby to the southbound carriageway would be removed and replaced by planted swales.

The most noticeable character impacts would be the constructed swales and the loss of existing mature trees. Both the magnitude of character impact and the sensitivity of this zone to change are considered moderate, resulting in an overall moderate impact rating.

The impact on landscape character is summarised in Table 5-4.

Plate 5-9: View of LCZ2 - 518 Londonderry Road, near Carrington Road (facing south)

5 Landscape character impact assessment

Plate 5-10: LCZ2 - Eastern side of Londonderry Road, view of residential development

Plate 5-11: LCZ2 - Western side of Londonderry Road, view of residential development

Sensitivity	Magnitude	Impact
Moderate	**Moderate**	**Moderate**
The sensitivity to change is considered moderate based on the more modified areas of residential properties.	The magnitude of impact is moderate based on the removal of existing trees and the construction of swales next to the southbound carriageway.	
Summary		
The impact on this character zone is considered moderate. This is based on the moderate physical impacts to the moderately sensitive residential properties and commercial facilities on the eastern side of Londonderry Road.		

Table 5-4: LCZ2 impact rating summary

5 Landscape character impact assessment

LCZ 3:

Existing landscape character

This zone is characterised by medium density residential developments to both sides of The Northern Road, between Eighth Avenue and Andrews Road. There are also some isolated bushland areas and generally wide turf verges with existing mature street trees.

The residential developments are a mix of one or two storey, built between the mid-2000's and present. The Jordan Springs development is nearby to the southbound carriageway and the Cranebrook developments nearby to the northbound carriageway.

The landscape character is the most urban compared to LCZ1 and LCZ2, but the setback of the residential developments, with large turf verges and rear fencing fronting the road does not give the impression of an urban character.

This zone comprises The Northern Road between Eighth Avenue, past Greenway Parkway, to Andrews Road, up to the Andrews Road Baseball Complex.

Refer to Plate 5-12 to Plate 5-14 for existing character images.

Landscape character changes

Changes to this landscape setting would be restricted to the existing landscape next to the southbound carriageway (eastern side of the road) and as a result of the underground drainage works proposed under The Northern Road and south of Andrews Road.

The road width would be extended to accommodate an evacuation shoulder with associated embankments to tie into existing ground levels, resulting in the removal of existing trees. This would be applicable up to Greenwood Parkway. Existing trees would also be removed to allow for the underground drainage works. Where possible, the disturbed landscape would be 'made good'. The SUP alongside Andrews Road would potentially have to be reconstructed and re-aligned due to the installation of the underground drainage works.

At certain locations, culverts would be installed or upgraded. Swales would also be constructed next to the road corridor at certain locations, to improve drainage.

Landscape character impact assessment

The impact of the proposal on the existing landscape character would be to increase the width of the road and perform underground drainage works. However, since this section of road is currently at least 3 lanes wide, compared to the other areas of the proposal where it is on 2 lanes wide, the dominance of the road would probably not be affected.

Any existing mature trees currently located nearby to the southbound carriageway would be removed and replaced by low level embankments and swales where necessary. The most noticeable impact would be the loss of existing mature trees.

The impact on landscape character is summarised in Table 5-5

Plate 5-12: View of LCZ3 - The Northern Road, near Andromeda Drive (facing south)

5 Landscape character impact assessment

Plate 5-13: LCZ3 - Eastern side view of The Northern Road, medium density residential development (near Ninth Avenue)

Plate 5-14: LCZ3 - Western side view of The Northern Road, residential development (near Andromeda Drive)

Sensitivity	Magnitude	Impact
Moderate The sensitivity of this zone is considered moderate, based on the more urban character of this zone.	**Low** The magnitude of impact is considered low, based on the limited size of swales and areas of tree removal.	**Moderate - Low**
Summary		
The impact on this character zone is considered moderate to low. This is based on the low physical impacts to the moderately sensitive residential properties on the eastern side of The Northern Road.		

Table 5-5: LCZ3 Impact rating summary

5 Landscape character impact assessment

5.4 Summary of landscape character impact assessment

The proposal has been identified as having some impacts across all the three landscape character zones and these have been ranked and the cumulative impact on sensitivity and magnitude has been assessed.

Of the three character zones, the highest character impact has been assessed to be on LCZ1, on The Northern Road between Richmond Road and Spinks road (and between Fifth Avenue and Eight Avenue). This zone comprises the highest proportion of road close to natures reserves or native bushland areas, which are highly sensitive to change. In addition, the proposal would have moderate impacts as a result of swale construction next to the road and associated existing tree removal, together with a number of areas of road raising with associated new or upgraded culverts. The overall impact is considered high to moderate.

LCZ2, largely covers Londonderry Road, between The Driftway and Cranebrook Road and a small portion of The Northern Road, between Spinks Road and Fifth Avenue. This zone has a more even distribution of less rural areas to both sides of the road, mainly residential, but also commercial at the northern end of this zone. The sensitivity of this zone is considered moderate and the magnitude of impact would also be moderate, based on swale construction and associated tree removal. The overall impact is therefore considered moderate.

LCZ3 covers the smallest and most urban area of the proposal, comprising The Northern Road, running through the suburbs of Cranebrook and Jordan Springs, and the area around Andrews Road. The sensitivity to change is considered moderate, based on the proximity to residential areas. The magnitude of change is considered low, based on the smaller size of swales required and the limited extent of associated existing tree removal from road widening and underground drainage works. The overall impact is considered moderate to low.

The landscape character assessment is summarised in Table 5-6 below.

Landscape Character Zone	Sensitivity	Magnitude	Impact
1 The Northern Road from Richmond Road to Spinks Road and Fifth Avenue to Eighth Avenue	High	Moderate	**High-Moderate**
2 Londonderry Road from The Driftway to Cranebrook Road and The Northern Road from Spinks Road to Fifth Avenue	Moderate	Moderate	**Moderate**
3 The Northern Road from Eighth Avenue to Andrews Road	Moderate	Low	**Moderate - Low**

Table 5-6: Landscape character impact rating summary

6 Visibility of the proposal

6.1 Chapter overview

This chapter identifies the areas where the proposal would be visible, in order to determine representative viewpoints that cover a range of different land uses and viewers surrounding the proposal.

6.2 Visual envelope

A visual envelope is a theoretical assessment of visibility to or from the proposal. Figure 6-1 on page 45 and Figure 6-2 on page 46 illustrates the visual envelope, which was generated manually during desktop analysis and verified in the field, taking in to account such factors as built structure, intervening vegetation and topography.

Viewpoints for assessment

Table 6-1 lists viewpoints that have been selected to assess potential visual impacts including:

- Publicly accessible locations that are representative of residential properties and businesses
- Heritage items and precincts
- Public domain, including parks, footpaths, shared user paths and lookouts
- Popular destinations and tourist attractions
- Road user views from the existing road.

The locations and directions of selected viewpoints are representative of the range of locations both within and beyond the road corridor and are shown in Figure 6-3 on page 47 and Figure 6-4 on page 48.

This list does not represent the entire number of receptors likely to be visually impacted by the proposal, but rather, represents the range of viewers potentially impacted by some part of the proposal across each LCZ. These viewpoints are assessed further in Section 7.3 on page 75.

VP	Location	LCZ
1	The Northern Road near Livvi's Playground (facing north east)	**LCZ 3**
2	The Northern Road near Ninth Avenue (facing north west)	**LCZ 3**
3	The Northern Road (facing north east) looking towards the Vincent Road intersection	**LCZ 1 / 3**
4	Intersection of Londonderry Road with The Northern Road and Cranebrook Road (facing south west)	**LCZ 2**
5	The Northern Road near Francis Greenway Correctional Complex (facing south west)	**LCZ 1**
6	Intersection of Richmond Road and The Northern Road (facing south)	**LCZ 1**
7	Intersection of Londonderry Road and Cherrybrook Chase (facing north)	**LCZ 2**
8	Intersection of Kenmare Road and Londonderry Road (facing south east)	**LCZ 2**
9	Intersection of Torkington Street and Londonderry Road (facing east)	**LCZ 2**
10	Intersection of Namatjira Avenue and Londonderry Road (facing north)	**LCZ 2**
11	Londonderry Road near The Driftway (facing north)	**LCZ 2**
12	Entry to Anglicare retirement home, Londonderry Road (facing south)	**LCZ 2**

Table 6-1: Viewpoint summary

6 Visibility of the proposal - visual envelope

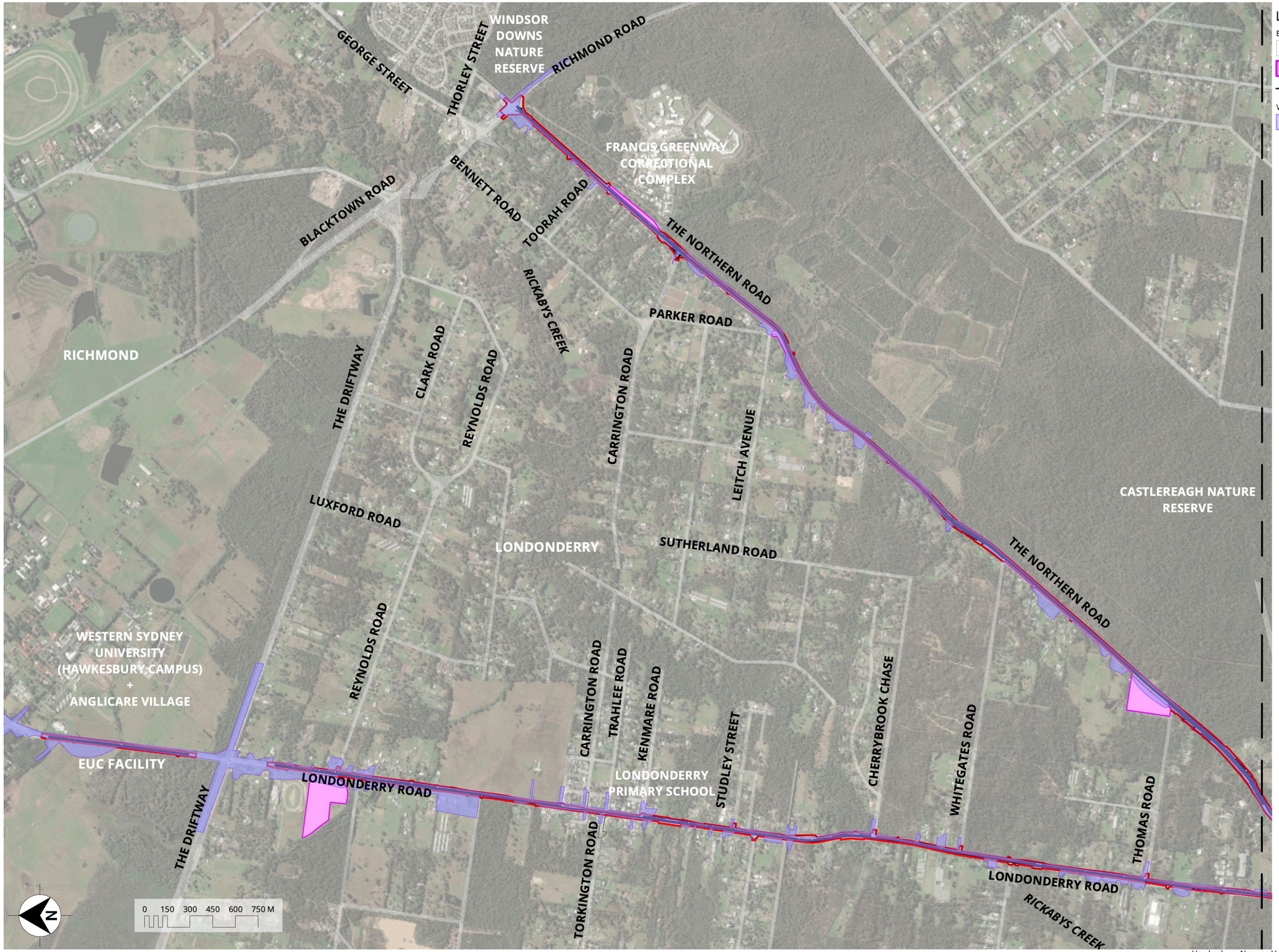
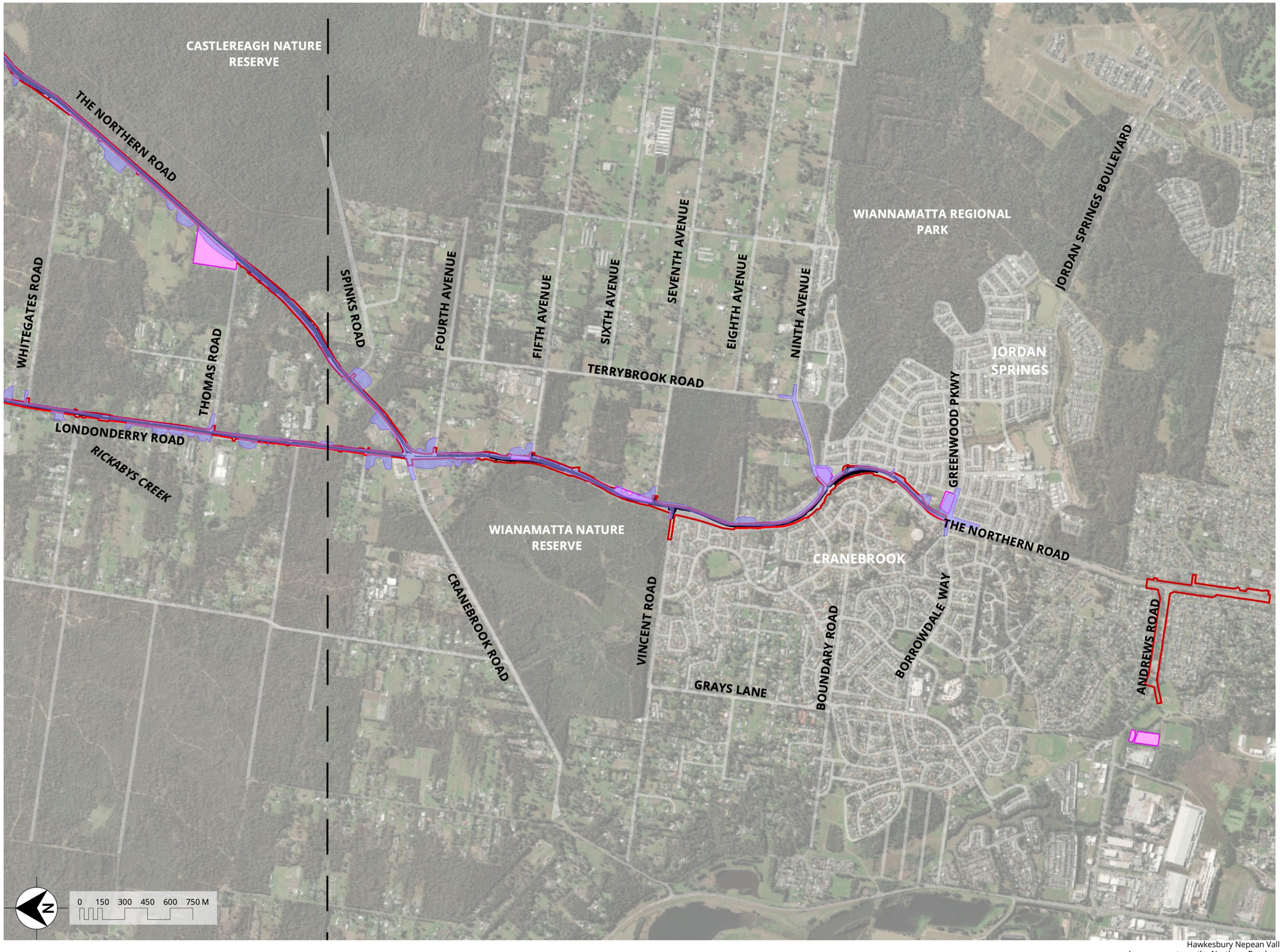


Figure 6-1: Visual envelope mapping sheet 1

6 Visibility of the proposal - visual envelope



LEGEND

EXISTING FEATURES

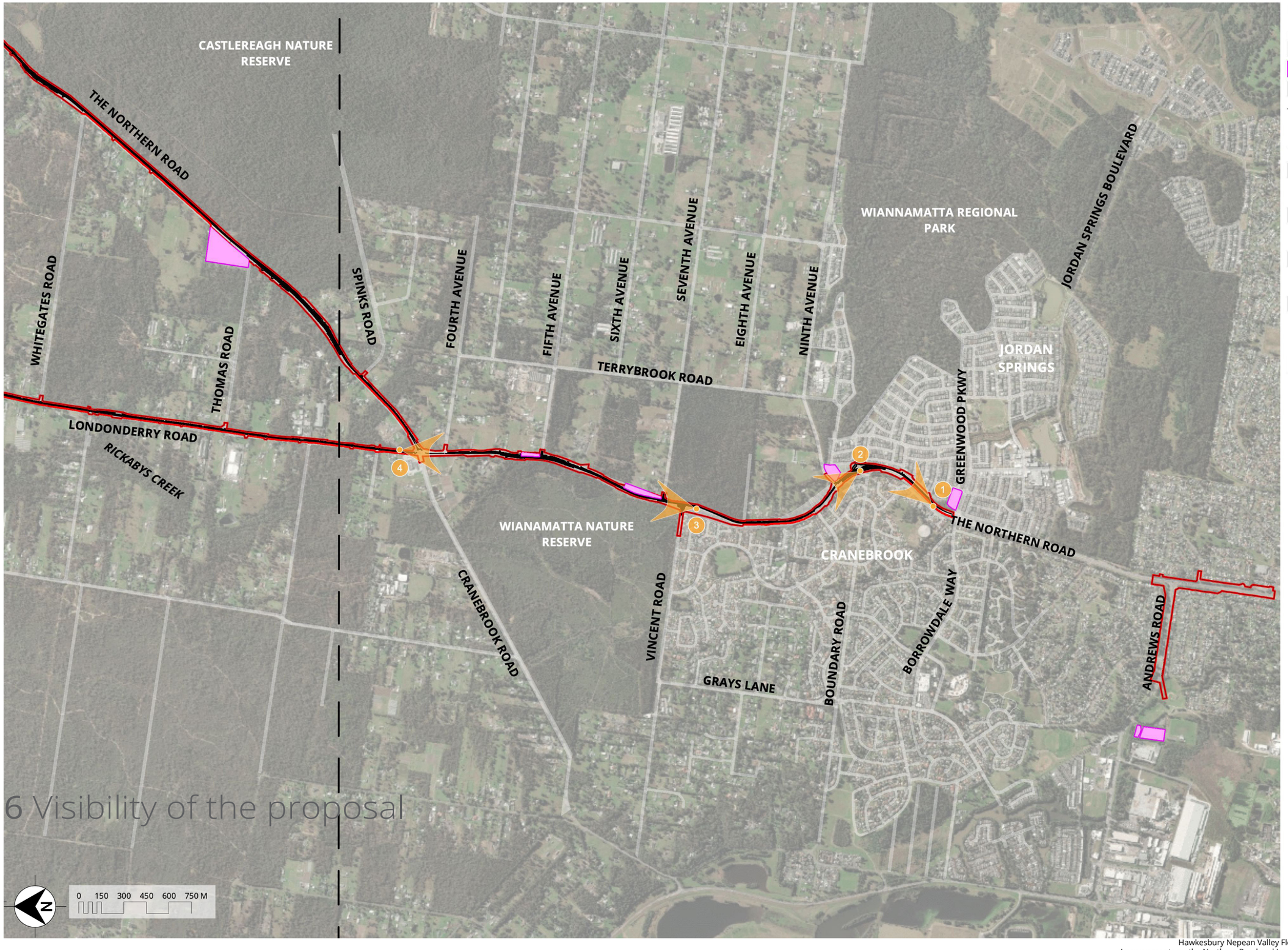
- PROPOSAL AREA
- ANCILLARY AREAS
- PAGE SEPARATION

VISUAL ENVELOPE

- APPROXIMATE EXTENT OF VISUAL ENVELOPE

Figure 6-2: Visual envelope mapping sheet 2

6 Visibility of the proposal - viewpoint locations



LEGEND

EXISTING FEATURES

- PROPOSAL AREA
- ANCILLARY AREAS
- ARTERIAL ROADS
- PAGE SEPARATION
- VIEWPOINT

VIEWPOINT LOCATIONS

1 VIEWPOINT 1 - THE NORTHERN ROAD NEAR LIVVI'S PLAYGROUND (FACING NORTH EAST)

2 VIEWPOINT 2 - THE NORTHERN ROAD NEAR NINTH AVENUE (FACING NORTH WEST)

3 VIEWPOINT 3- THE NORTHERN ROAD (FACING NORTH EAST) TOWARDS VINCENT ROAD INTERSECTION

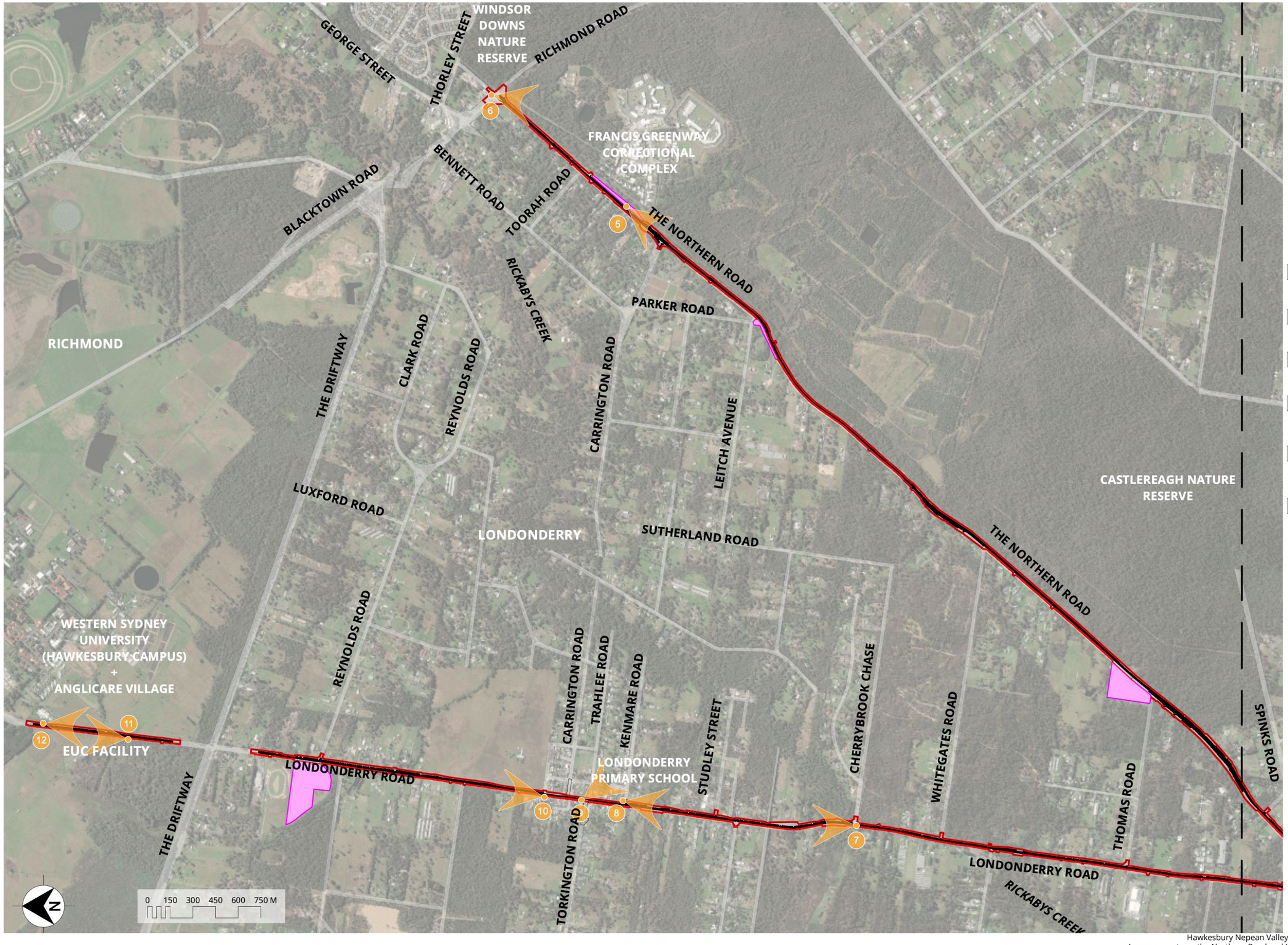
4 VIEWPOINT 4 - INTERSECTION OF THE NORTHERN ROAD, CRANEBROOK ROAD AND LONDONDERRY ROAD (FACING SOUTH WEST)

7 VIEWPOINT 7 - INTERSECTION OF LONDONDERRY ROAD AND CHERRYBROOK CHASE (FACING NORTH)

6 Visibility of the proposal

Figure 6-3: Viewpoint locations sheet 1

6 Visibility of the proposal - viewpoint locations



LEGEND

EXISTING FEATURES

- PROPOSAL AREA
- ANCILLARY AREAS
- ARTERIAL ROADS
- PAGE SEPARATION
- VIEWPOINT

VIEWPOINT LOCATIONS

05	VIEWPOINT 5 - THE NORTHERN ROAD NEAR FRANCIS GREENWAY CORRECTIONAL COMPLEX (FACING SOUTH WEST)
06	VIEWPOINT 6 - INTERSECTION OF RICHMOND ROAD AND THE NORTHERN ROAD (FACING SOUTH)
07	VIEWPOINT 7 - INTERSECTION OF LONDONDERRY ROAD AND CHERRYBROOK CHASE (FACING NORTH)
08	VIEWPOINT 8 - INTERSECTION OF KENMARE ROAD AND LONDONDERRY ROAD (FACING SOUTH EAST)
09	VIEWPOINT 9 - INTERSECTION OF TORKINGTON STREET AND LONDONDERRY ROAD (FACING EAST)
10	VIEWPOINT 10 - INTERSECTION OF NAMATJIRA AVENUE AND LONDONDERRY ROAD (FACING NORTH)
11	VIEWPOINT 11 - LONDONDERRY ROAD NEAR THE DRIFTWAY (FACING NORTH)
12	VIEWPOINT 12 - ENTRY TO ANGLICARE RETIREMENT HOME ON LONDONDERRY ROAD (FACING SOUTH)

Figure 6-4: Viewpoint locations sheet 2

7 Visual impact assessment

7.1 Chapter overview

This chapter assesses the visual impact at each of the selected viewpoints based on the established visual envelope.

7.2 Methodology

Impact assessments are based on a qualitative assessment of the sensitivity of the view and magnitude of the proposal potentially visible in that view. This enables the development of a mitigation strategy to address the impacts identified.

Sensitivity

Sensitivity is the measure of the 'completeness' and the perceived 'value' of the existing view. An assessment is made as to the quality of the landscape, its cultural and historical importance to the community, scenic value and overall composition of the place.

The following sensitivity parameters have been used as the basis for this assessment:

- The category of view such as residential, tourism or commercial and frequency at which the scene is viewed
- The elements of the proposal that are visible
- Importance of the view. Places with high social, recreational, and historical significance to local residents have higher sensitivity, as do areas of unique scenic quality
- Generally, views with the highest sensitivity include:
  - Residential views that would be affected by the proposal and the context of this view i.e. kitchen window, balcony, bedroom, living room
  - Public open space with a notable visual landscape, for example, lookouts or other scenic natural areas
  - Views with high cultural and historical significance on the visual landscape
- Views with the lowest sensitivity are most likely to be:
  - Commercial areas with enclosed workplaces
  - Road user views where the road corridor signage take precedence – however it is important to provide a stimulating motorist experience, particularly for tourists.

Magnitude

The 'magnitude of visual change' describes the contrast or type of change resulting from the proposal or proposal, the extent of change and also the proximity of the viewer. Changes are categorised as follows:

- A high magnitude of change would result if the proposal is of a major scale and considered out of scale or uncharacteristic of the existing view, or if there is considerable modification to the existing built fabric or landscape
- A moderate magnitude of change would result if the proposal is prominent but not considered to be substantially different from the existing character
- A low magnitude of change would result if there is minimal alteration to the existing view and the proposal is of a scale and nature that is consistent with the existing landscape.

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Table 7-1: Visual impact rating matrix, Source: Transport EIA-N04

7 Visual impact assessment

Assessment tools

In order to assess the potential impacts of the proposal across the variable landscape features of the study area, it was necessary to investigate the potential visual impacts using different tools.

Views were assessed in conjunction with plans and site photography taken during the site visit.

Transport EIA-N04 defines the methodology that was used to assess the likely changes to landscape composition. Elements of the view include dominance of form, lines, colours and textures. The qualitative sensitivity of potential viewers was combined with objective measurement to form assessment conclusions.

Notated photographs

The proposed road design has been overlaid onto the site photographs, scaled and positioned so that they matched existing features.

Each photograph was then marked up a to illustrate the proposed change as a result of the proposal. These broad illustrations portrayed a more flexible appearance allowing changes to occur throughout the development of the road design. Each image provides an approximation of the design in its setting rather than a fully resolved representation of the design and graphically present the following design elements:

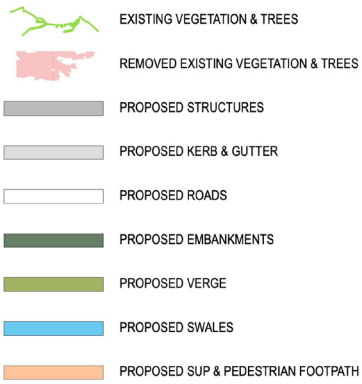


Plate 7-1: Legend for viewpoint site analysis and photographic 3D montages

7 Visual impact assessment

Viewpoint 1

Location and description

The viewpoint is located on the existing grass verge, close to the southbound travel lane of The Northern Road and is located at the southern end of the study area. The viewpoint is facing north east towards the residential area of Cranebrook, near the recreational area of Livvi's Place Playground in the suburb of Jordan Springs.

The major compositional elements within the view are the existing mature tree plantings on the western side of the road (with associated vegetated embankment) and tree plantings to the eastern side of the road, which frame the current view of the road corridor. The existing trees provide a screen between the road corridor and the residential areas beyond.

The existing two lane road (with north and southbound carriageways) has asphalt shoulders and grass verges at this location and although surrounded by residential areas, the provision of street lighting is the main visible element of the urbanised location of this viewpoint.

Visible elements of the proposal

There would be an extension to the southbound carriageway width to accommodate an evacuation shoulder, with an associated verge and small, low embankment to tie into the existing ground level. In addition, any disturbed landscape would be 'made good'. The most noticeable element would be the overall widening of the existing road and associated elements.

Affected viewers

- Motorists.

Description of impacts

There would be a low magnitude of impact, based on the road widening, which would incorporate an existing asphalt and gravel verge. The proposed embankment would be minimal in height and extent. Since the existing road side trees are sufficiently set-back from the edge of the existing road, no tree removal would be required.

The overall visual impact would be moderate to low, based on a moderate sensitivity to change due to the semi-rural setting of the viewpoint.

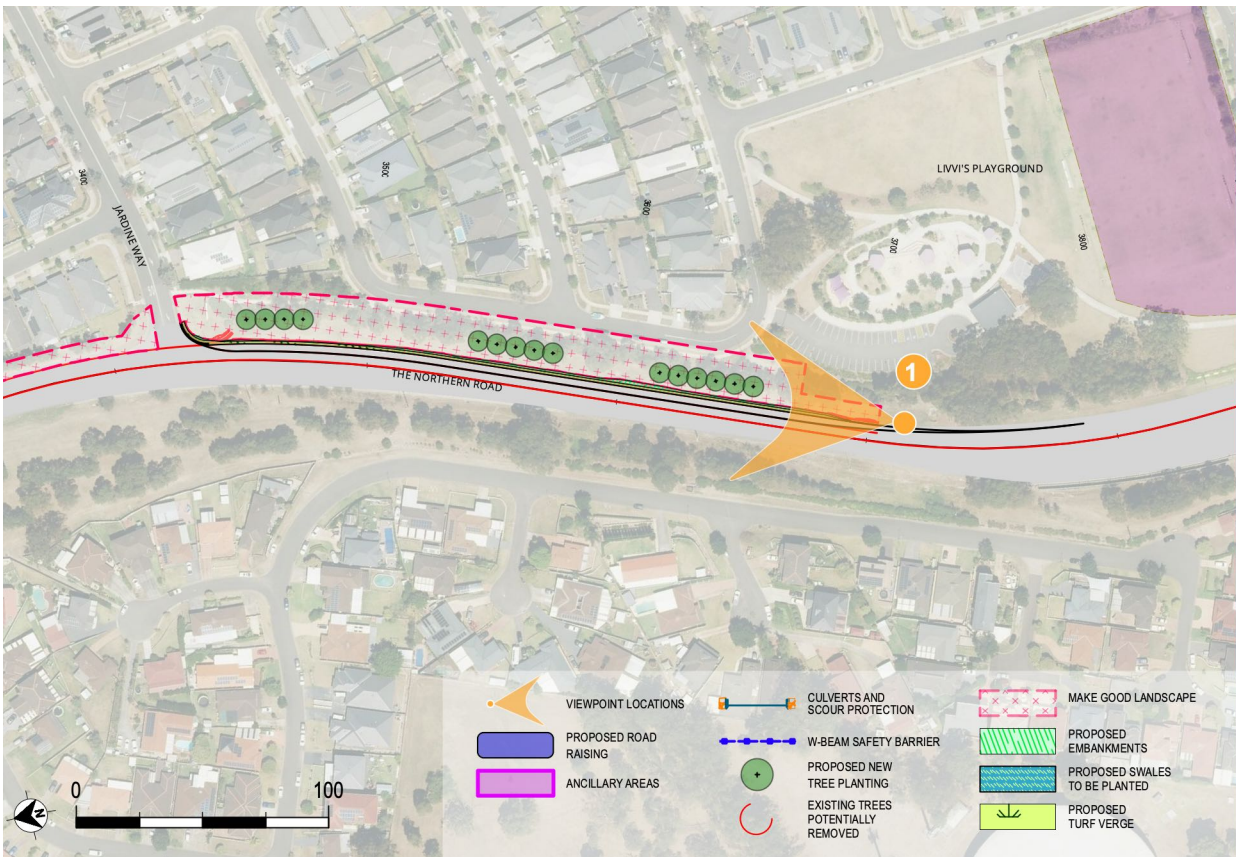


Figure 7-1: Viewpoint 1 location plan

7 Visual impact assessment

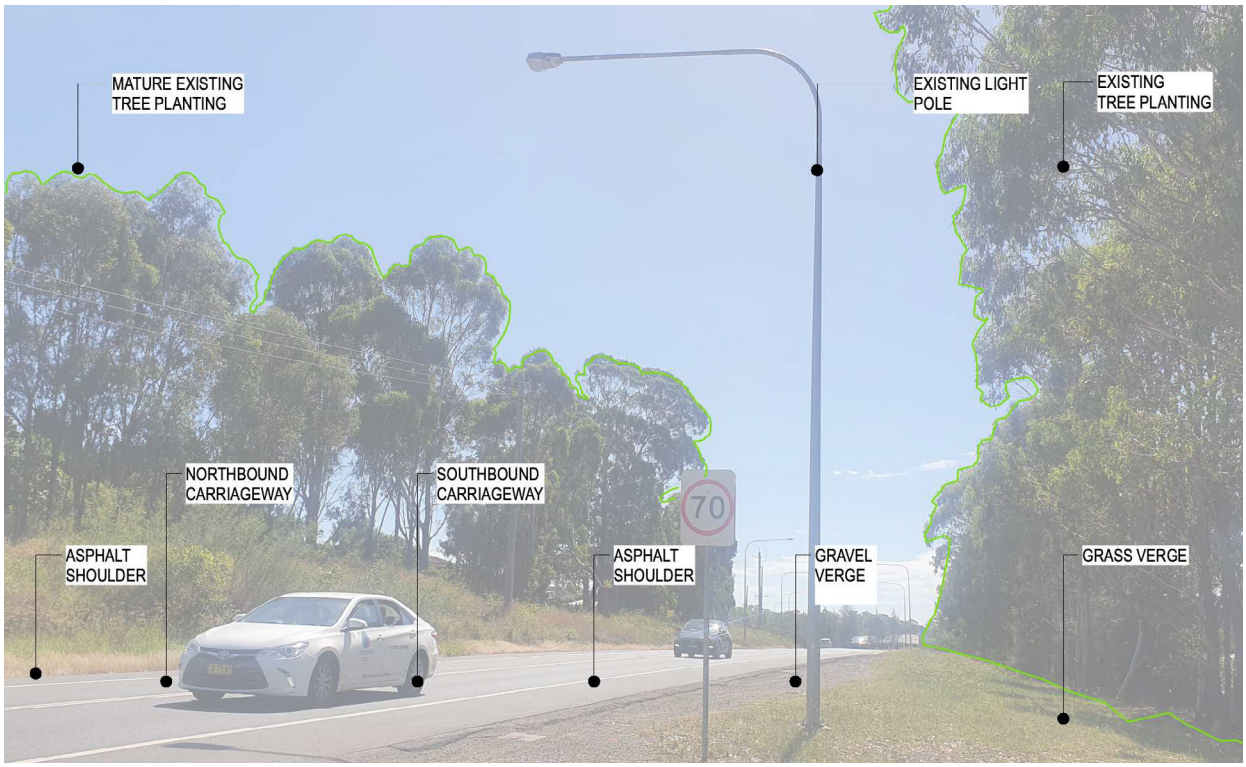


Figure 7-2: Viewpoint 1 - The Northern Road near Livvi's Park (facing north east) - Existing view

Figure 7-3: Viewpoint 1 - The Northern Road near Livvi's Park (facing north east) - Proposal view

Sensitivity	Magnitude	Impact
Moderate The existing semi-rural setting would have a moderate sensitivity to change based on the current framing of the road corridor by existing mature trees, roadside embankment vegetation and a wide grass verge to the eastern side of the road.	**Low** The magnitude of change would be low, based on an extended road width, verge and embankment, where most of the extended road pavement would include an existing narrow asphalt verge.	**Moderate - Low**

Table 7-2: Visual impact summary viewpoint 1

7 Visual impact assessment

Viewpoint 2

Location and description

The viewpoint is located within the road carriageway of The Northern Road within the southern part of the study area. The viewpoint is facing north west towards the local adjoining single storey residential homes of Cranebrook.

The major compositional elements within this viewpoint are the mature trees to the both the eastern and western sides of the road which frame the road corridor that comprises a two lane road with existing asphalt shoulders.

There is a wide grass verge to western side of the road, which extends back to the side fencing of the residential properties, with stands of mature trees. On the eastern side of the road, this verge is not as wide, but comprises more native vegetation of grasses and bushland trees and provides some open views between stands of trees.

Visible elements of the proposal

There would be an extension to the southbound carriageway width to accommodate an evacuation shoulder. At this location there would also be swales constructed to the side of the northbound carriageway and locally to the side of the southbound carriageway to connect with a proposed culvert (with scour protection measures). Any disturbed landscape would be 'made good'.

Affected viewers

- Motorists.

Description of impacts

At this location the overall visual impact would be moderate to low. This is based on a moderate sensitivity to change as a result of the semi-rural nature of the view.

The magnitude of visual impact is considered low, based on the southbound carriageway extension incorporating an existing asphalt shoulder and the swales affecting only low level elements of the view.

Generally most of the existing trees that dominate the view would be being retained, due to their distant set-back from the road on the western side of the road, where most of the disturbance works are proposed. A few existing mature trees would be removed on the eastern side of the road to accommodate a swale from the proposed culvert.

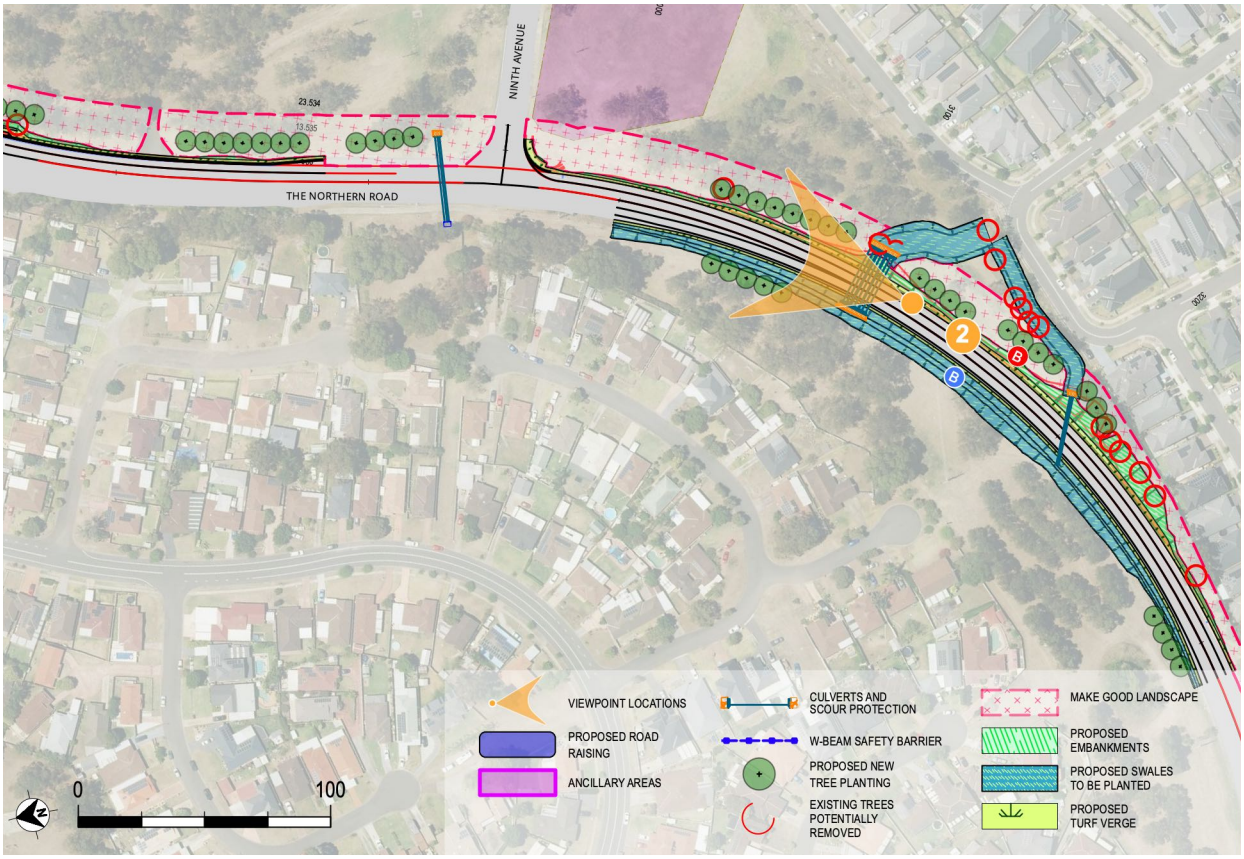


Figure 7-4: Viewpoint 2 location plan

7 Visual impact assessment

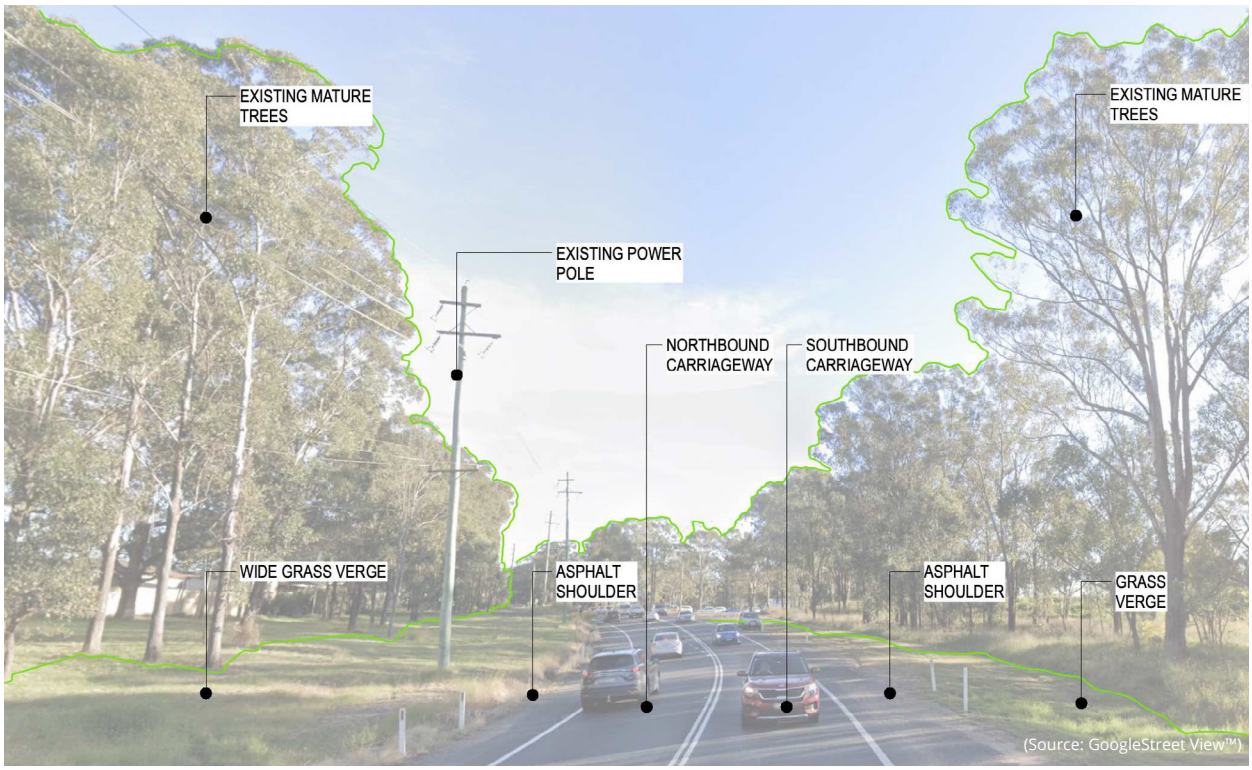


Figure 7-5: Viewpoint 2 - The Northern Road near Ninth Avenue (facing north west) - Existing view

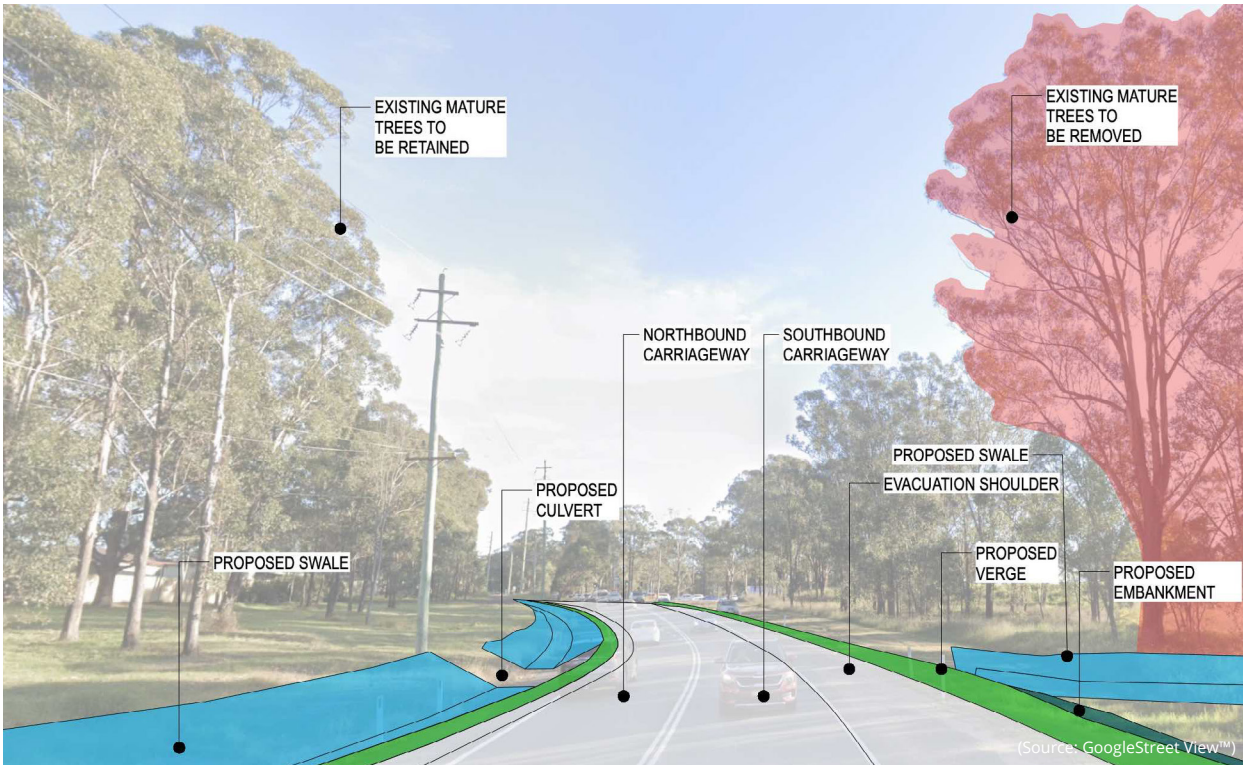


Figure 7-6: Viewpoint 2 - The Northern Road near Ninth Avenue (facing north west) - Proposal view

Sensitivity	Magnitude	Impact
Moderate The existing semi-rural setting would have a moderate sensitivity to change based on the current framing of the road corridor by existing mature trees, a wide grass verge to the western side of the road and bushland trees to the eastern side of the road.	**Low** The magnitude of change would be low, based on an extended road width, verge and swales, where most of the extended road pavement would include an existing narrow asphalt verge.	**Moderate - Low**

Table 7-3: Visual impact summary viewpoint 2

7 Visual impact assessment

Viewpoint 3

Location and description

The viewpoint is located on northbound carriageway on The Northern Road, facing north east towards the Vincent Road intersection.

The Wianamatta Nature Reserve is located next to the northbound carriageway, the southern most corner of the reserve is located immediately adjoining the Vincent Road intersection. The nature reserve is next to the western side of The Northern Road from Vincent Road to just south of the intersection with Cranebrook Road.

There is Aboriginal Land Council land next to the southbound carriageway at this viewpoint, which comprises an area of native bushland.

The major compositional elements to this viewpoint are the existing mature bushland trees to both sides of the road. The western side trees in the foreground of the view are not part of the Wianamatta Nature Reserve, but comprise a stand of mature trees that currently visually screen the residential properties of the nearby suburb of Cranebrook. At this intersection, the two lanes of The Northern Road, with asphalt shoulders are locally divided by a raised concrete median strip.

Visible elements of the proposal

At this viewpoint the proposal fundamentally re-positions The Northern Road road carriageways, in conjunction with the widening of the southbound carriageway to accommodate an evacuation shoulder.

In visual terms, the road would appear off-centred, to the west of the current view and further away from the current stand of native bushland (Aboriginal Land Council land) which would remain undisturbed. There would be an extensive embankment to tie the new road extent into existing ground levels.

In addition, the existing median would be made wider and locally replaced with two rows of highly visible, removable, flexible median barriers at the intersection to enable the right turn from Vincent Road into The Northern Road during an evacuation operation. At the western side of the road, there would be also be swale components visible connecting culverts under The Northern Road and Vincent Road.

Affected viewers

- Motorists
- Residents of nearby properties.

Description of impacts

The sensitivity of the view is considered moderate based on the partly rural setting of the view, with the presence of existing mature trees and native bushland.

The magnitude of the visual impact is considered moderate as a result of the re-positioning of the road, new embankments being a large part of the new view and the removal of a number of existing mature trees.

The overall impact is considered moderate.

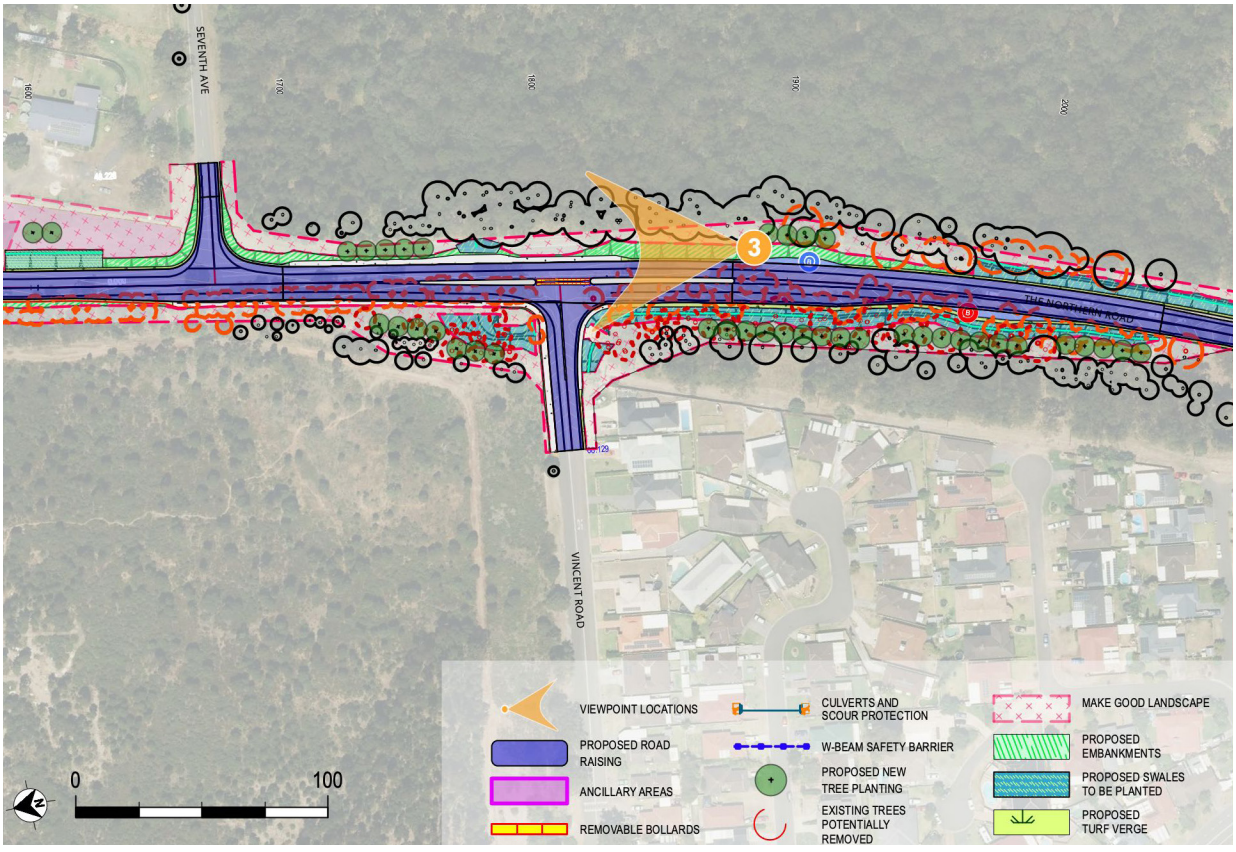


Figure 7-7: Viewpoint 3 location plan

7 Visual impact assessment

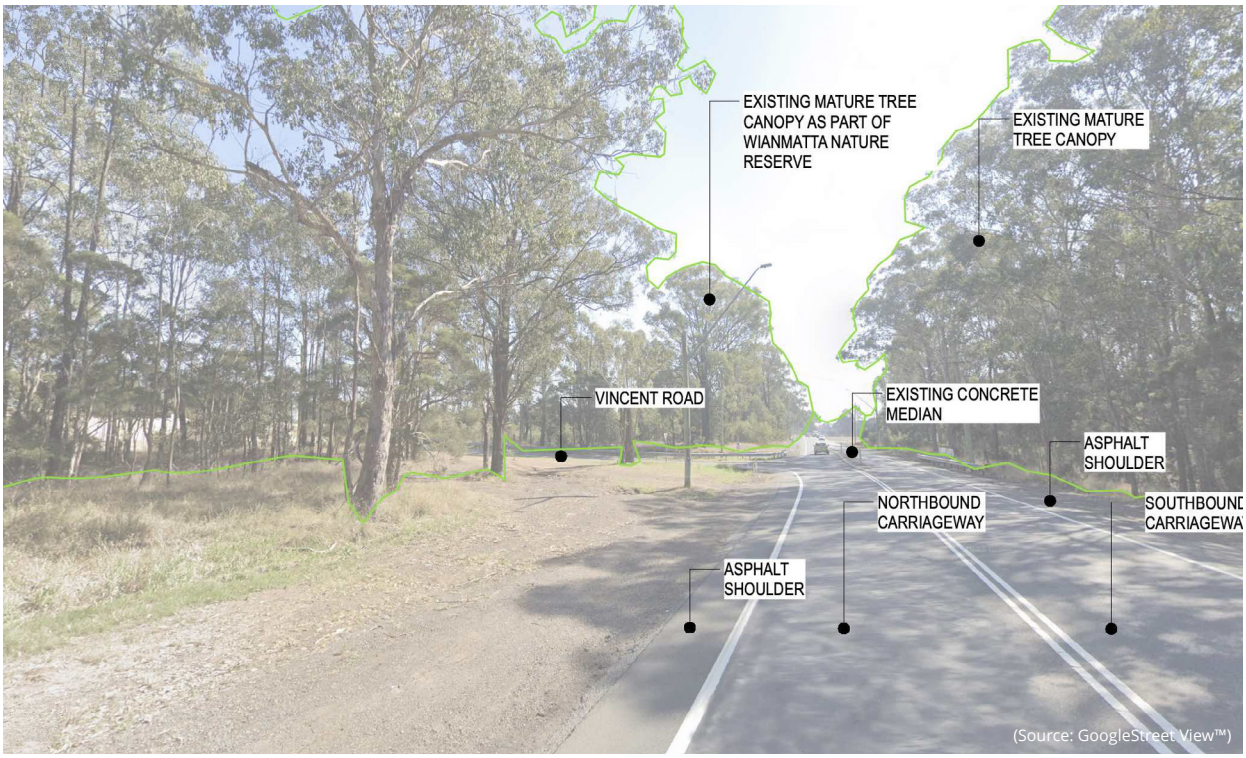


Figure 7-8: Viewpoint 3 - The Northern Road (facing north east) looking towards the Vincent Road intersection - Existing view

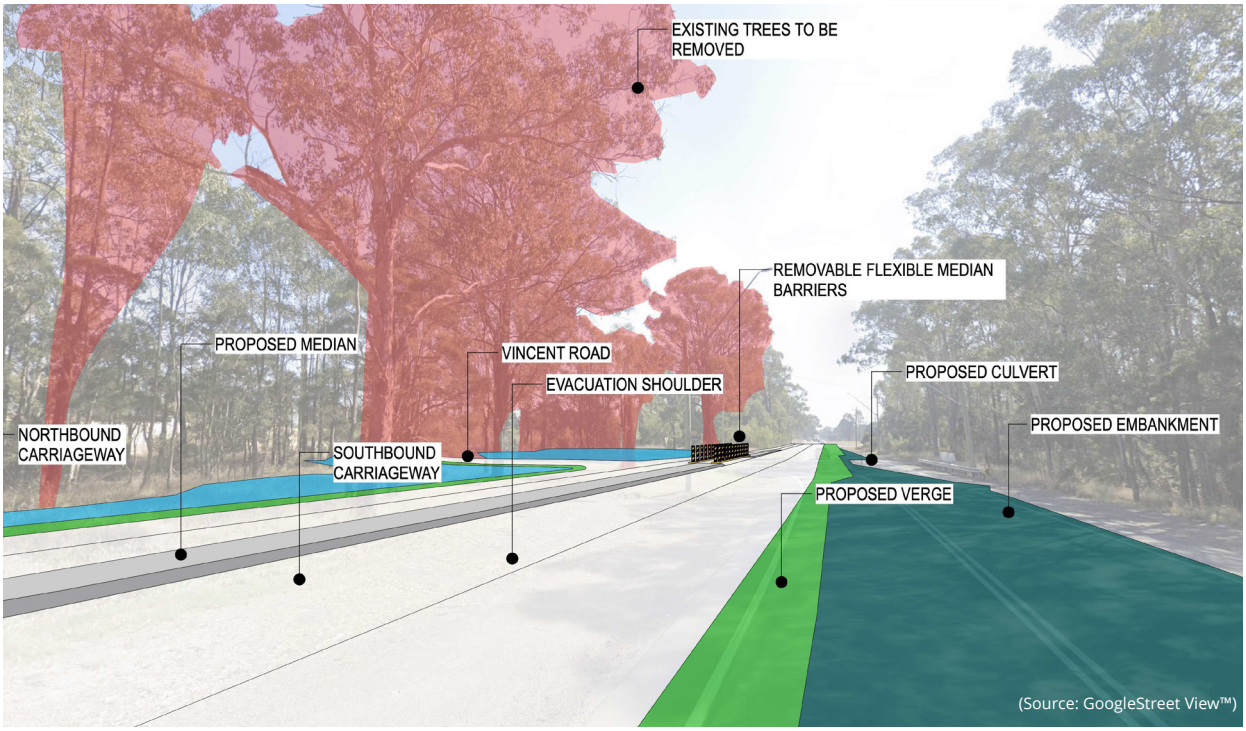


Figure 7-9: Viewpoint 3 -The Northern Road (facing north east) looking towards the Vincent Road intersection - Proposal view

Sensitivity	Magnitude	Impact
Moderate The sensitivity of this view is considered moderate based on the partly rural setting to the view and the presence of existing vegetation in the existing view	**Moderate** The magnitude of visual impact is moderate based on the repositioning of the existing road to the west of the existing view, with associated new embankment, combining to increase the visible width of the road corridor. In addition there would be a number of existing mature trees requiring removal.	**Moderate**

Table 7-4: Visual impact summary viewpoint 3

7 Visual impact assessment

Viewpoint 4

Location and description

The viewpoint is located on the Southbound carriageway of Londonderry Road at the approach to the roundabout intersection with The Northern Road and Cranebrook Road, facing south west along Londonderry Road.

The main compositional elements of the view are the existing mature trees to the western side of Londonderry Road at the approach to the intersection, the two lane road and the expansive frontage to the commercial properties (McDonald's and associated service station) to the western side of the existing road. The existing Londonderry Road includes a gravel verge to the western side. With the exception of the mature trees to the eastern side of the road corridor, road pavement and hardscape elements dominate the existing view.

Visible elements of the proposal

At this viewpoint, there would be an extension in the width of the paved element of Londonderry Road, as the existing gravel verge is incorporated into the new evacuation shoulder adjoining the southbound carriageway. The construction of a swale next to this evacuation shoulder would result in the removal of a line of existing mature trees, one or two rows deep on the approach to the roundabout. However, it is noted that only the front portion of the existing stand of trees would be removed.

Any tree removal to The Northern Road would only be visible once the trees fronting Londonderry Road (north of the intersection) were removed.

Affected viewers

- Motorists
- Patrons of the commercial facilities close to the intersection.

Description of impacts

The sensitivity of this viewpoint is considered low, based on the dominance of road pavement and hardscape elements.

The magnitude of visual impact however would be moderate, largely based on the removal of a line of existing mature trees flanking the approach to the roundabout intersection, along with trees on the eastern side of The Northern Road. The extended carriageway widths to the southbound carriageways of Londonderry Road and The Northern Road would have minimal visual impact.

The overall visual impact of the proposal is considered moderate to low.

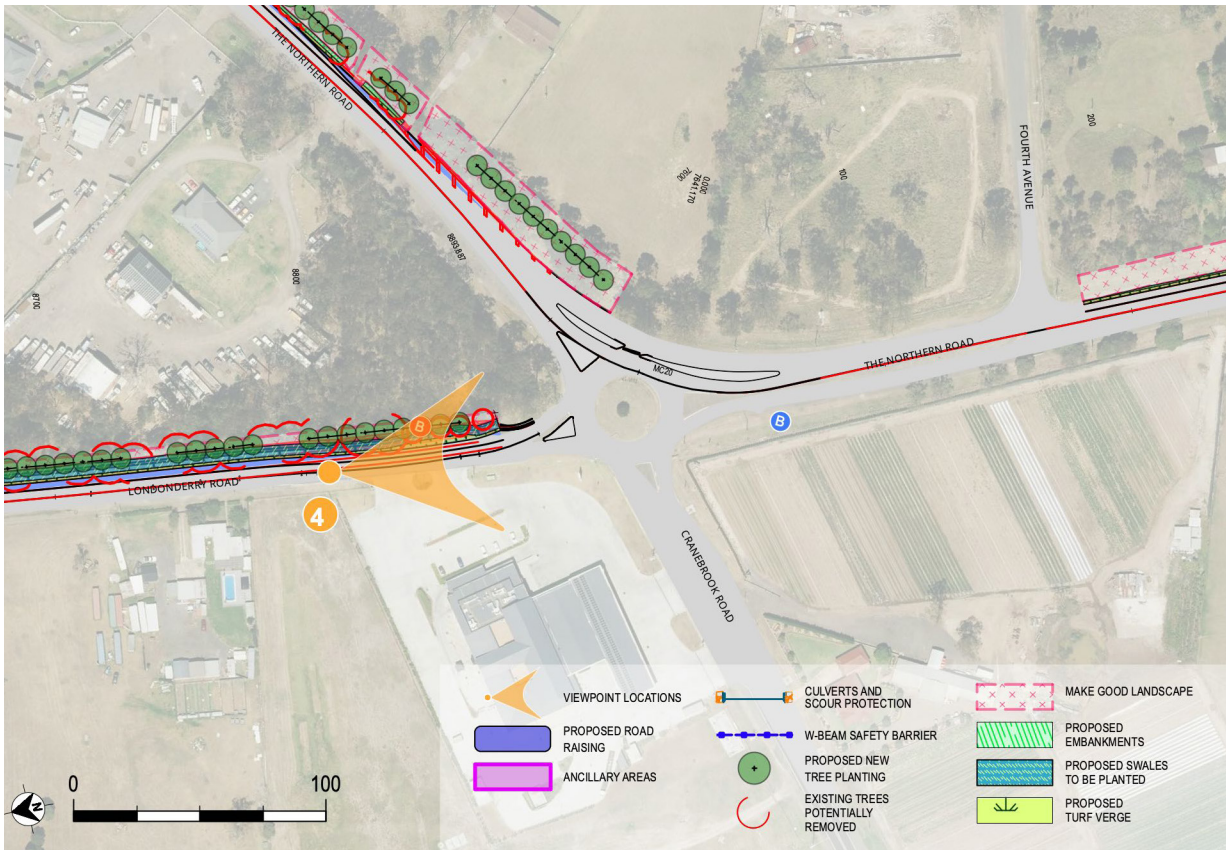


Figure 7-10: Viewpoint 4 location plan

7 Visual impact assessment

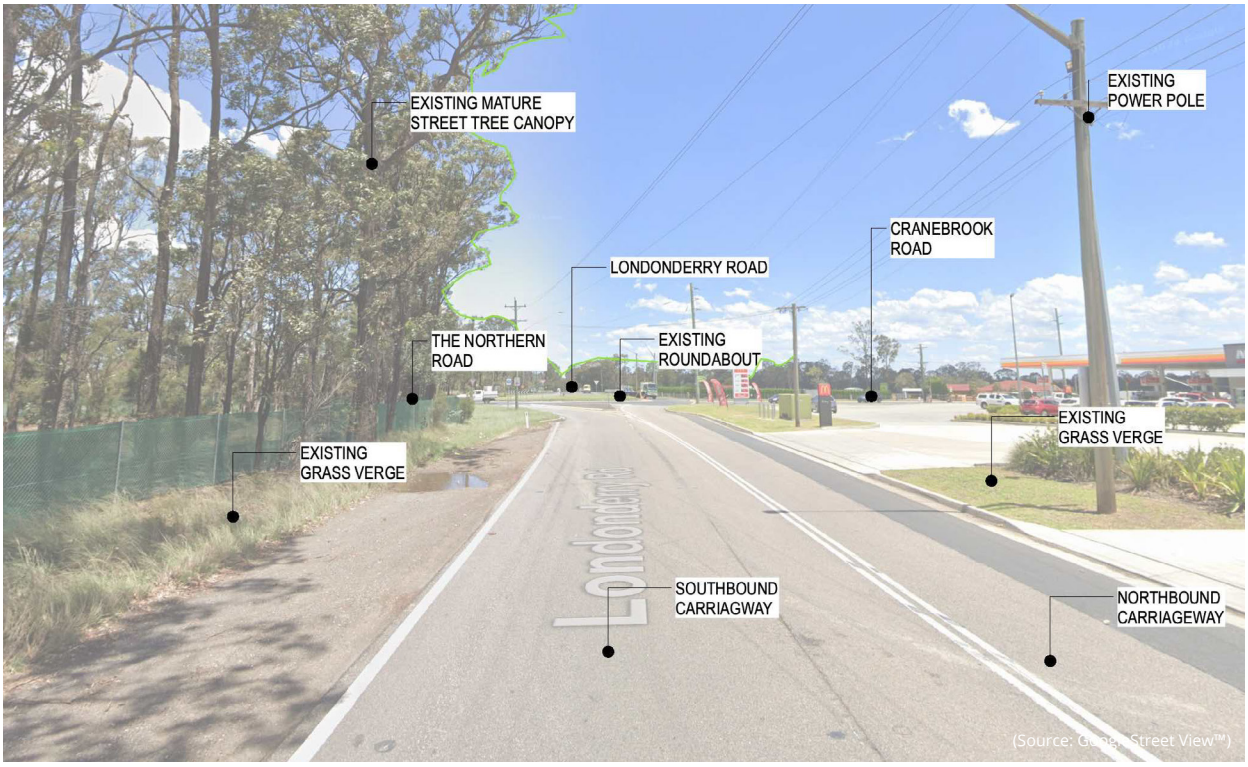


Figure 7-11: Viewpoint 4 - Intersection of Londonderry Road with The Northern Road and Cranebrook Road (facing south west

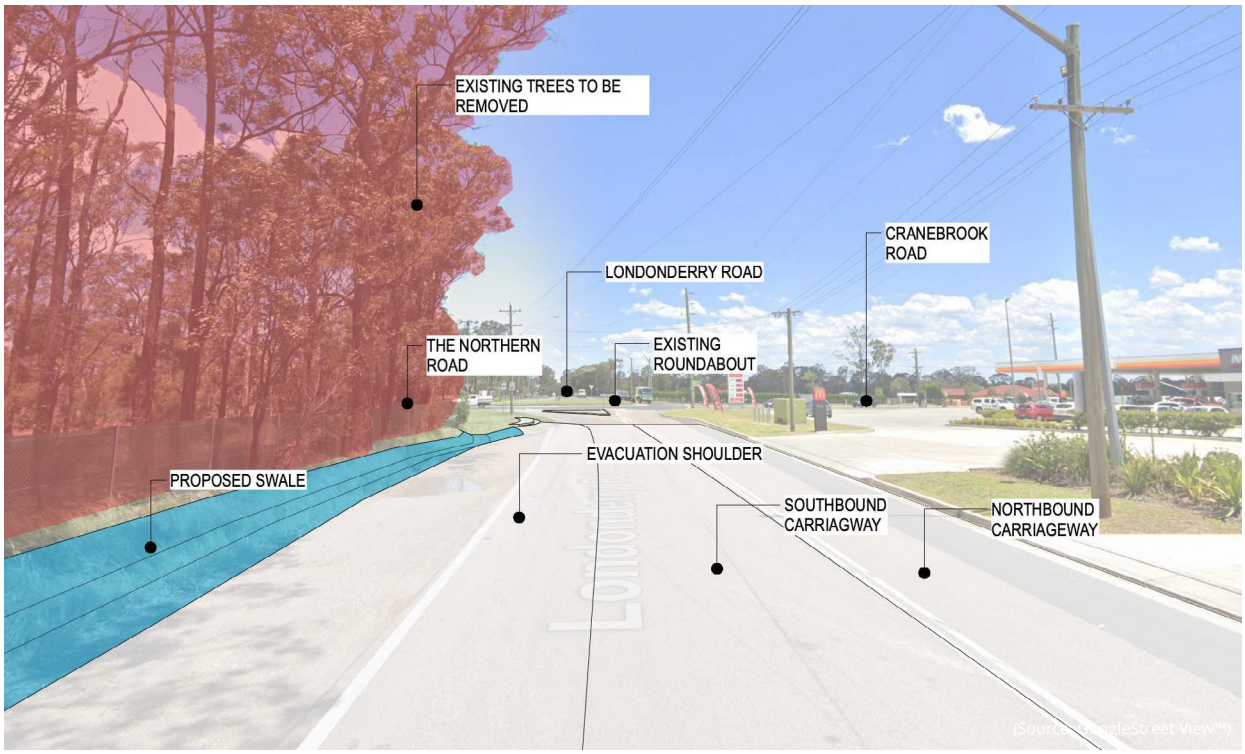


Figure 7-12: Viewpoint 4 - Intersection of Londonderry Road with The Northern Road and Cranebrook Road (facing south west - Proposal view

Sensitivity	Magnitude	Impact
Low The existing dominance of road pavement and hard surfaces contribute to a low sensitivity to visual impact	**Moderate** There would be a moderate magnitude of impact based on the removal of existing trees adjoining the eastern side of Londonderry Road (next to the southbound carriageway). The extension of the road pavement would have minimal impact.	**Moderate - Low**

Table 7-5: Visual impact summary viewpoint 4

7 Visual impact assessment

Viewpoint 5

Location and description

This viewpoint is located close to the perimeter of the Francis Greenway Correctional Complex, on the southbound carriageway of The Northern Road, with a backdrop of native bushland trees in the distance.

The main compositional elements of this viewpoint are the existing trees, comprising a large mature foreground tree close to the eastern side of the road, together with low roadside trees and more isolated stands of mature trees in front of residential properties to the western side of the road. In addition, there is a backdrop of existing bushland in the background of the view. The perimeter fencing is the only visible element of the Correctional Centre at this viewpoint.

Visible elements of the proposal

The main visible elements of the proposal would be the proposed swales, verge and extended road pavement to accommodate the evacuation shoulder. Although these are low level elements to the viewpoint, their construction would result in the associated removal of a number of existing trees.

Affected viewers

- Motorists
- Employees accessing the Francis Greenway Correctional Complex
- Local residents.

Description of impacts

The sensitivity of this view is considered moderate, based on the presence of existing trees to the edge of the Francis Greenway Correctional Complex and residential properties, but most notably the native bushland in the distance of the view. The existing two lane road with asphalt shoulders also contribute to the semi-rural setting of the road.

The magnitude of the visual impact is considered moderate, based on the construction of swales along the side of the southbound carriageway stretching into the distance and the associated removal of existing trees.

The overall visual impact is considered moderate.

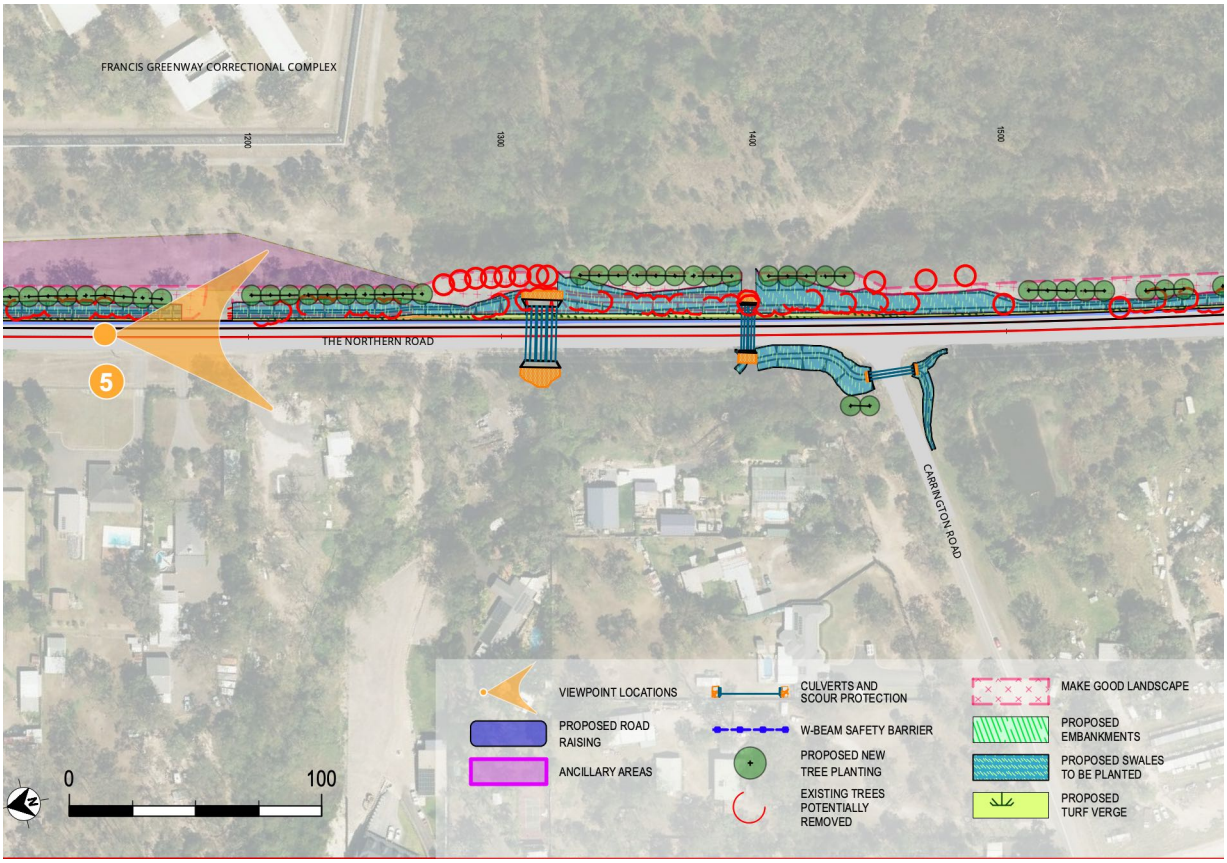


Figure 7-13: Viewpoint 5 location plan

7 Visual impact assessment

Figure 7-14: Viewpoint 5 - The Northern Road near Francis Greenway Correctional Complex (facing north east) - Existing view

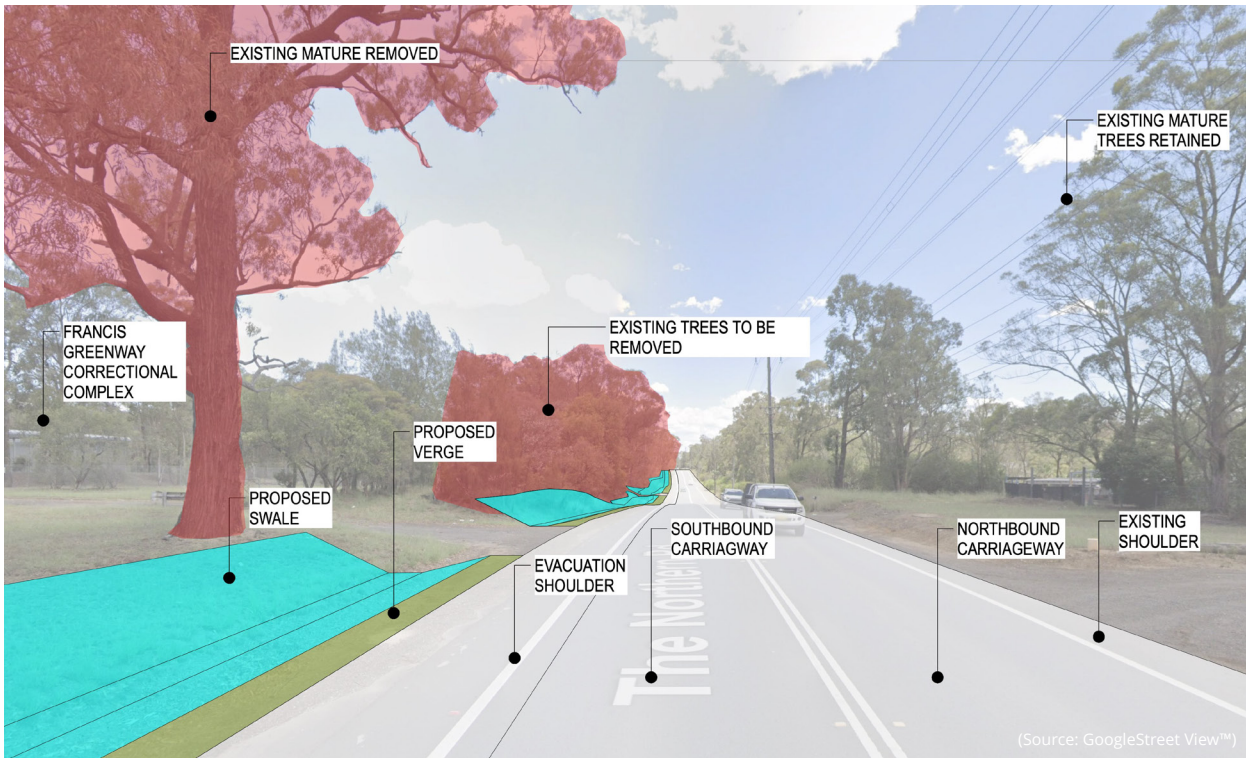


Figure 7-15: Viewpoint 5 - The Northern Road near Francis Greenway Correctional Complex (facing north east) - Proposal view

Sensitivity	Magnitude	Impact
Moderate The sensitivity of this viewpoint is considered moderate, based on the existing semi-rural nature of the road corridor and the dominance of existing trees.	**Moderate** The magnitude of the impact is moderate, largely based on associated removal of existing trees as a result of the addition of the low level swale elements.	**Moderate**

Table 7-6: Visual impact summary viewpoint 5

7 Visual impact assessment

Viewpoint 6

Location and description

The viewpoint is located to the side of the commercial facilities at the roundabout intersection of The Northern Road with Richmond Road, on the Richmond Road approach, facing south. The viewpoint is located at the northern end of The Northern Road portion of the proposal.

The main compositional elements that comprise this viewpoint are the mature trees to the side of the southbound carriageway of The Northern Road and the existing infrastructure of the roundabout.

Visible elements of the proposal

At this viewpoint the visible elements would be a low embankment at the southern corner of the intersection associated with the extension of the southbound carriageway width to accommodate an evacuation shoulder to The Northern Road. This extended width however would not be visible. In addition, there would be an extensive swale system located parallel to the evacuation shoulder to improve drainage to The Northern Road at the southern side of the intersection.

Affected viewers

- Motorists
- Patrons of commercial facilities close to the intersection.

Description of impacts

The sensitivity of the visual impact is considered low, based on the dominance of the existing infrastructure on the view.

The magnitude of the impact would be low based on the main elements of change being only low level elements and at a distance from the viewpoint. There would be isolated trees removed next to the southbound carriageway of The Northern Road. The number of trees removed in the distance are shown indicatively, as it is difficult to identify exact numbers.

The overall visual impact is considered low at this viewpoint.

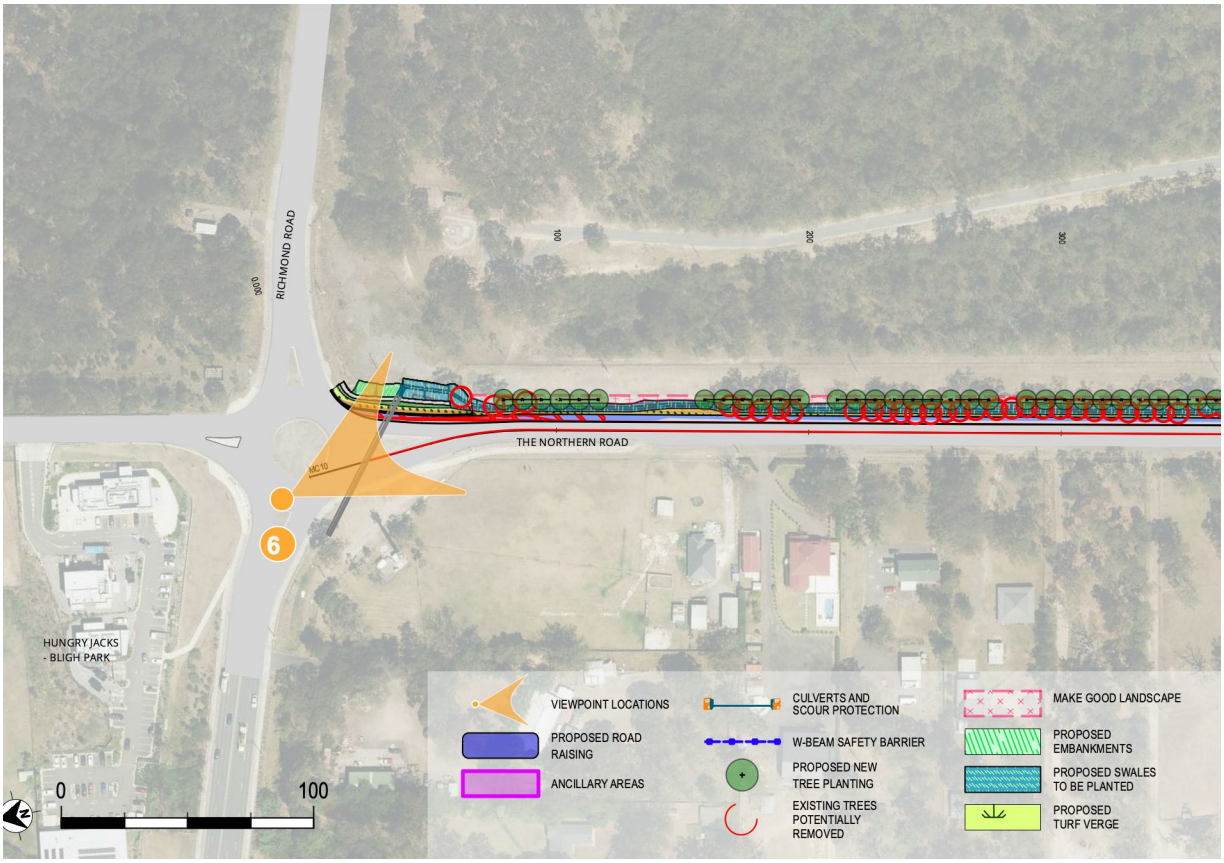


Figure 7-16: Viewpoint 6 location plan

7 Visual impact assessment

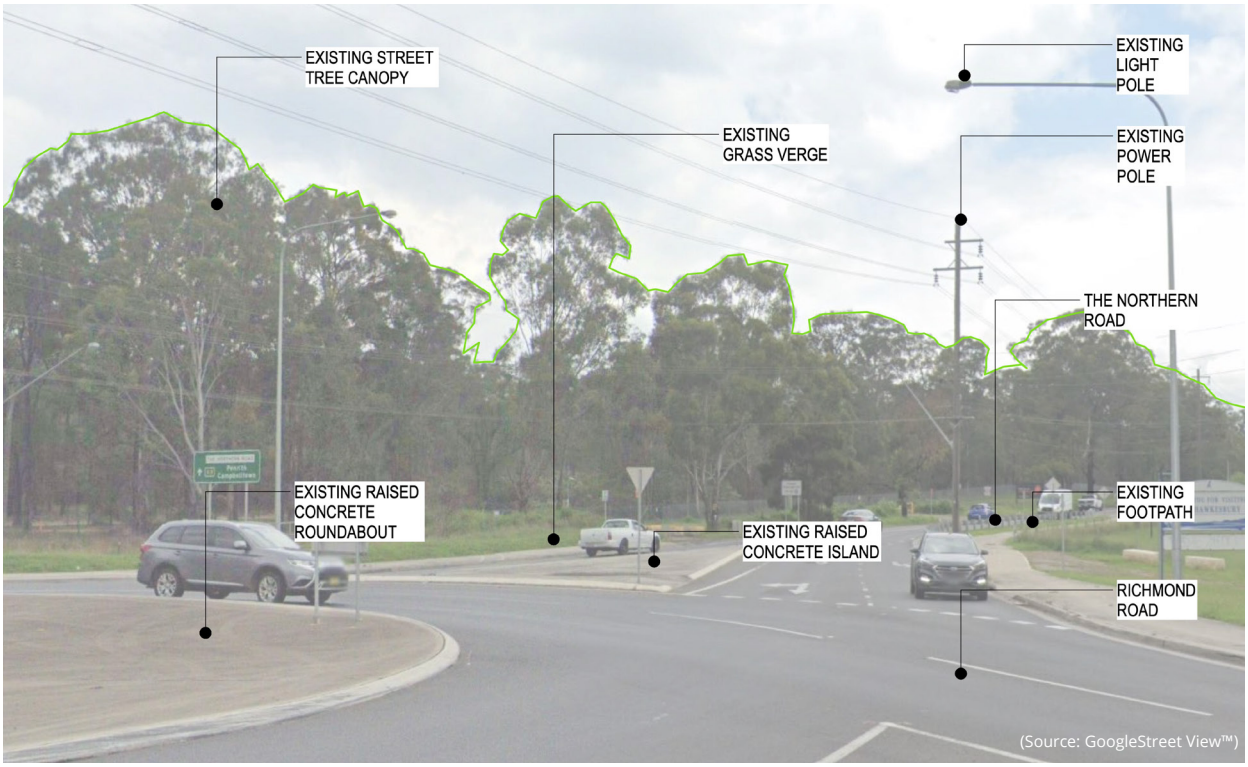


Figure 7-17: Viewpoint 6 - Intersection of Richmond Road with The Northern Road (facing south) - Existing view

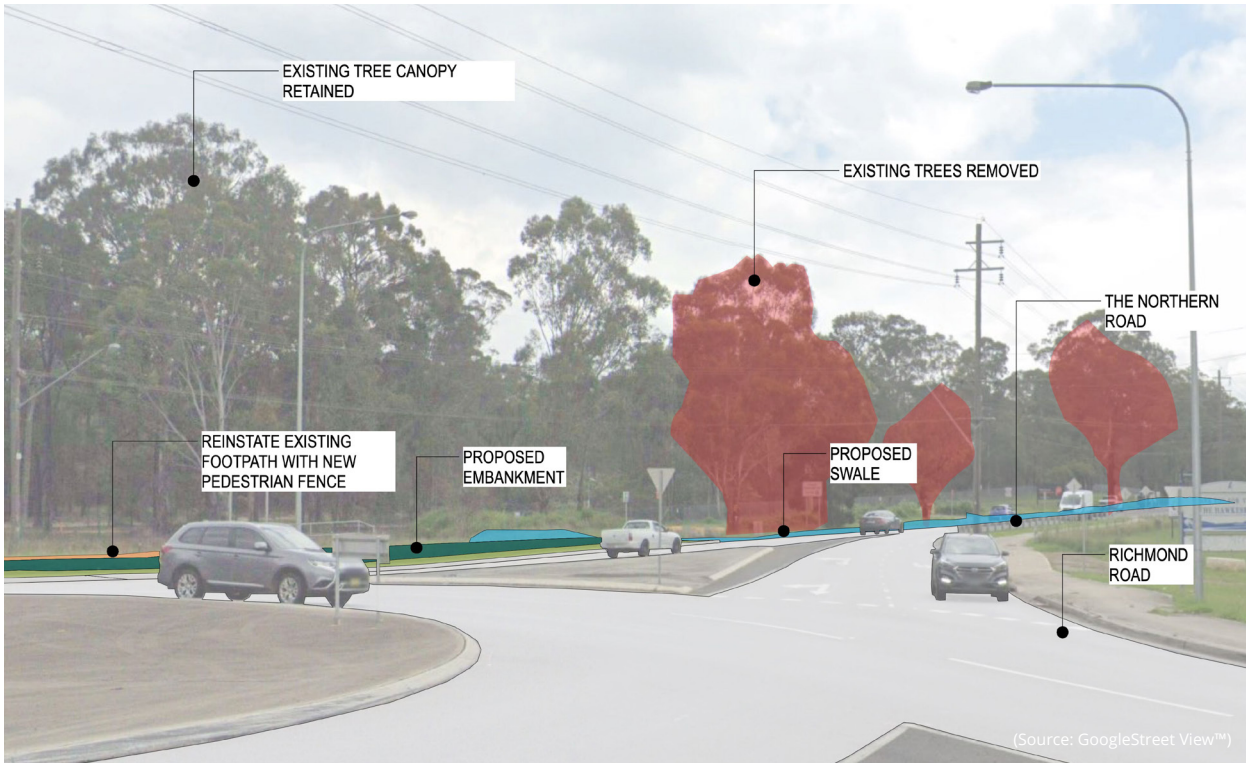


Figure 7-18: Viewpoint 6 - Intersection of Richmond Road with The Northern Road (facing south) - Proposal view

Sensitivity	Magnitude	Impact
Low The sensitivity of this viewpoint is low, based on the dominance of the existing infrastructure.	**Low** The magnitude of impact is low, since the new elements of proposed embankments, swales and slightly widened road width would be difficult to see as they would be at a distance to the viewpoint. The most noticeable element would be the removal of isolated trees next to the southbound carriageway	**Low**

Table 7-7: Visual impact summary viewpoint 6

7 Visual impact assessment

Viewpoint 7

Location and description

The viewpoint is located within the carriageway of Cherrybrook Chase road at the intersection with Londonderry Road, facing north along the alignment of Londonderry Road.

The main compositional element of the view is the existing vegetation, associated with Rickabys Creek, predominantly the existing mature trees next to the northbound carriageway of Londonderry Road, but also the existing vegetation next to the southbound carriageway forming part of the Richmond Park Estate.

Additional elements to the view are the furniture elements of rural style timber post and rail fencing, but also infrastructural elements of W-beam barriers.

The foreground view includes the existing culvert to Londonderry Road.

Visible elements of the proposal

At this viewpoint the main visible elements would be the modification of the existing embankment to constructed a swale and the associated modifications to the existing culvert, which would include rock scour protection. The existing asphalt shoulder would largely accommodate the evacuation shoulder at this location and would not be visible.

Affected viewers

- Motorists
- Local residents.

Description of impacts

The sensitivity of the impact is considered moderate, based on the semi-rural setting to the existing road. The mature vegetation of Rickabys Creek is located very close to either side of the existing road. Screening the existing residential properties, although there is visible estate signage, culverts and existing road barriers within the existing view that reduce the sensitivity of the view.

The magnitude of the proposal would be low based on the visual impacts being largely restricted to the foreground of the view with culvert modifications (not shown), embankment modifications to accommodate a swale and loss of some existing mature trees to the eastern side of Londonderry Road.

The overall visual impact is considered moderate to low.

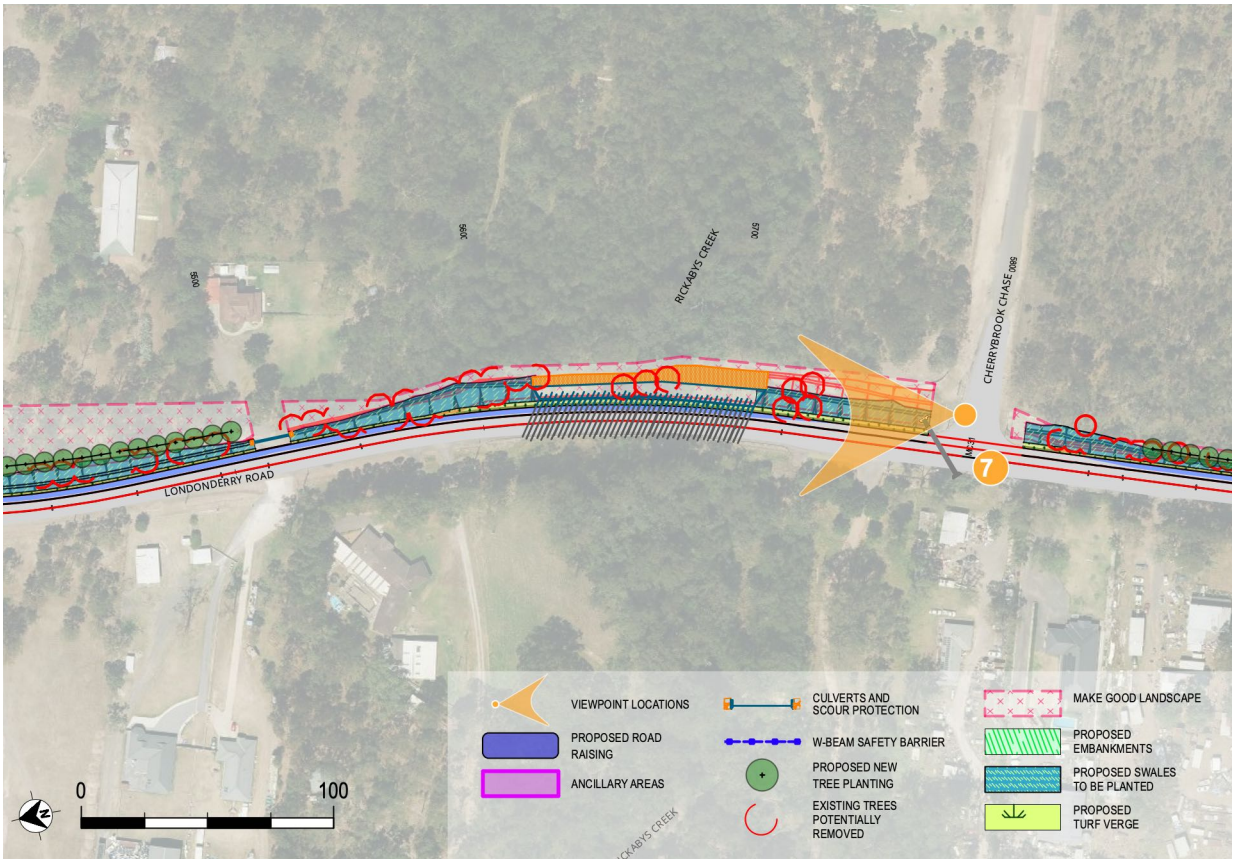


Figure 7-19: Viewpoint 7 location plan

7 Visual impact assessment

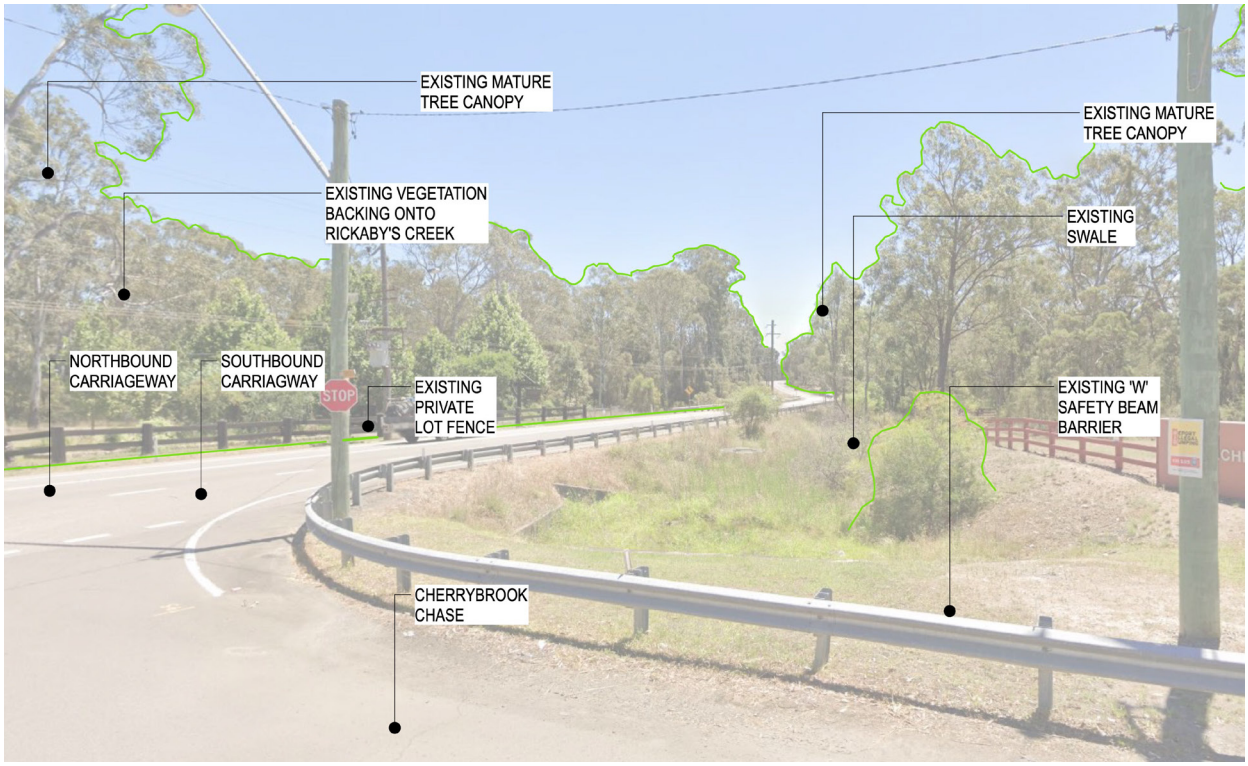


Figure 7-20: Viewpoint 7 - Intersection of Londonderry Road and Cherrybrook Chase (facing north) - Existing view

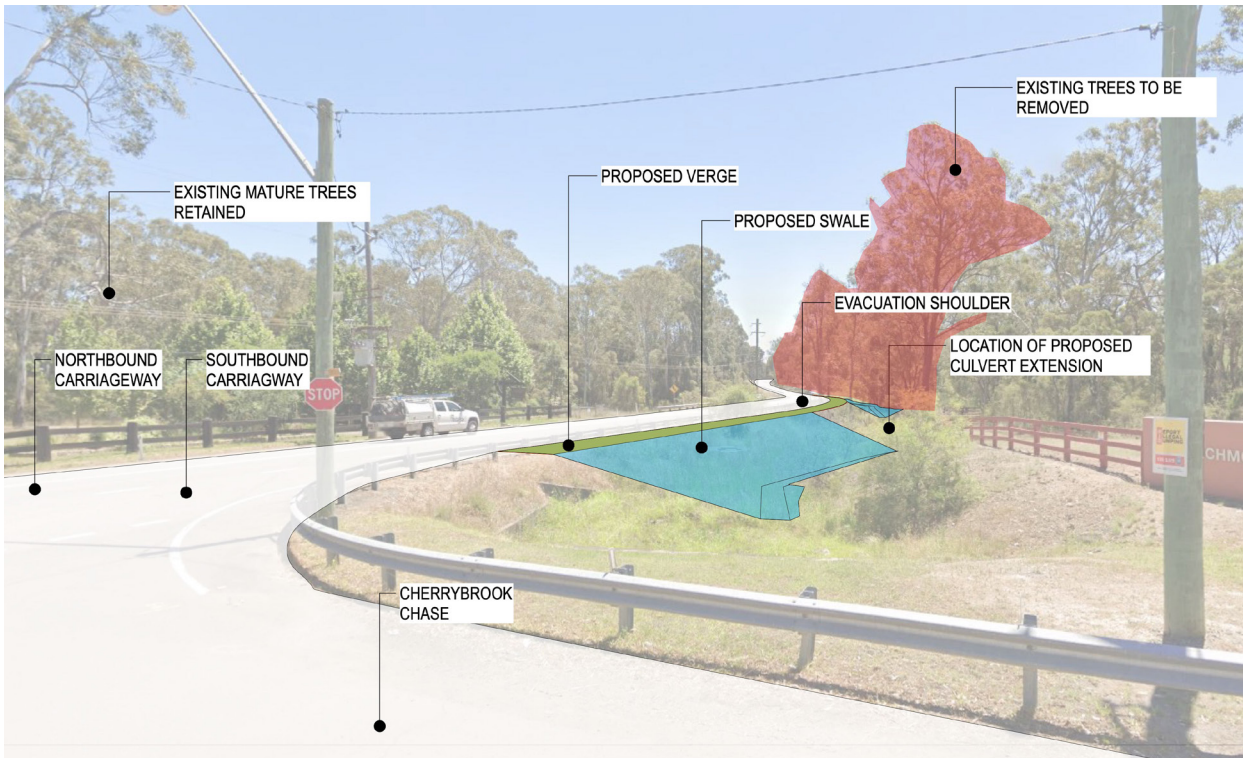


Figure 7-21: Viewpoint 7 - Intersection of Londonderry Road and Cherrybrook Chase (facing north) - Proposal view

Sensitivity	Magnitude	Impact
Moderate The sensitivity is moderate based on the dominance of the Londonderry Road, associated transport infrastructure and other urban elements which dominate the otherwise rural view.	**Low** The magnitude of impact is considered low, due to the minimal impact of existing tree removal to the eastern side of Londonderry Road and culvert modifications in the foreground of the view.	**Moderate - Low**

Table 7-8: Visual impact summary viewpoint 7

7 Visual impact assessment

Viewpoint 8

Location and description

The viewpoint is located at the edge of the carriageway of Kenmare Road at the approach to the intersection with Londonderry Road and is facing south west, looking along Londonderry Road.

The major compositional elements of the view are the existing road infrastructure and footpath with isolated existing mature street trees located on both sides of the existing road, notably in front of single storey residential dwellings on the western side of the road.

Visible elements of the proposal

There would be an extension to the southbound carriageway width to accommodate an evacuation shoulder, but the most visible elements would be the extended road corridor with a relocated footpath and proposed swale.

Affected viewers

- Motorists
- Pedestrians
- Local residents.

Description of impacts

The sensitivity of this viewpoint is moderate, based on the rural residential setting to the existing road with isolated mature trees and grass verges.

The magnitude of impact is considered low, based on the visible elements of the proposal being low level impacts, with the exception of the removal of a few isolated existing mature trees to be removed on the eastern side of the road.

The overall impact is considered moderate to low.

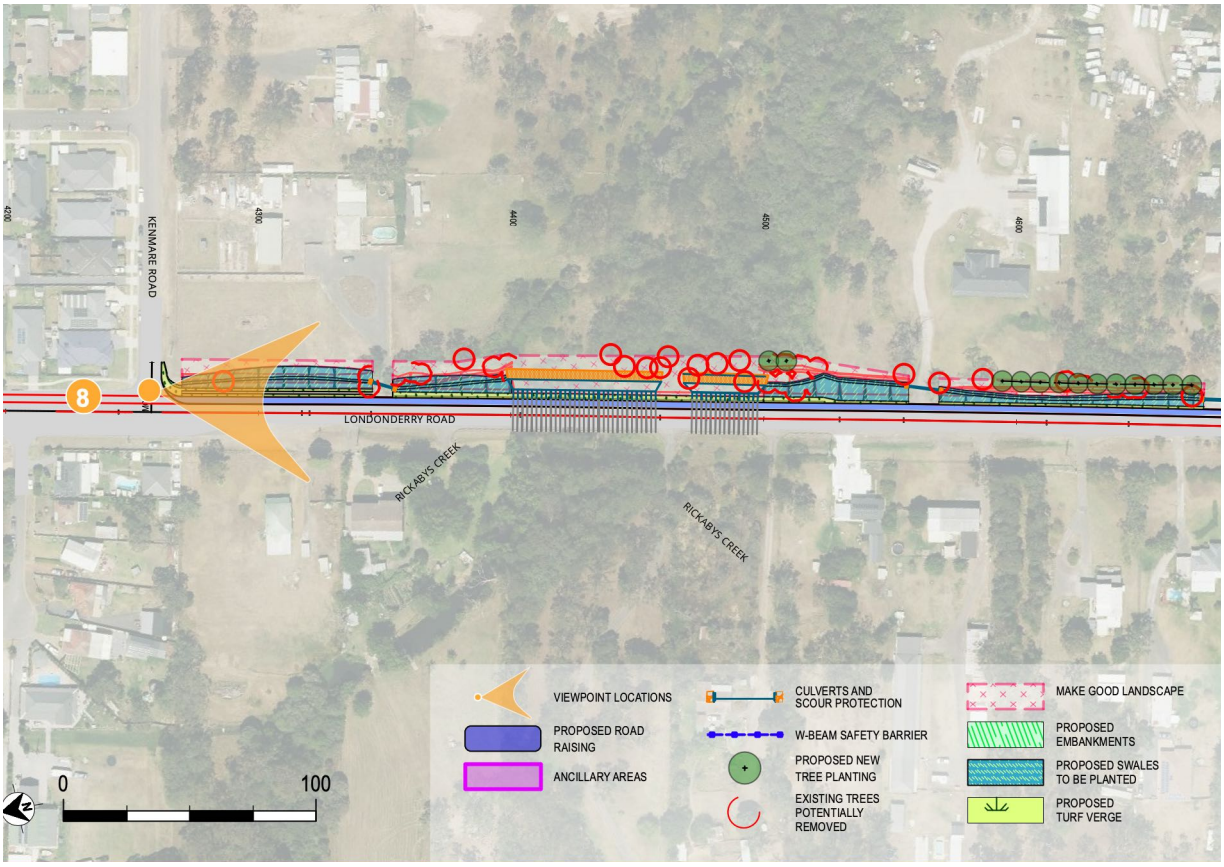


Figure 7-22: Viewpoint 8 location plan

7 Visual impact assessment

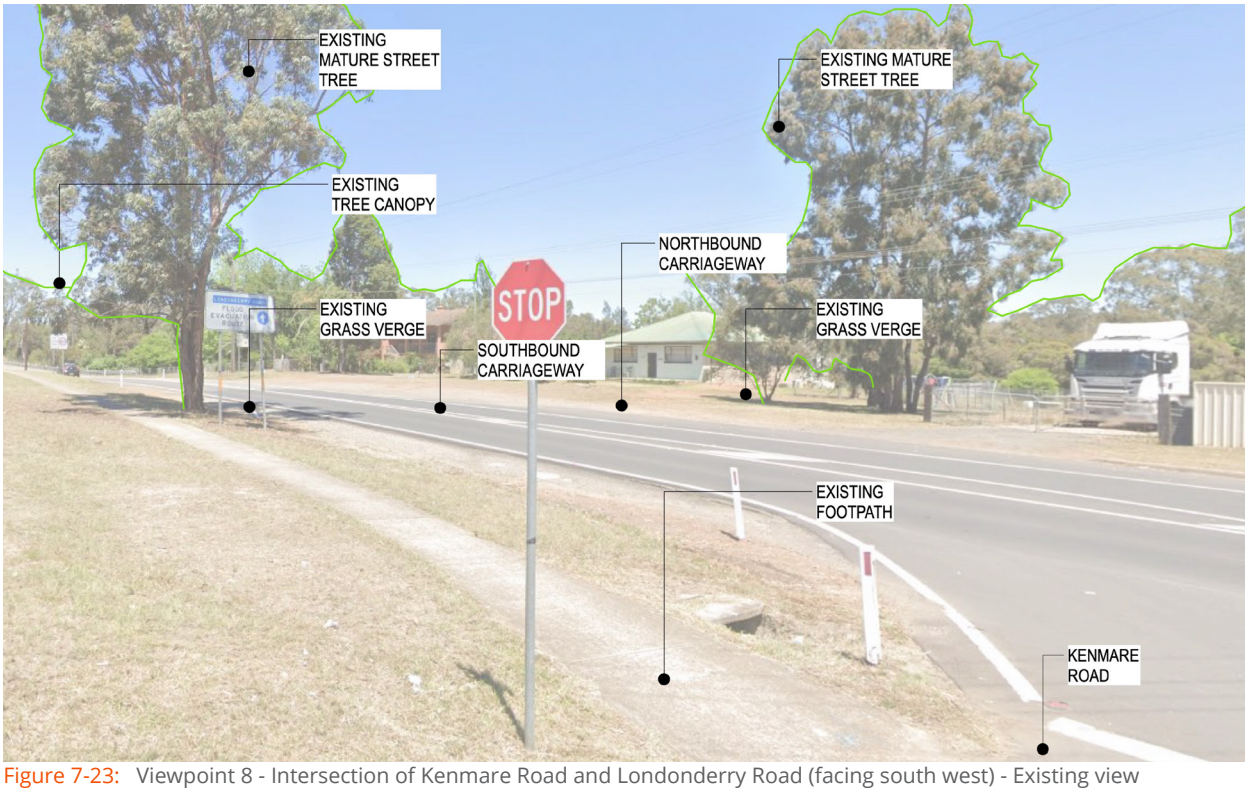


Figure 7-23: Viewpoint 8 - Intersection of Kenmare Road and Londonderry Road (facing south west) - Existing view

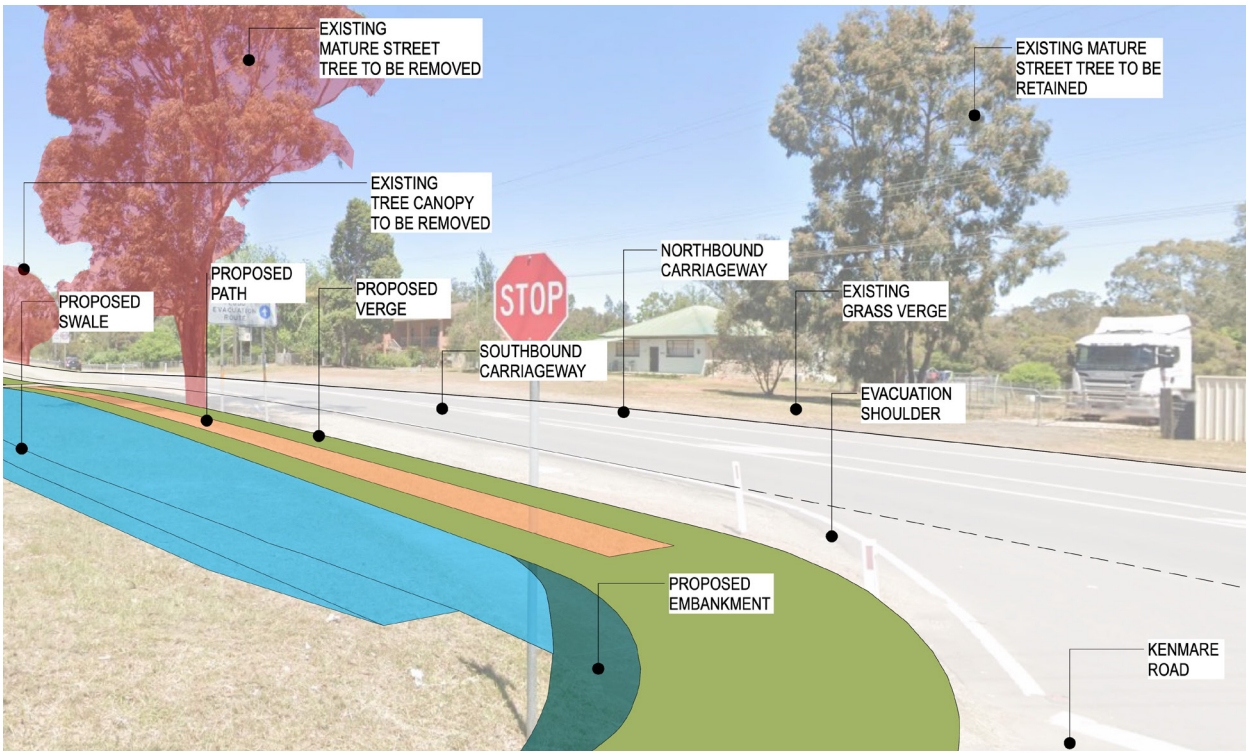


Figure 7-24: Viewpoint 8 - Intersection of Kenmare Road and Londonderry Road (facing south west) - Proposal view

Sensitivity	Magnitude	Impact
Moderate The sensitivity to change is considered moderate based on the rural residential setting to the road.	**Low** The magnitude of impact would be low based on the elements of the proposal only affecting the low level foreground view, with the exception of the removal of a few isolated mature trees in the middle-ground and background.	**Moderate - Low**

Table 7-9: Visual impact summary viewpoint 8

7 Visual impact assessment

Viewpoint 9

Location and description

The viewpoint is located on the intersection of Torkington Street and Londonderry Road, facing towards the east and Londonderry Public School.

The major compositional elements of the view are the existing mature street trees surrounding the primary school, within the school grounds and in the grass verge, opposite the viewpoint.

The buildings that characterise the view are the church set back from the road opposite the viewpoint and the primary school to the south of the view. Londonderry Road is an existing two lane road with kerb and gutters at this location, which runs next to the school.

Visible elements of the proposal

Within this viewpoint there would be no visible elements as the evacuation shoulder would utilise the existing road pavement.

Affected viewers

- Motorists
- Pedestrians
- Local residents on adjoining streets.

Description of impacts

Whilst the primary school setting with existing mature trees represent a moderate sensitivity to the view, the magnitude of the visual impact is negligible. This area of Londonderry Road would be unaffected, except for any 'make good' landscape works to the existing turf verge.

The resultant overall impact is negligible.

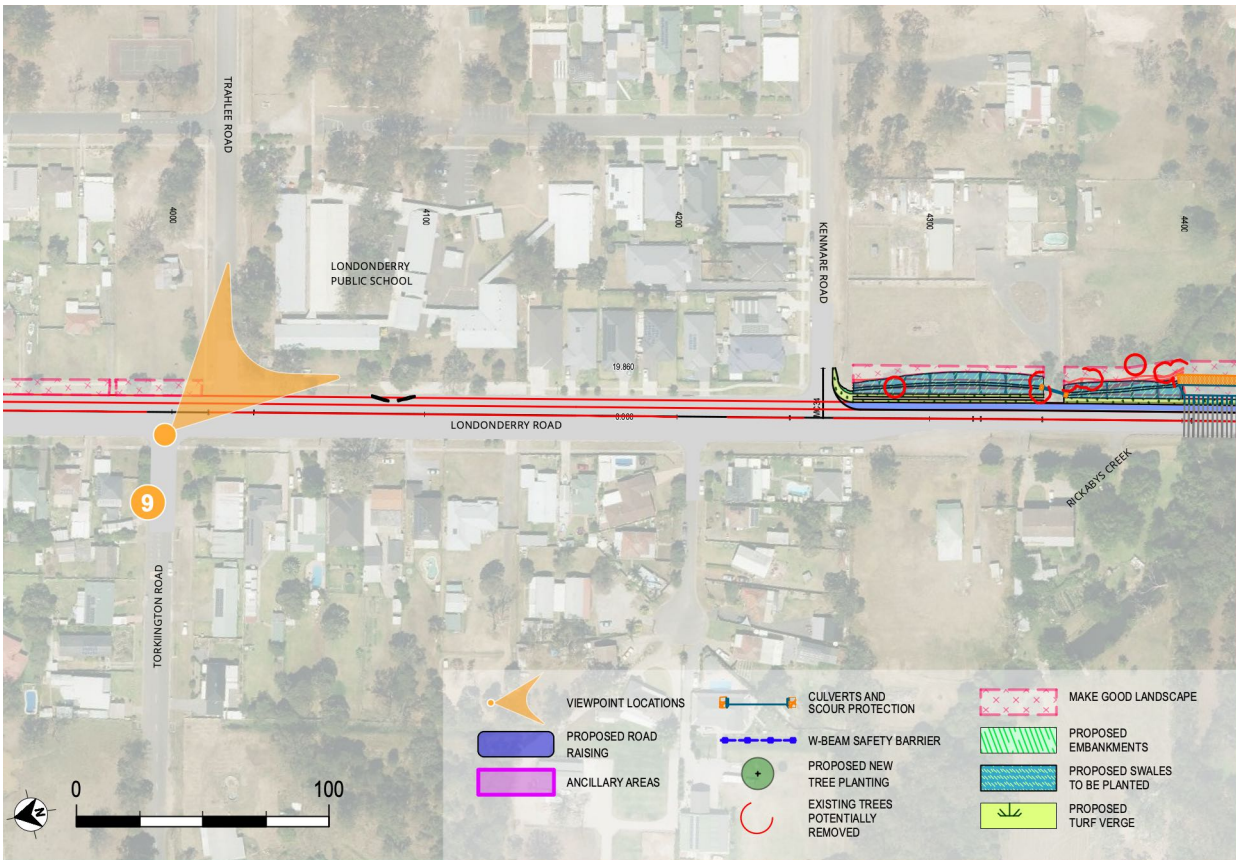


Figure 7-25: Viewpoint 9 location plan

7 Visual impact assessment

Figure 7-26: Viewpoint 9 - Intersection of Torkington Street and Londonderry Road (facing east) - Existing view

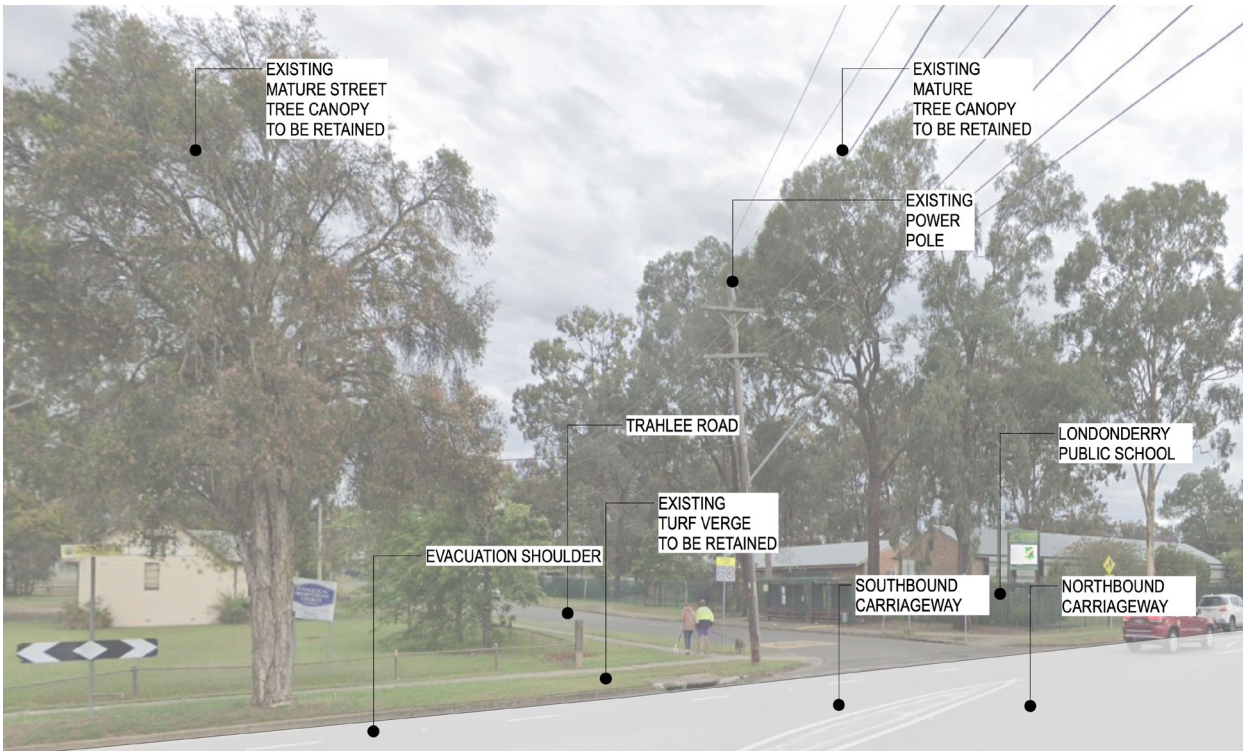


Figure 7-27: Viewpoint 9 - Intersection of Torkington Street and Londonderry Road (facing east) - Proposal view

Sensitivity	Magnitude	Impact
Moderate The sensitivity is considered moderate based on the school and mature tree setting to the existing road.	**Negligible** The magnitude of impact is negligible with the evacuation shoulder being accommodated within the existing road pavement and the only potential impact being 'making good' the works to the existing verges.	**Negligible**

Table 7-10: Visual impact summary viewpoint 9

7 Visual impact assessment

Viewpoint 10

Location and description

The viewpoint location is at the intersection of Namatjira Avenue and Londonderry Road, facing north along Londonderry Road.

The main visual compositional elements of the view are the residential and commercial elements on the western side of the road, next to the northbound carriageway and the existing mature roadside vegetation on the eastern side of the road, next to the southbound carriageway.

To the western side of the northbound carriageway, the view is residential focussed with a more urban setting to the road corridor. The low level elements include a grassed verge with pedestrian path, road kerb and asphalt shoulder. In the background of the view, the residential properties change from single storey typical suburban homes to become larger private rural lots with longer driveway set backs and the pedestrian path discontinues.

To the eastern side of the southbound carriageway there is a more rural visual character. There is an informal gravel verge to the edge to the existing road with existing roadside trees in close proximity to this with an informal understorey of native grasses. These trees currently form a visual screen to the RAAF Londonderry site which is set back beyond the trees.

Visible elements of the proposal

There would be an extension of the southbound carriageway to replace and extend the area of the existing gravel verge with an evacuation shoulder. There would also be a narrow verge and low embankment to tie the extended road width to existing ground levels.

The most visible element of the proposal would be the removal of existing roadside trees impacted by the proposal works or the change to the existing ground level at this location. A number of existing trees would also be removed due their location within the construction/ disturbance zone of these works.

Affected viewers

- Motorists
- Pedestrians
- Local residents.

Description of impacts

The sensitivity of this viewpoint is considered moderate, based on the proximity of residential properties. The magnitude of the visual impact of the widening of the road next to the southbound carriageway would be relatively low, however when combined with the number of existing trees that would require removal, it is considered moderate.

The overall visual impact is considered moderate.

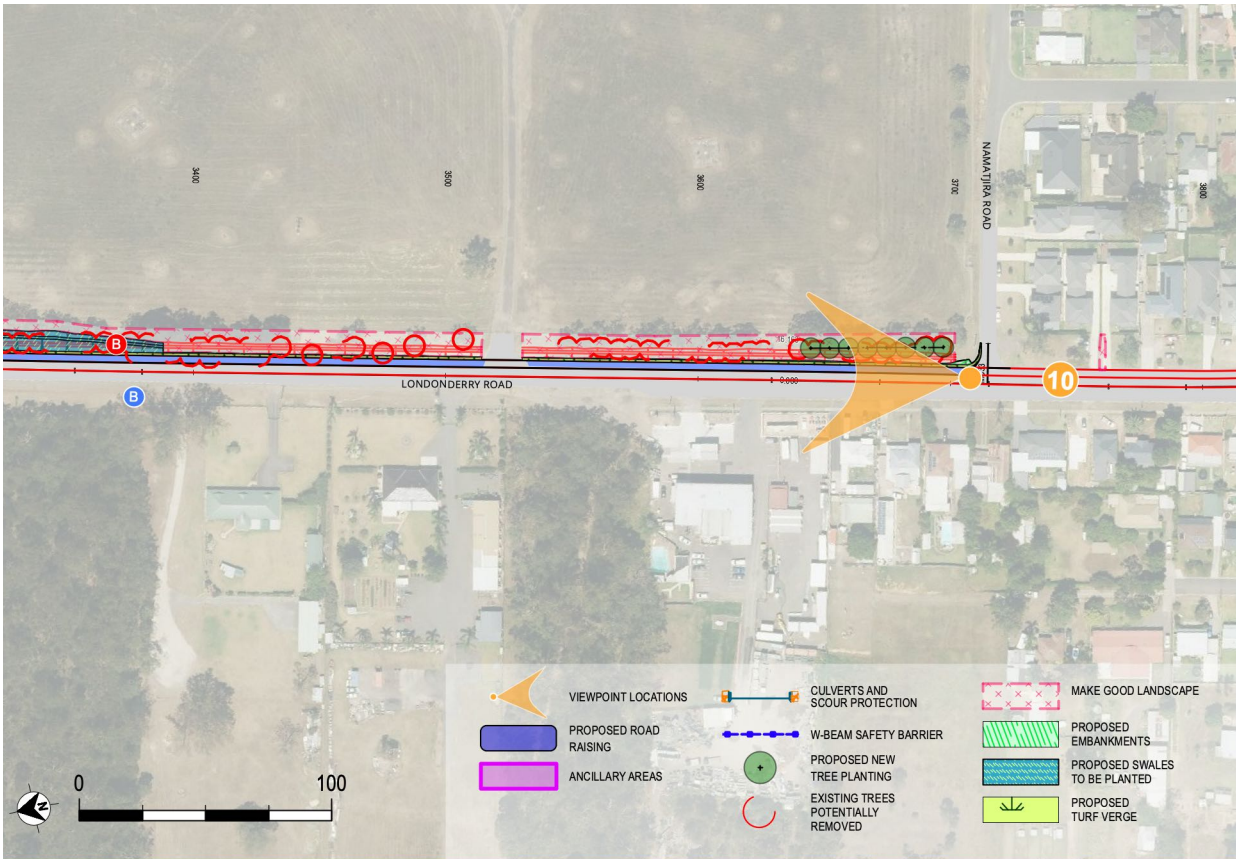


Figure 7-28: Viewpoint 10 location plan

7 Visual impact assessment

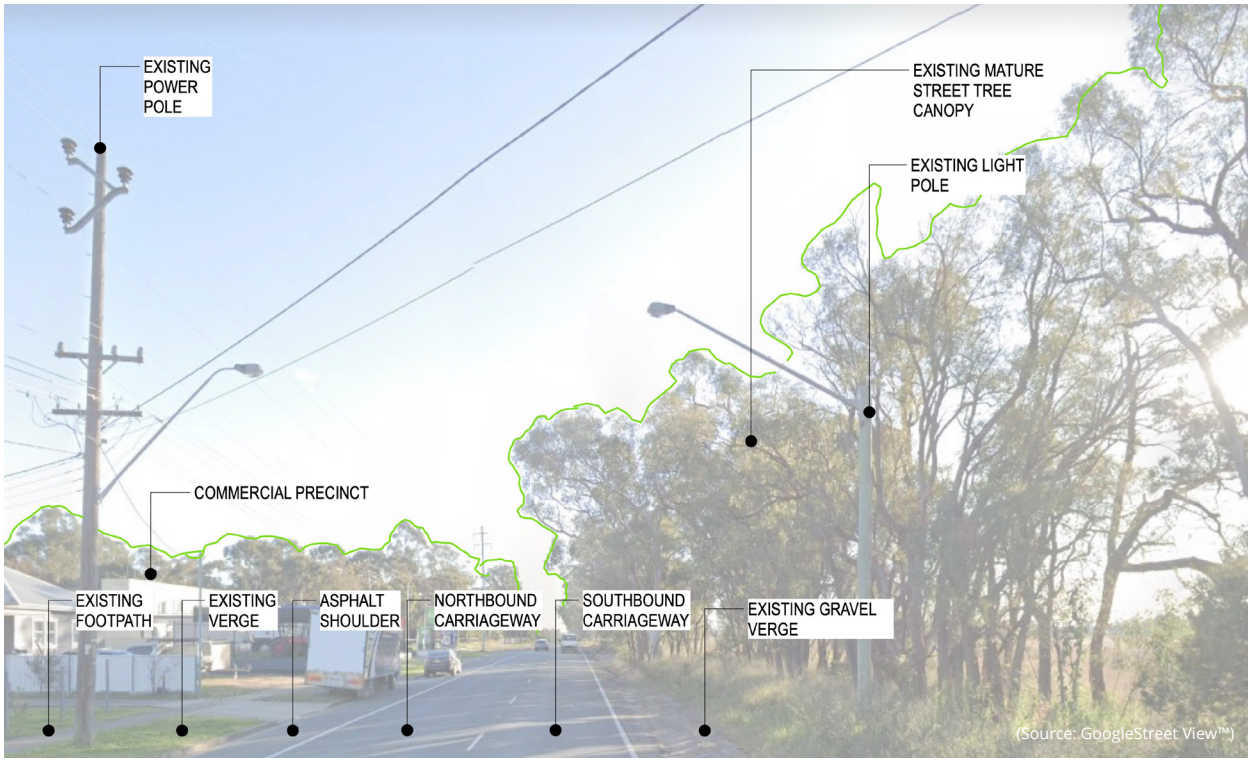


Figure 7-29: Viewpoint 10 - Intersection of Namatjira Avenue and Londonderry Road (facing north) - Existing view

Figure 7-30: Viewpoint 10 - Intersection of Namatjira Avenue and Londonderry Road (facing north) - Proposal view

Sensitivity	Magnitude	Impact
Moderate The urban nature of part of this view comprising some commercial properties and the existing road is offset by the sensitivity of the residential properties and the rural setting of the existing roadside trees and informal grass verge. The overall sensitivity is considered moderate	**Moderate** The magnitude of the visual impact of the proposal is considered moderate based on the existing roadside vegetation being removed opposite residential properties, including trees which would most likely be removed for the construction of the evacuation shoulder.	**Moderate**

Table 7-11: Visual impact summary viewpoint 10

7 Visual impact assessment

Viewpoint 11

Location and description

The viewpoint is located on the northbound carriageway of Londonderry Road, just north of the intersection with The Driftway, but south of the intersection with Southee Road. To the west of the viewpoint (next to the northbound carriageway) is the EucFACE experimental facility and associated access.

The viewpoint comprises the two lane carriageway of Londonderry Road and nearby vegetation. Immediately next to the southbound carriageway are isolated stands of native mature trees within the adjoining private rural lots, which is typical for this northern portion of Londonderry Road.

Larger stands of native trees are located nearby to the northbound lane, beyond an initial grass verge set back to the existing road edge. These trees are part of the Eucalyptus Free Air Carbon Dioxide Enrichment regeneration experimentation facility (EucFACE facility), run by Western Sydney University.

Visible elements of the proposal

There would be an extension to the southbound carriageway width to accommodate an evacuation shoulder which would incorporate the existing asphalt shoulder. The associated construction of swales next to the southbound carriageway would result in a number of the existing mature roadside trees being removed due to the proximity of the proposal or associated construction activities.

Affected viewers

- Motorists
- Local residents.

Description of impacts

The sensitivity of this viewpoint is considered moderate, based on the existing semi-rural setting of the view. The existing road is a clear component of the existing view which is framed by existing roadside vegetation, notably to the western side of the road (next to the southbound carriageway).

The magnitude of the visual impact of the proposal would be low based on the removal of some of the existing mature street trees nearby to the southbound carriageway that would be removed.

The overall visual impact is considered moderate to low.

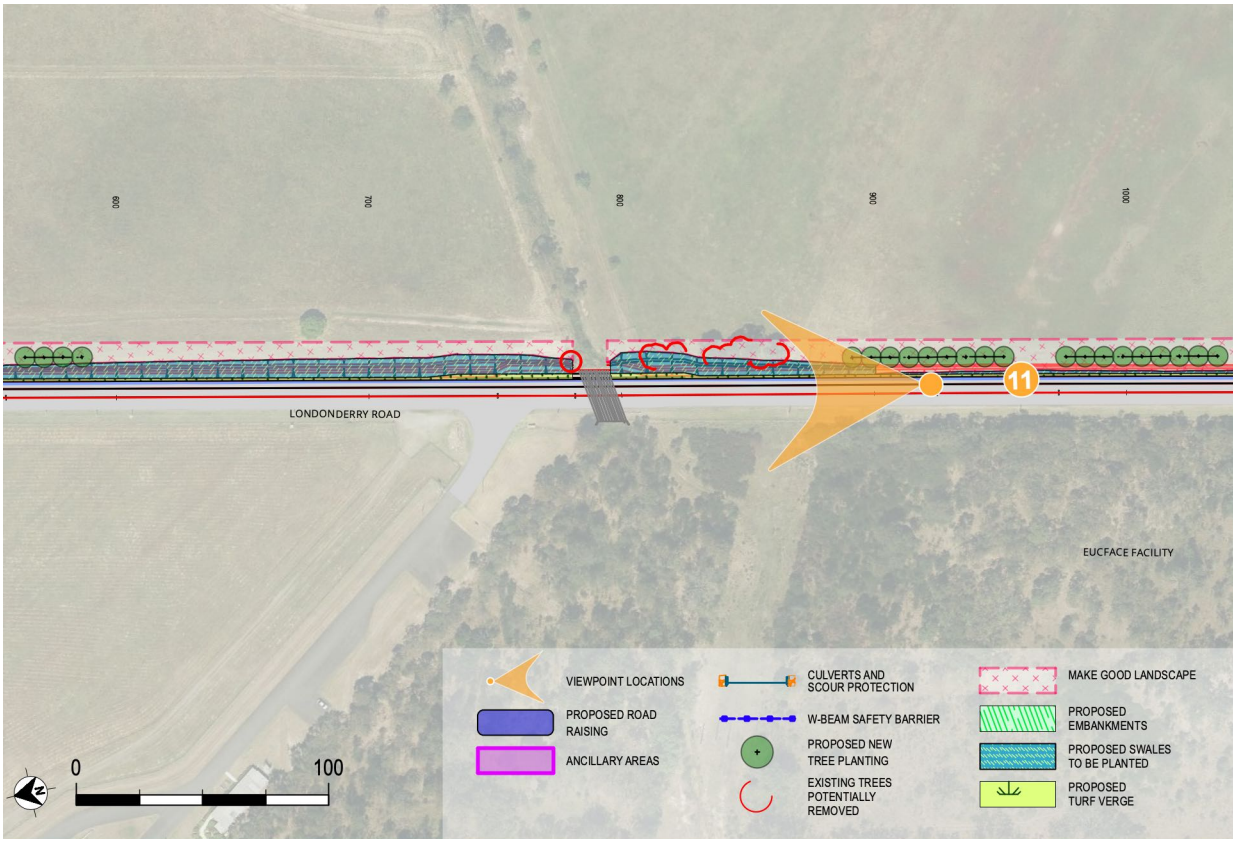


Figure 7-31: Viewpoint 11 location plan

7 Visual impact assessment

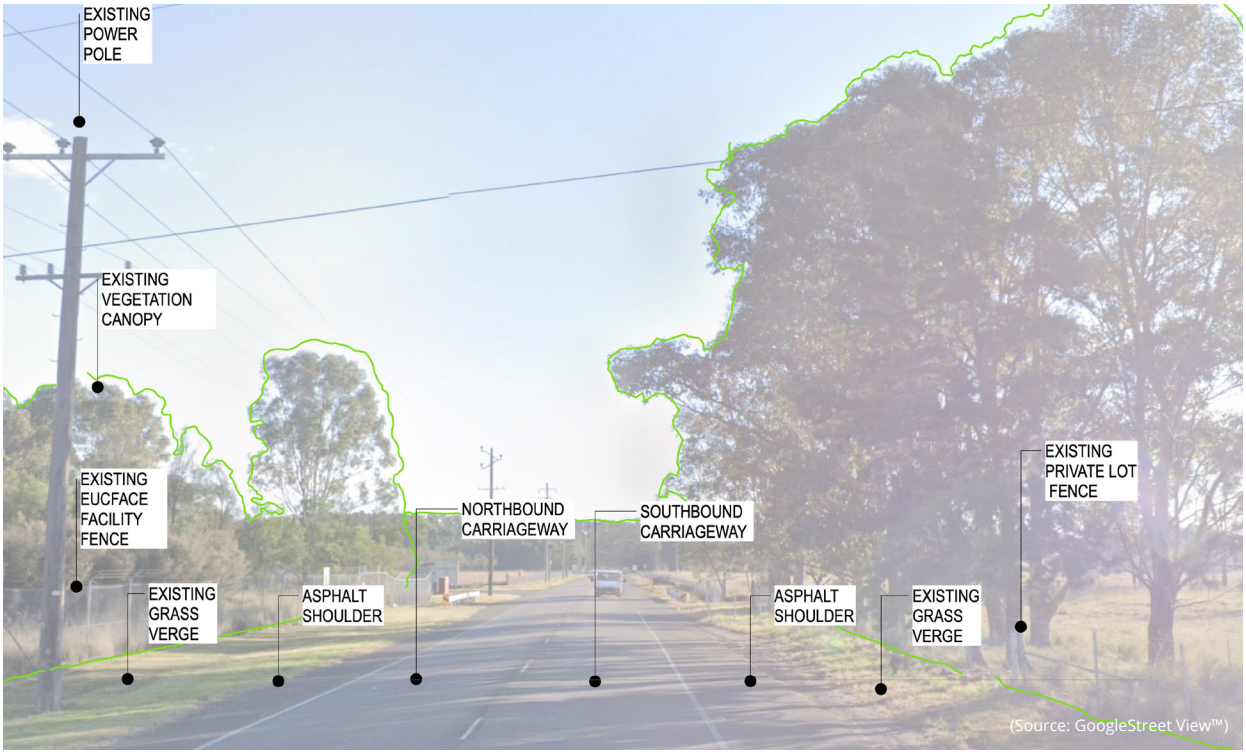


Figure 7-32: Viewpoint 11 - Londonderry Road near The Driftway (facing north) - Existing view

Figure 7-33: Viewpoint 11 - Londonderry Road near The Driftway (facing north) - Proposal view

Sensitivity	Magnitude	Impact
Moderate The sensitivity of the view is considered moderate based on its semi-rural setting and the presence of the current road infrastructure with asphalt shoulders and informal grass verges.	**Low** The overall magnitude of visual impact is considered low. Some isolated mature trees next to the southbound carriageway would be removed as part of the proposal and its construction, however the major visible elements of the proposal would be low level elements with limited impact on the existing view	**Moderate - Low**

Table 7-12: Visual impact summary viewpoint 11

7 Visual impact assessment

Viewpoint 12

Location and description

The viewpoint is located close to the entry to the Anglicare retirement facility on Londonderry Road, facing south. The EucFACE experiment facility occupies land on the opposite side of the road, nearby to the northbound carriageway.

The main compositional element of the view is the open rural landscape to both the east and western sides of the existing two lane road, which itself has a rural character comprising existing asphalt shoulders without kerbing.

As part of the rural landscape there are stands of mature native bushland trees, largely in the background of the view to the western side of the road.

The Anglicare retirement facility is set back from the eastern side of the road, with an access road off the southbound carriageway in the middle-ground of the view (screened by existing trees). The associated low level buildings have little dominance to the existing view.

Visible elements of the proposal

There would be an extension to the southbound carriageway width to accommodate an evacuation shoulder, which would include the existing asphalt shoulder. The main visible elements of the proposal would however be the proposed swale close to the southbound carriageway.

Affected viewers

- Motorists
- Local retirement facility residents
- Eucalyptus regeneration facility workers

Description of impacts

The sensitivity of this viewpoint is considered moderate based on the open rural setting of the existing view but with the existing road infrastructure dominating the view.

The magnitude of impact is considered low, based on the visible elements of the proposal being at a low level and therefore having limited impact on the existing view.

The overall visual impact of the proposal is considered moderate to low at this viewpoint.

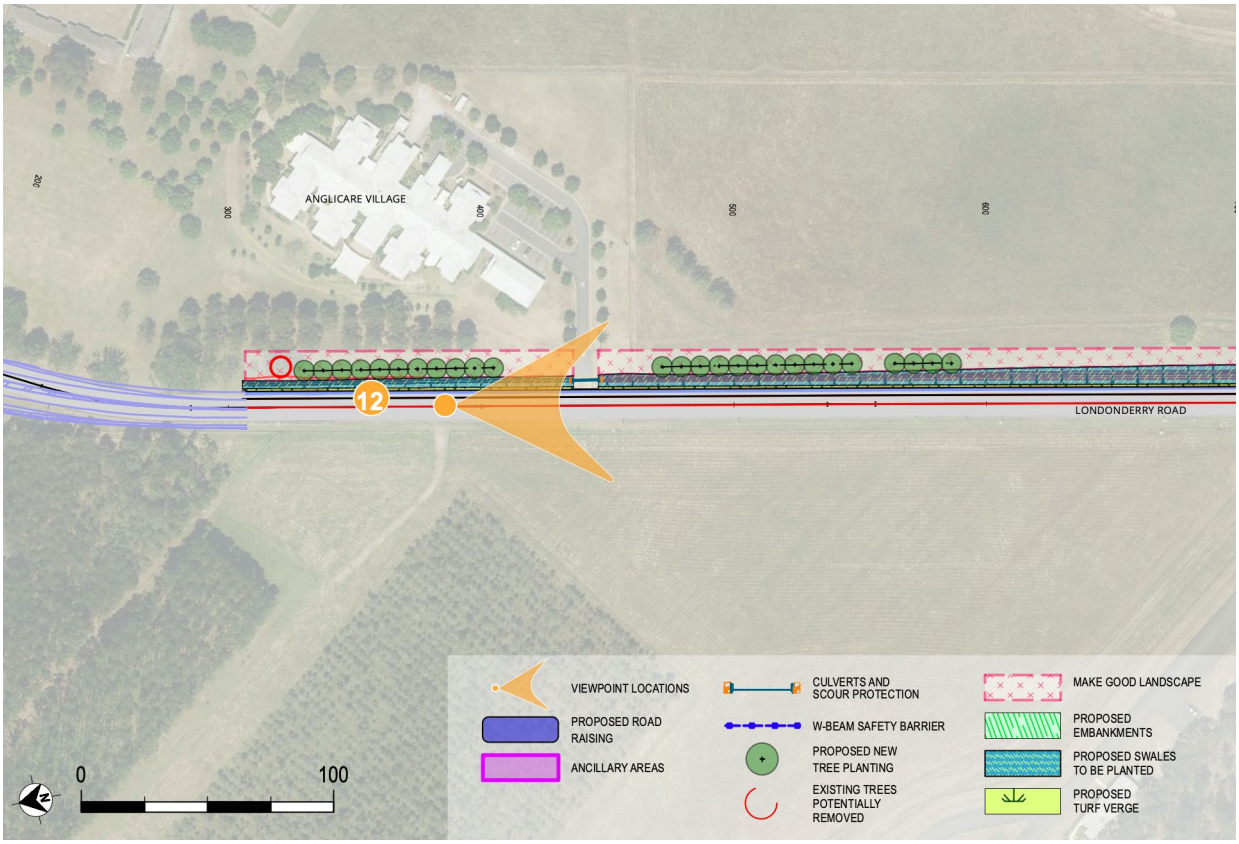


Figure 7-34: Viewpoint 12 location plan

7 Visual impact assessment

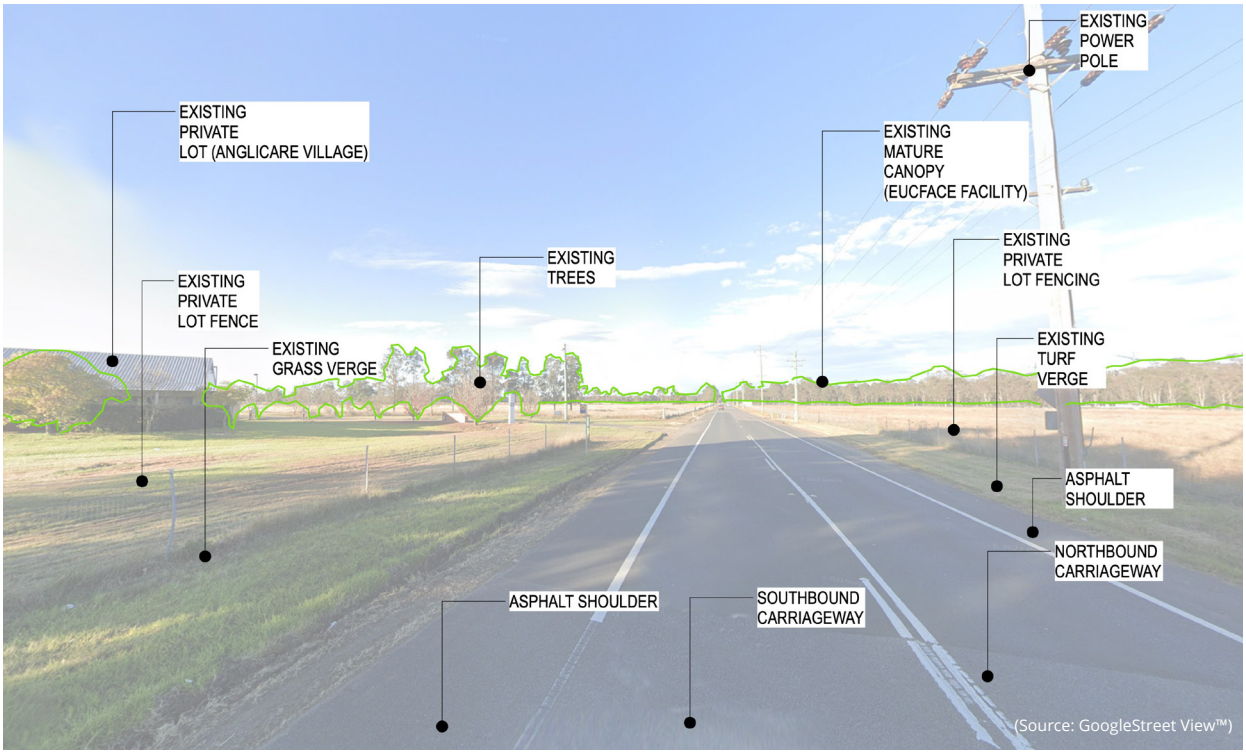


Figure 7-35: Viewpoint 12 - Entry to Anglicare retirement facility, Londonderry Road (facing south) - Existing view

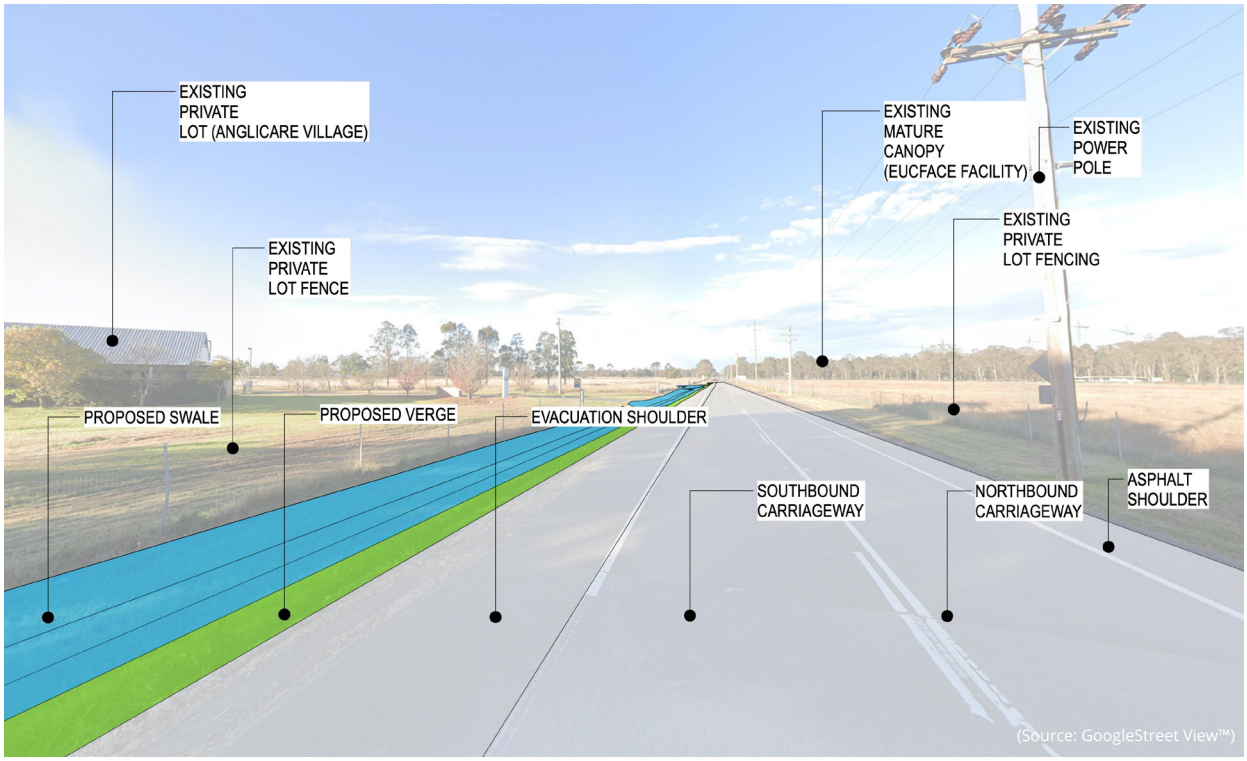


Figure 7-36: Viewpoint 12 - Entry to Anglicare retirement facility, Londonderry Road (facing south) - Proposal view

Sensitivity	Magnitude	Impact
Moderate The sensitivity of this viewpoint is considered moderate, based on the semi-rural setting of the existing view with some presence of built form and infrastructure.	**Low** The magnitude of the visual impact on this view is considered low based on the major visible elements being low level and therefore having limited impact on the existing view. There are also no existing trees that would require removal at this viewpoint.	**Moderate - Low**

Table 7-13: Visual impact summary viewpoint 12

7 Visual impact assessment

7.3 Summary of visual impact assessment

The visual impact assessment has identified twelve viewpoints. Three of the viewpoints are considered to have a moderate visual impact, Viewpoints 3, 5 and 10. Viewpoint 3 is located on The Northern Road, looking towards the intersection with Vincent Road (at the southern end of the proposal). At this viewpoint, the proposal includes the repositioning of The Northern Road carriageways within the road corridor, and incorporates an evacuation shoulder adjoining the southbound carriageway. It also features two rows of removable, flexible medians on the approaches to the intersection and a wide embankment to tie back into existing ground levels. Whilst the proposal should limit any potential impact on the Aboriginal Land Council land, it would result in some existing mature trees being removed. These are mainly restricted to existing residential screen planting, but some trees to the very edge of the Wianamatta Nature Reserve would also be removed. Viewpoint 5 is on The Northern Road (in the northern portion of the proposal) near the Francis Greenway Correction Complex and is representative of the typical construction of swales along The Northern Road with associated tree removal required. Trees to be removed should be restricted generally to the first one to two rows back from the road where there are stands of native bushland. Viewpoint 10 is on Londonderry Road and illustrates typical elements of the proposal (swales, the evacuation shoulder and groups of existing trees to be removed).

Seven of the viewpoints are assessed to have a moderate to low overall visual impact. These are viewpoints 1, 2, 4, 7, 8, 11 and 12. Viewpoints 1 and 2 are on The Northern Road at the southern end of the proposal and illustrate generally low level impacts of the proposal. Viewpoints 4, 7, 8, 11 & 12 are on Londonderry Road and illustrate either low or moderate magnitudes of visual impact. The sensitivity rating of each viewpoint contributes to the overall visual impact rating. Viewpoints 11 and 12 are located at the northern end of Londonderry Road, approaching the intersection with The Driftway. They are typically located in areas with a rural setting of existing open views, isolated mature tree stands or distant stands of native bushland, resulting in a moderate sensitivity to change. Viewpoint 7 is also on Londonderry Road and displays swales, the evacuation shoulder, and groups of existing trees to be removed, the extent of which would be dependant on the proximity of the proposal works to existing tree locations.

Two viewpoints are considered to have either a low or a negligible visual impact. These are viewpoints 6 on The Northern Road and 9 on Londonderry Road. The low rating of viewpoint 6 is based on its location nearby to the roundabout intersection of Londonderry with Richmond Road (at the northern end of the proposal) and the limited impact of the low level elements of change. Viewpoint 9 is located facing Londonderry Public School (on Londonderry Road) and would have a negligible visual impact, since there are little or no above ground elements to proposal at this location, with works being limited to underground drainage.

VP	Location	Sensitivity	Magnitude	Impact
HNV State Roads				
1	The Northern Road near Livvi's Playground (facing north east)	Moderate	Low	**Moderate - Low**
2	The Northern Road near Ninth Avenue (facing north west)	Moderate	Low	**Moderate - Low**
3	The Northern Road (facing north east) looking towards the Vincent Road intersection	Moderate	Moderate	**Moderate**
4	Intersection of Londonderry Road with The Northern Road and Cranebrook Road (facing south west)	Low	Moderate	**Moderate - Low**
5	The Northern Road near Francis Greenway Correctional Complex (facing south west)	Moderate	Moderate	**Moderate**
6	Intersection of Richmond Road with The Northern Road (facing south)	Low	Low	**Low**
7	Intersection of Londonderry Road and Cherrybrook Chase (facing north)	Moderate	Low	**Moderate - Low**
8	Intersection of Kenmare Road and Londonderry Road (facing south east)	Moderate	Low	**Moderate - Low**
9	Intersection of Torkington Street and Londonderry Road (facing east)	Moderate	Negligible	**Negligible**
10	Intersection of Namatjira Avenue and Londonderry Road (facing north)	Moderate	Moderate	**Moderate**
11	Londonderry Road near The Driftway (facing north)	Moderate	Low	**Moderate-Low**
12	Entry to Anglicare retirement facility, Londonderry Road (facing south)	Moderate	Low	**Moderate-Low**

Table 7-14: Viewpoint assessment summary

7 Visual impact assessment

7.4 Impacts during construction

Construction methodology and staging

Details of the construction methodology and staging of the works would be developed further at the detailed design stage. For concept design stage, to assess the likely landscape character and visual impacts of the proposal construction, a basic sequencing of the road works is assumed:

- Site establishment at ancillary facilities
- Site set-out and survey
- Tree removal
- Utility relocation works
- Box out and excavation of new pavement
- New stormwater pits and connections
- Pavement construction
- Line marking
- Site demobilisation.

Ancillary facilities

The construction stage of the proposal would involve the formation of ancillary facility sites. An 'ancillary facility' is a term used to describe the allocated areas of land, separate to the site, which support the construction works temporarily. The construction works, and ancillary facilities, would have landscape character impacts on their surroundings, and visual impacts for receptors, such as residents, visitors and motorists.

The extent of these landscape character and visual impacts would vary on the specific usage of each ancillary facility, and the duration of time it operates for before being 'made good'. Potential ancillary facility uses include:

- Site compound areas for site offices and parking facilities
- Storage of materials
- Storage of various types of construction vehicles, from light vehicles and rollers through to delivery trucks, concrete mixers and excavators
- Accommodating generators required for providing electricity to site and compound areas.

Potential landscape character and visual impacts

The proposal construction, and the introduction of these ancillary facilities, would result in temporary landscape character and visual impacts. These include:

- Visual presence of temporary buildings, stockpiles of materials, vehicles and machinery
- Noise from machinery and vehicles, audible from neighbouring properties
- Light spill from night time activities
- Visual and audible impact from construction activities on and around the road corridor
- Potential loss of vegetation, including mature trees.

These impacts would be more noticeable in residential areas, and in recreational open spaces where the landscape character is more sensitive to change.

There are two general types of ancillary facility proposed for the concept design stage. These are:

- Smaller ancillary facilities, along the road corridor, which would be staged
- Larger ancillary facilities, located in areas of disused or recreational open space, near to the road corridor, which would be used for comparatively longer periods of time.

The smaller ancillary facilities would be located in more urban settings on the road corridor and would temporarily exaggerate the existing urban character of the areas through construction activities and noise. They would also temporarily provide more human elements in the semi-urban views, such as vehicles, machinery, buildings, and the storage of construction materials.

The larger ancillary facilities, located in areas of open space, would temporarily disturb the otherwise more rural character of the areas. They would alter the nature of the views, dominated by open space and vegetation, making them appear more urban. However, these areas are less likely to be as readily visible by receptors such as residents and motorists.

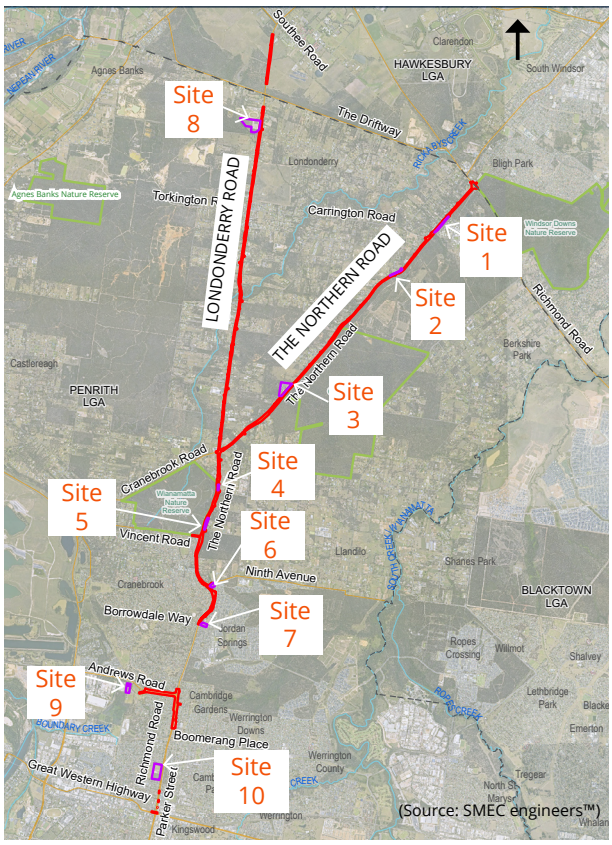


Figure 7-37: Ancillary facility areas key plan

7 Visual impact assessment

Location of ancillary facilities

The two general types of ancillary facility associated with this proposal are:

- Those located along the road corridor which would be staged (10, 9, 5, 4, 2 and 1) illustrated in Figure 6-3 on page 47 and Figure 6-4 on page 48
- Those located in areas of open space, either disused or recreational (8, 7, 6 and 3) illustrated in Figure 7-37 and below in Plate 7-2 to Plate 7-5.

The ancillary facilities highlighted below, positioned in open space areas near the road corridor, would be comparatively larger than the ancillary facilities located along the road corridor, and would likely be in operation for a longer time.

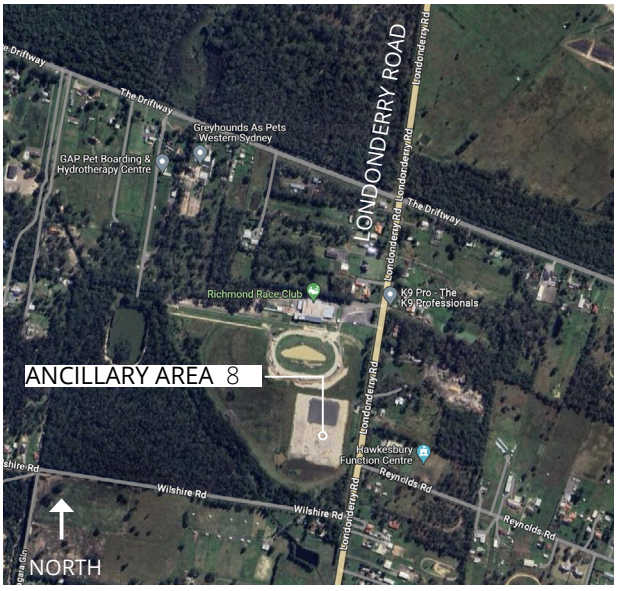


Plate 7-2: Ancillary Area 8

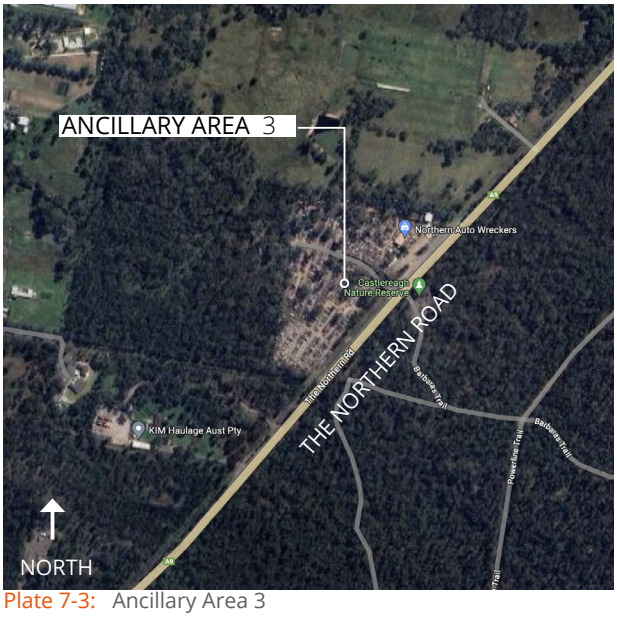


Plate 7-3: Ancillary Area 3

Plate 7-4: Ancillary Area 6

Plate 7-5: Ancillary Area 7

The Northern Road near Wianamatta Reserve

8 Mitigation strategy

8.1 Chapter overview

This section provides a strategic, corridor-wide mitigation strategy to reduce the landscape character and visual impacts of the proposal.

This is supplemented by suggested safeguarding measures that should be reviewed and enforced as the proposal progresses through the detailed design and construction stages.

8.2 Mitigation incorporated into the concept design

The landscape and urban design concept responds to the overall proposal objectives and principles set out in Section 3 on page 18. An explanation of the steps taken to integrate these objectives and principles into the urban design concept, in order to mitigate potential landscape character and visual impacts of the proposal from the start, are set out in Section 4 on page 23.

8.3 Strategic mitigation measures for the detailed design stage

The detailed design of the proposal is to respond to the urban design strategy through the objectives and principles, included in Section 3 on page 18. These provide the basis for landscape-specific, corridor-wide, design mitigation measures which informed the concept design and would continue to direct the detailed design of the proposal.

The urban design strategy was developed using the guidelines included in Transport's urban design policy, *Beyond the Pavement*. The detailed design should follow the guideline's four physical urban design objectives:

1. Ensure a sensitive fit with the built, natural, and cultural environment
2. Contribute to accessibility and connectivity for all modes of movement
3. Contribute to the design quality of the public domain
4. Help revitalise areas and contribute to the local and broader economy.

As part of these objectives (and principles as outlined in Section 3 on page 18) the following key strategic mitigation measures are to guide the detailed design of the proposal:

- Plant new trees to help mitigate the removal of existing trees and reduce the UHI effect
- Restore areas and planting disturbed through construction, with 'make good' landscape works as a minimum
- Select endemic plant species/species that align with the local character of the existing landscape.

There would be an integrated approach to the urban design development, which is to be supported by project teams including urban design contractors from Transport's *Registration Scheme for Construction Industry Contractors*.

8 Mitigation strategy

8.4 Safeguarding measures for the construction stage

The construction stage of the proposal would have landscape character and visual impacts, which have been outlined on page 76. Below are a range of safeguarding measures recommended for consideration which would reduce the impact of the proposal at the construction stage:

- Where nominated, suitable screening barriers are to be provided when construction activities are visible from near by areas
- Existing footpaths, SUPs and cycleways, which require diversion, to have suitable alternative routes provided during construction period
- Existing trees and exclusion zones, identified by an Arborist, to be protected for the duration of construction
- Progressive revegetation to be undertaken, to limit erosion and sedimentation, and speed up the visual assimilation of 'make good' areas
- Where possible, use of daylight hours working to reduce visual impact of temporary lighting and noise
- Ensure sediment and run-off control, reducing unsightly spill into surrounding areas
- Excess materials to be removed once construction is complete.

Ancillary facilities

Mitigating measures which apply to the ancillary facilities required during construction include:

- Ancillary facilities to be located, where possible, in areas where there would be minimal disruption to the existing landscape features
- Thoughtful positioning of ancillary facilities which are screened, where possible, by vegetation, temporary fencing or existing urban infrastructure
- Staging of activities to reduce disruption to residents, motorists and other users.

Once construction is complete, a landscape management plan is to be prepared to ensure regular monitoring and managing of the landscape re-instatement works. This would ensure the landscape restoration establishes over time, to achieve detailed design outcomes

9 Summary of Urban Design findings

Overview

Following an analysis of landscape context, the development of objectives, principles, strategies, an assessment of landscape character and visual impact has been undertaken in accordance with Transport guidelines.

The results of this assessment have been incorporated into the concept urban design drawings and are to be further refined during detailed design.

The landscape character and visual impact assessment of the proposal represents a qualitative assessment based on the landscape character zones and selected representative viewpoints, which have been determined based on an investigation of landscape and cultural context as well as an analysis of land use, vegetation, topography and scenic values. This analysis then proposes a series of mitigation and safeguarding measures that are to be utilised to help reduce the landscape character and visual impacts of the proposal.

Findings

This proposal is essentially a widening of the existing road to the southbound carriageway, to accommodate an evacuation shoulder. In addition a network of swales, new or upgraded culverts is proposed to improve drainage and help reduce road evacuation road resilience. Some areas of The Northern Road would also have the existing road level raised and in these areas more notable culverts are proposed.

The intersection of Vincent Road with The Northern Road is the only location where the alignment of the existing road (both northbound and southbound carriageways) has been amended to reduce the impact on Deerubbin LALC property (to the east), and Wianamatta Nature Reserve (to the west).

In visual and landscape character terms, most of the above referenced proposed engineering works, with the exception of the Vincent Road intersection with The Northern Road, would involve modification of the low level view and result in the installation of swales and low level embankments. Planting and turfing of swales and embankments are among the mitigation measures that would reduce this impact.

The greatest visual impact from the proposed engineering works would be the loss of the existing mature trees in several locations. Replacement tree planting is a major part of the mitigation measures that should help to reduce this visual impact, although it would be a number of years before these benefits are seen.

scape DESIGN

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