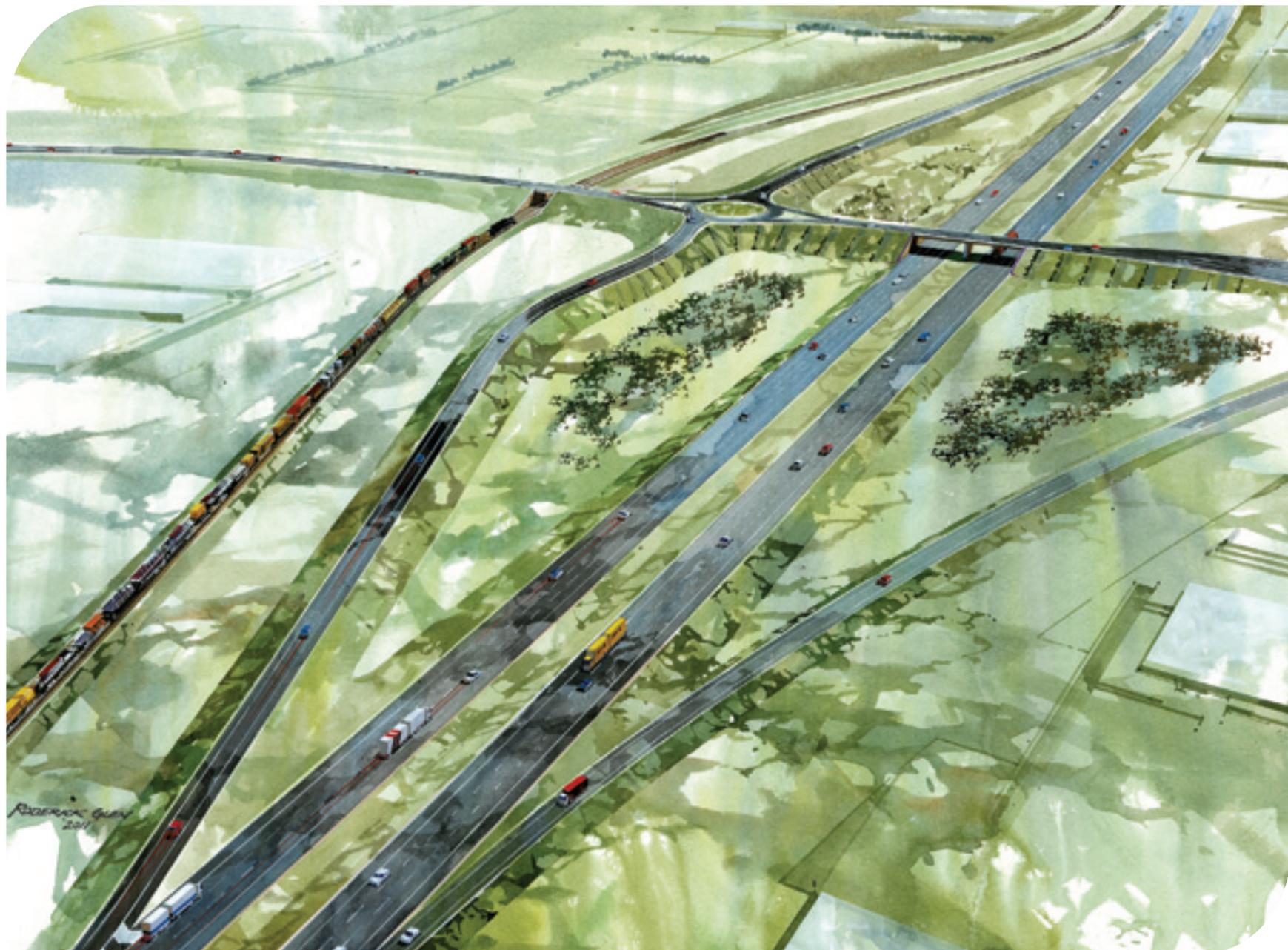


DELIVERING OUR TRANSPORT FUTURE NOW

north-south corridor northern connector



Project Impact Report Volume 2

An environmental, social and economic assessment



Government of South Australia
Department for Transport,
Energy and Infrastructure

DELIVERING OUR TRANSPORT FUTURE NOW

north-south corridor northern connector



Part D. Effects of the project on the social, cultural and economic environment.

Part D

- 10** Landscape, visual amenity and urban design
- 11** Noise and vibration
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10 Landscape, visual amenity and urban design

10.1 Introduction

The urban design framework established for the Northern Connector corridor aims to integrate and ameliorate its visual and physical impacts on the landscape. The Northern Connector will open significant urban design and landscape architecture opportunities.

10.1.1 Visual impact assessment approach

The study area is largely contained on the northern Adelaide Plains. Therefore, the visual impact assessment was undertaken for the corridor itself and for the surrounding areas, from which the Northern Connector will be viewed.

The visual impact assessment comprises an analysis of the landscape character and scenic quality of the project area, and an impact assessment of the existing site character in relation to the Northern Connector. The assessment also identifies any opportunities to enhance amenity, visual quality, mitigate visual obtrusions and capture scenic views.

The landscape site analysis was developed from a combination of site visits and desktop analysis to create an understanding of the landscape character and natural systems of the project corridor. It included:

- identifying and mapping pre-European plant associations and communities
- identifying the prevailing orientation, aspect, topography and drainage patterns along the corridor
- mapping the underlying geology and soil associations
- determining generalised weather patterns and climate factors, and identifying the soil moisture budget in the area
- mapping existing significant and remnant landscapes
- identifying and mapping existing views and vistas and well as vantage and focal points.

This analysis of the existing site and landscape character informed the process of visual and landscape impact assessment. It helped to develop the urban design framework, select the alignment, and reveal the engineering implications of project solutions.

For context, the corridor was split into landscape character zones based on the prevailing landform, land uses, existing vegetation, visual character and existing views and vistas. Each zone described and assessed for scenic quality and visual and landscape sensitivity.

Visual impact assessment methodology

The visual impact assessment viewed the site in its current condition. Its points of view were within the area of construction and outside the corridor to assess visual impact of the project on the surrounding areas and communities.

Likely impacts and opportunities were identified and recorded. They then informed and provided a basis for mitigation measures for the urban and landscape design, minimising impacts to the landscape and adjacent areas.

Existing conditions

Following definition of the nine landscape character zones, an extensive site-specific landscape-based analysis was undertaken via further field visits and desktop studies. Existing conditions were recorded in plan form based on the preliminary concept design as a guide to the potential impacts on the existing environment.

Landscape character area description

The first part of the visual assessment described each landscape character zone by identifying the existing character of the zone as well as land uses, land forms, landscape and visual features, existing views, built forms and local landmarks.

Scenic quality rating

The scenic quality of the landscape character zone was also qualitatively assessed and rated as low, moderate or high, based on an understanding of the project corridor's landscape character.

Visual and landscape sensitivity assessment

The sensitivity of the visual environment and landscape systems to potential changes was assessed and related to the level at which any visual change to a landscape character would affect viewers of the site in relation to prominence of views into the site and accessibility to views.

Potential impacts

The proposed alignment and interchanges of the Northern Connector were then assessed as to their impact on the landscape character area, and potential visual impacts or opportunities. Impacts included the diminishing of views, major interruption to landscape features and visual impact on residential properties. Opportunities were considered, such as potential views from the Northern Connector corridor to landscape features or scenic views of high scenic quality or interest to road users.

Negative visual impacts on existing residential properties are of more concern than those affecting potential road users. The impact on residents is permanent; the impact on road users is temporary. Negative impacts to road users are still a concern: the experience of the road user could affect tourism or social perception of the Northern Connector. An unattractive experience for the road user on the Northern Connector could affect public perception of the project.

10.1.2 Visual impact assessment terminology

Landscape character

Landscape character can be defined as a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse. Its elements include:

- geology and soils
- landform
- land use
- natural vegetation and wildlife
- agricultural patterns and practices
- residential patterns and building styles
- drainage
- modified landscapes
- visual amenity.

A combination of physical, biological and cultural attributes makes each landscape character area unique to its location at a point of time. Season change can bring a vastly different character to an area; the site was analysed throughout the year to produce a landscape character description.

Scenic quality

Scenic quality relates to an indication of the visual attractiveness or appeal of a landscape, by human perception, and to the inherent visual qualities of a landscape and to the views possible to or from that landscape. The scenic quality of each landscape character area was assessed in relation to the general scenic quality of the surrounding area and context in the Adelaide Plains.

Scenic quality is generally perceived through positive landscape characteristics or features such as:

- *Naturalness* — the proportion and integrity of the landscape in its apparently undeveloped natural condition
- *Vegetation and wildlife* — diversity and contrast of the vegetative land cover and associated fauna (if present)
- *Landform* — diversity and contrast (height, slope, pattern features) of the topography
- *Water and shoreline* — diversity and contrast of the shoreline, and the presence, extent and character of water forms

- *Pattern* — focal points, diversity, harmony, rhythm and juxtaposition of elements in the landscape throughout the setting
- *Built form and activity* — the contribution of built elements and cultural landscape modifications, and associated human activity
- *Interesting cultural features*
- *Distant scenic views* to features such as to the Mount Lofty Ranges.

Characteristics and features considered to contribute to negative or low scenic quality include:

- highly modified landscapes, high levels of human disturbance
- landscapes with few natural features, and few trees
- flat landforms with little variation in topography
- highly urbanised features, such as housing developments
- commercial, agricultural or industrial development of a landscape.

These assumptions of what contributes to positive or negative scenic quality are generalisations, and not applicable to all circumstances, viewers or landscapes.

The scenic quality ratings used for this assessment are:

High — considered to be above average in its surrounding landscape context, considered distinctive or of interest to the majority of viewers.

Moderate — considered to be average in its surrounding landscape context, and considered by to be reasonably pleasant by the majority of viewers.

Low — considered below average in its surrounding landscape context, with views in the area considered to be uninteresting or even unattractive by most viewers.

Visual and landscape sensitivity

Landscape sensitivity is a combination of the capacity of a landscape to visually 'absorb' development, structures, land clearing and other changes, and the presence of viewers, residents and their relative viewing distance. Steep, bare slopes have almost no capacity to screen development, with a low visual absorption capacity; tall dense forest on flat land can provide effective screening and low sensitivity to visual change.

Visual sensitivity is strongest around fixed viewing positions, residential areas and elevated viewing positions. The proximity of potential viewers correlates to sensitivity, with closer proximity generally creating higher sensitivity.

Landscape sensitivity relates to the sensitivity of a site's landscape character and landscape systems to potential change associated with development of the site. The most sensitive landscape systems are natural systems, including watercourses and vegetated areas. Other sensitive sites may include socially important or culturally significant sites and landmarks.

10.1.3 Policy and legislative requirements

Native Vegetation Act 1991

The South Australian *Native Vegetation Act 1991* ensures that native vegetation is protected in South Australia. It applies to all terrestrial and marine native vegetation, with the exception of defined areas in the Adelaide metropolitan area.

Approval is required to clear vegetation. An application must be submitted to the Native Vegetation Council and an offset or significant environmental benefit provided — in on-ground works (e.g. revegetation, bush care) or by payment to the Native Vegetation Fund.

Construction of the Northern Connector would affect or require the removal of areas of remnant vegetation. The Department for Transport, Energy and Infrastructure will submit an application to the Native Vegetation Council to seek removal of this native vegetation and outline measures to achieve the required significant environmental benefit.

South Australia Urban Design Charter

The South Australian Urban Design Charter (Department of Transport and Urban Planning 2004) is a policy initiative of the South Australian Government that promotes beneficial urban design in managing public places, public buildings and infrastructure. Application of the charter ensures that effective management and design of public areas results in positive relationships for public spaces and the adjacent environment.

The urban design framework for the Northern Connector (see Section 6.5) sets the foundation for future design concepts and outlines a sound urban design process.

Planting Indigenous Species Policy

The *Planting Indigenous Species Policy* outlines the South Australian Government's commitment to plant indigenous vegetation on government-managed lands and projects. The priority of planting indigenous species:

- encourages use of plants adapted to the South Australian environment
- emphasises the value for conservation of native vegetation
- supports government biodiversity and conservation strategies.

The pre-European vegetation communities of the project area have been researched, and current and previous vegetation surveys reviewed. Indigenous plant species will be used for landscaping and revegetation in the Northern Connector corridor and wider project area (e.g. offset wetlands).

10.2 Existing conditions

10.2.1 Broad landscape description

Natural features of significance in the project area include:

- Little Para River corridor
- Dry Creek corridor
- Bolivar Wastewater Treatment Plant (WWTP) and associated tree belt buffer planting
- mangroves
- extensive habitat and wetland areas in and around Barker Inlet.

The predominant landscape qualities are largely cultural or manufactured as a result of residential development, industrial uses, farming, salt production, transport operations, and other land uses.

Northern section

The Northern section is predominantly a developed landscape of farms and greenhouses used for food production, industrial use, processing plants and larger residential allotments. Small pockets of remnant vegetation provide a link to the former landscape of the area and are important for habitat and biodiversity.

The landscape of the horticultural industry is generally ordered, with long rows of production trees and fields of crops in rotation. The resultant mosaic is a major landscape feature that forms the largest visually significant aspect and contributes to the identity of the Northern section.

The strong grid of the local road network frames long-distance views and connects to Port Wakefield Road. There are significant and important views from the flat northern Adelaide plains landscape. Middle and long distance views would be available at certain locations along the corridor.

Central section

The Central section contains Bolivar WWTP and the adjoining suburban area to the east of Port Wakefield Road (including Paralowie and Salisbury Downs).

Bolivar WWTP is a large facility that includes:

- treatment ponds
- the treatment plant
- areas of remnant vegetation
- historic planted boulevards of trees
- a linear planted tree belt to the east of the facility to control insects (midges).

Important visually significant elements include the tree belt, boulevards of exotic tree species, both planted and remnant open woodlands and views to the west over the treatment ponds.

Little Para River, which passes beneath Port Wakefield Road, is one of northern Adelaide's most important river and drainage systems. It is largely vegetated and forms a critical biodiversity and habitat corridor across Salisbury. It presents a major opportunity for enhancement and for engagement, interpretation and viewing.

Port Wakefield Road and the suburban areas to the east are relatively close to the Northern Connector corridor and may be affected visually and acoustically by the project. The visual character of the road is dominated by retail, tourist, commercial, industrial and residential uses. Both planted and remnant trees and understorey vegetation exist in the median and on road verges.

Southern section

The marine waters, mangroves and shrublands of Barker Inlet and Port River estuary, on the eastern side of Gulf St Vincent, are one of South Australia's largest and most ecologically productive estuaries. The area plays a critical role in maintaining coastal and marine biodiversity, the stability of Gulf St Vincent, and economically important commercial and recreational fisheries.

The wetlands are a very important visual component of the character of northern Adelaide and attract local, interstate and international visitors. Any negative visual impact from the Northern Connector must be carefully managed and integrated into the overall character of the wetlands.

The Southern section is also visually dominated by the dramatic, shaped forms of Cheetham Salt Ltd Dry Creek salt fields. As a significant local visual marker, they present an opportunity in the urban design strategy.

The Southern section could also be a significant gateway and urban design landmark through:

- a significant bridge structure
- embankments
- earth works or land shaping
- tree planting
- wetlands.

These opportunities would be further identified and developed during the detailed design phase.

All three sections have unique habitat for a select range of flora and fauna as well as a visually diverse and interesting series of natural, manufactured and cultural landscapes. With a dynamic and visionary urban design strategy, the journey along the Northern Connector corridor would be visually diverse and interesting.

10.2.2 Pre-European plant associations

Knowledge of the site and the landscape opportunities must be based on an understanding of the pre-European plant associations. This knowledge informs remediation, assists in selecting appropriate plant species that can survive the local climatic and geological conditions, and directs the landscape design philosophy.

Five pre-European plant associations or communities were originally present in the project area:

- *Eucalyptus porosa* (Mallee Box) woodland
- *Austrostipa* spp. (Spear Grass), *Danthonia* spp. (Wallaby Grass) grassland
- *Eucalyptus camaldulensis* (River Red Gum), *Eucalyptus leucoxylon* (SA Blue Gum) woodland
- Mixed Samphire, *Sclerostegia* spp. (Bindyi), *Atriplex paludosa* spp. (Marsh Saltbush), *Sarcocornia* spp. low shrubland
- *Avicennia marina* (Grey Mangrove) low woodland.

For a more detailed discussion on vegetation, see Chapter 17.

10.2.3 Existing significant and remnant landscapes

Eight significant landscape features are present in the project area:

- Wetlands, predominantly in the Southern section, including Barker Inlet Wetlands north and south, form, together with other wetlands in the area, the largest constructed wetlands in Australia.
- Shallow water habitat in the salt fields of the project area attract migratory birds.
- Mangroves dominate the intertidal flats of the Port River estuary in remnant forests extending from Barker Inlet to beyond St Kilda to the north. They are by far the largest natural element in northern Adelaide and are a very important component of the ecology of the region.
- Intertidal samphire flats, with drought and salt tolerant species including Saltbush (*Sclerolaena* spp., *Atriplex* spp.), Blue Bush (*Maireana* spp.) and *Chenopodium* and *Rhagodia* spp., form part of the largest area of chenopod shrubland in South Australia.
- Little Para River is lined by a predominantly remnant River Red Gum woodland with degraded understorey, and samphire and chenopod shrublands. This well-known major recreational and environmental open space network is degraded and altered in many areas but is an important river and creek system that crosses the plain from Adelaide Hills to the coast and drains large parts of northern Adelaide.

- Dry Creek has deep, highly augmented banks that divide Globe Derby Park from Cheetham Salt Ltd salt fields. At its lower outlet it forms an intertidal habitat with self established mangroves upstream from the Port River estuary.
- *Gahnia filum* (Thatching Grass) is listed as a vulnerable ecosystem in South Australia (Department for Environment and Heritage 2009) and would have originally been present throughout this region, in saline coastal areas, before European contact. A patch of *Gahnia filum* is present in the Northern section, adjacent to Bolivar WWTP.
- Bolivar WWTP tree plantation belt, which is an important insect buffer, extends along the eastern edge of the WWTP and contains a significant stand of mature eucalypt trees that form a large, constructed woodland. Remnant River Red Gums remain in the southern extreme of this belt.

10.2.4 Topography and landform

The Northern Connector corridor has three broad physiographical characters:

- Coastal plain covers much of the project area, incorporating features such as the St Kilda mangroves and the Torrens Island samphire flats.
- Lower alluvial plain extends largely along the eastern boundary of the project area and includes residential development areas east of Port Wakefield Road and some areas in the Northern section.
- River corridors are confined to the banks of the Little Para River and Dry Creek; extending from the upper alluvial plain towards the Adelaide Hills.

These broadly defined physiographical character zones encapsulate the defining and dominant landscape and physiographic characteristics of the area. They have been adopted for assessing visual impact.

10.2.5 Landscape soil and geology

Urban development in northern Adelaide has altered much of the original soil horizon structure, as soil and fill from other areas has often been incorporated. In most developments using cut and fill, the original soil profile has been completely removed and replaced with fill. The implications for plant selection are wide ranging. In some instances, the imported fill has improved the quality of the original soil. In most areas, the imported fill has a lower humus and nutrient content than the original soil and the soil profile in which many beneficial micro-organisms once lived has been completely destroyed.

The physiographical characters and their quality for plants are:

- *coastal plain* — poor quality; drained and filled through development, either completely altering or covering the original soil profile; supports a limited variety of plant species

- *lower alluvial plain* — most productive soils of the Adelaide Plains; supports a wide variety of plant species.

10.2.6 Weather, climate and soil moisture budgets

The Bureau of Meteorology Parafield Airport weather station climatic data for the project area can be summarised as:

- average 9 am temperature: 16°C
- average 3 pm temperature: 20.6°C
- annual precipitation: 460.50 mm
- annual evaporation: 2,044 mm.

Around these averages, temperatures often range into the mid-40s during summer and can go as low as 5°C during winter.

Rainfall varies across the project area, decreasing significantly closer to the coast. Annual precipitation has variances of up to 100 mm.

During droughts, average rainfall can be reduced significantly, and available rainfall and soil moisture become important factors in determining plant survival.

Soil moisture budgets are an important aspect of determining plant selection and landscape management. The budget for the area shows that the period when available soil moisture is being used, through evaporation and transpiration, is very short (less than one month) before deficit, where evaporation exceeds precipitation, begins again in early August.

For much of the year plants need to survive drought conditions, interrupted only by a brief period of rainfall. Emphasis will be placed on sustainable plantings and the use of indigenous or endemic plant species. Due to the long deficit period, plants would need to be watered during the establishment phase to ensure survival.

Plant establishment would ideally begin in late May, when:

- temperatures are decreasing
- the soil retains some heat to aid in root development
- some rainfall is available.

The soil moisture budget highlights the need for sustainable practices and development of water management and harvesting techniques to offset the long deficit period.

10.2.7 Landscape character zones

The nine landscape character zones are shown in Figure 10.1.



Source: DEH, DTEI, DPLG

Figure 10.1 Landscape Character Zones



- Northern Connector road
- Northern Connector rail
- Spur line to Port Flat siding
- Northern Expressway
- South Road Superway
- Existing roads
- Existing railway

Landscape character zone 1 — Northern interchange

Landscape character zone 1 includes the northern extremities of the project corridor, as well as the junction with the new Northern Expressway and existing Port Wakefield Road (Figure 10.1).

Landscape character

The landscape characteristics of this zone are:

- flat, open natural topography
- market gardens and greenhouses as the dominant land use
- several residential dwellings located along Port Wakefield Road, Curnow Road, Symes Road, Flight Road and Anjanto Road
- Adelaide International Raceway located to the north of the Northern interchange
- vegetation cover of trees planted along the perimeter of properties and fields
- little remnant vegetation
- perimeter tree plantings making wind breaks and limiting distant views in some areas
- street trees scattered along road corridors a dominant feature, along with largely domestic-scale overhead powerlines in road verges.

Scenic quality rating

The scenic quality is considered to be low. An inconsistent built form, largely brick and tile residential construction as well as light industrial, prefabricated aluminium and steel buildings, together with the prevailing inconsistent landscape character is of minor qualitative merit in an otherwise flat landscape.

Visual and landscape sensitivity

Residential properties in the vicinity of the Northern interchange would be sensitive to major visual change in the area. These properties would experience significant negative visual impacts due to their proximity to the interchange.

Landscape character zone 2 — Waterloo Corner

Landscape character zone 2 (Figure 10.1) includes the area from St Kilda Road to Summer Road, crossing Undo Road, and the South Australian Gun Club shooting range and a go-kart track.

Landscape character

The landscape characteristics of this zone are:

- flat and open natural topography
- land uses a mix of market gardens, greenhouses, open fields and an agricultural fish farm
- several residential dwellings located prominently on St Kilda Road, with other dwellings along Undo Road, Robinson Road and Summer Road
- vegetation cover of trees planted along the perimeter of properties and fields
- a dense planting of trees surrounding the shooting range forming a visual screen along the southern edge of Undo Road and western edge of Roberts Lane, and reducing distant views to create a feeling of enclosure in a localised dominant landscape feature.

Scenic quality rating

Landscape character zone 2 is considered to be of moderate scenic quality, with stands of mature trees surrounding properties and road corridors.

Visual and landscape sensitivity

The area is highly sensitive to visual change because of the residential properties along St Kilda Road, Undo Road, Summer Road, and Robinson Road.

Landscape character zone 3 — Bolivar

Landscape character zone 3 (Figure 10.1) contains Bolivar WWTP, properties surrounding Bolivar interchange, and the Whitehorse Inn, Highway One Caravan and Tourist Park, and Caltex service station.

Landscape character

The landscape characteristics of this zone are:

- flat and open natural topography
- a tree line bordering the eastern edge of Bolivar WWTP, reducing views across the landscape
- open distant views in the WWTP, and to the west, with low-lying treatment ponds allowing expansive views
- extensive tree buffer along the eastern edge of Bolivar WWTP is the dominant landscape feature of the area
- distant views to the Adelaide Hills Face Zone restricted by the tree buffer

- tree buffer used by South Australian Mounted Police to agist and rest horses; buffer area divided by livestock fencing creating a rural landscape aesthetic
- the dominant built form of Bolivar WWTP
- formally planted exotic and native tree avenues and wind breaks framing interesting views and vistas in many directions.

Scenic quality rating

The scenic quality of the Bolivar landscape character area is considered to be moderate. Views through the tree belt buffering the western edge of Bolivar are considered to be of a high visual quality, with dense natural vegetation forming visual relief in the mostly flat, open landscape.

Visual and landscape sensitivity

Most of this zone is an industrial area with few residential properties. Residents and guests of the Highway One Caravan and Tourist Park to the east of the project on Port Wakefield Road would be highly sensitive to any visual change in the area due to the close proximity to the Northern Connector and Bolivar interchange.

Landscape character zone 4 — Little Para River and Dry Creek

Landscape character zone 4 (Figure 10.1) is a complex area of:

- Little Para River and Dry Creek flowing to the remnant mangroves of Port River estuary
- Globe Derby Park trotting track and associated rural residential community
- wetlands, including the Daniel Avenue and Whites Road wetlands
- salt concentration ponds
- Port River estuary, with remnant mangrove and intertidal samphire communities.

Landscape character

The landscape characteristics of this zone are:

- Little Para River's lower riparian zone
 - main creek line and flood basins surrounded by large river red gums and other native trees
 - dynamic seasonal quality (i.e. varying from a dry creek bed to a flooded riparian zone)
 - public recreation trails following the creek line
 - a critically important cross-plains recreational and habitat corridor
- deep, highly augmented banks of Dry Creek dividing Globe Derby Park from Cheetham Salt Ltd salt fields

- embankment on the northern bank preventing views to the creek line from Globe Derby Park
- intertidal creek bed with large tides pushing up the creek line
- emergent communities of mangroves establishing upstream
- intertidal samphire flats with an open characteristic and low-lying vegetation over a white salty ground plain
- large overhead powerlines over the mangroves forming a prominent visual feature and dominant element in the otherwise natural landscape.

The juxtaposition of natural and heavily modified landscapes in this zone creates a unique landscape character zone. It is a landscape with areas of high natural amenity that has also been substantially modified by human activity.

Scenic quality rating

Scenic quality in zone 4 is varied, with areas surrounding the wetlands and mangroves offering high scenic quality compared with the lower scenic quality of Globe Derby Park and the salt fields.

The highly modified Dry Creek is considered to be of low scenic quality, with engineered or mechanically shaped embankments offering little or minimal visual appeal. Mangroves are developing upstream in the lower areas of the creek line, creating visual interest and emergent ecosystems.

Birds attracted to the area also offer dynamic points of visual interest.

The intertidal samphire and mangrove areas have a natural landscape character supporting high visual amenity in comparison to the surrounding highly modified landscape characteristics.

Visual and landscape sensitivity

Visual sensitivity of zone 4 is moderate due to the proximity of Globe Derby Park residents to the Northern Connector corridor.

The intertidal samphire and mangrove areas are considered to be of high visual and landscape sensitivity due to their unique landscape character and qualities.

The wetlands provide visual amenity to the area and would be sensitive to visual change.

Landscape character zone 5 — Cheetham Salt Ltd salt fields

Landscape character zone 5 (Figure 10.1) consists largely of the Cheetham Salt Ltd salt fields. This highly modified landscape is used to manufacture salt and is a mix of salt crystallisation fields, salt concentration ponds, deep borrow pits, and striking mounds of salt, and silted and surplus material from the salt extraction process.

Landscape character

The landscape characteristics of this zone are:

- salt mounds clearly visible from Port Wakefield Road and parts of Salisbury Highway
- embankments dividing the landscape to form channels, pans and larger ponds used in the manufacture of salt and sodium products
- salt mounds forming a dominant visual feature in the low-lying landscape
- landscape almost ‘alien’ with unnatural characteristics due to the high levels of industrial modification
- salt fields a visual landmark that define the location with middle ground and distant views for road users on Port Wakefield Road and Salisbury Highway
- salt mounds forming visual barriers in an otherwise flat, low-lying topography
- western edges of the Cheetham Salt Ltd site bordered by extensive mangroves of the Port River estuary
- large high voltage power lines a prominent feature, leading away from the site to the west over the mangrove forest.

Scenic quality rating

Middle ground and distant views from the site to the adjoining mangrove forest are of high scenic quality.

Foreground and middle-ground views in the salt fields are considered to be of moderate scenic quality, with the distinctive modified character of the area providing unique views and visual interest.

Visual and landscape sensitivity

Visual sensitivity in the vicinity of the salt works is considered to be low, given the highly modified nature of the area. The lack of residential properties and public access in the area attributes to this low visual sensitivity.

Landscape character zone 6 — North Arm Creek mangroves

Landscape character zone 6 (Figure 10.1) contains the remnant tidal mangroves of North Arm Creek in low-lying tidal plains adjacent to the outlet of Barker Inlet Wetlands.

Landscape character

The landscape characteristics of this zone are:

- shallow tidal creek of the Port River with a narrow channel and mudflats bordered by a dense belt of mangroves
- the outlet for the Barker Inlet Wetlands through North Arm Creek
- eastern edge of the creek bordered by Cheetham Salt Ltd salt fields

- no residential properties in this zone.

Scenic quality rating

The scenic quality of this area is considered to be high. In the context of the project area, zone 6 provides high levels of visual stimulus, including views to the constructed Barker Inlet wetlands, emergent and established mangrove habitats and long distant views to the Adelaide Hills.

Visual and landscape sensitivity

The mangroves are one of the largest remnant vegetation communities in Adelaide and would be extremely vulnerable to even minor visual disturbance or alteration.

Landscape character zone 7 — Barker Inlet wetlands

Landscape character zone 7 (Figure 10.1) contains Barker Inlet north and south wetlands. The constructed landforms of the wetlands create an undulating topography, with pools of water divided by raised banks.

Landscape character

The landscape characteristics of this zone are:

- an embankment separating the eastern side of Barker Inlet north wetlands (fresh water) from the western side (intertidal), creating diverse visual and landscape qualities
- large numbers of significant bird species attracted to the area
- changing nature of the intertidal wetlands creating a dynamic landscape character that offers unique visual experiences
- very limited numbers of large trees in the area, providing views throughout the wetlands and to more distant scenic views beyond, such as east to the Mount Lofty Ranges
- access to views of the dense mature mangroves
- evening views across the expanse of the horizon from north to south, perhaps one of northern Adelaide's finest views
- surrounded to the south by the Port River Expressway and the industrial land uses beyond
- surrounded to the west by Wingfield (Adelaide City Council) landfill site
- surrounded to the north and east by Cheetham Salt Ltd salt fields
- no residential properties in this zone.

Scenic quality rating

The scenic quality of this area is considered to be high. In the context of the project area, zone 7 provides high levels of visual stimulus, including the constructed wetlands and long distant views to the Adelaide Hills.

Visual and landscape sensitivity

Barker Inlet Wetlands north are the most sensitive to visual change of all the landscape character zones, with direct impacts from the road construction. Zone 7 will be extremely vulnerable to even minor visual disturbance or alteration.

Landscape character zone 8 — Gillman

Landscape character zone 8 (Figure 10.1) contains undeveloped land with sparse vegetation cover in the suburbs of Gillman and Dry Creek.

Landscape character

This zone has:

- flat, open landscape characterised by highly weed invaded samphire shrubland
- a sea wall (earth embankment) along the northern edge of this zone blocking distant views to the north, with only the dense mangrove canopy evident immediately beyond the sea wall
- distant views to the Adelaide Hills to the east
- middle-ground views to the large mound and infrastructure associated with the former Wingfield landfill site
- Range and Magazine wetlands located to the south and east of the site as the main points of visual interest in this zone.

Scenic quality rating

The scenic quality of this zone is considered to be low, with a low level of visual stimulus. Piles of waste fill and weed species contribute to the poor scenic quality.

Visual and landscape sensitivity

This zone is of low visual and landscape sensitivity due to the lack of residential properties and public access to the area. Businesses operating on the boundaries of this zone would be moderately sensitive to visual change but could be viewed as a positive given the existing degraded nature of the area.

Landscape character zone 9 — Wingfield

Landscape character

Landscape characteristics of zone 9 (Figure 10.1) are:

- defined largely by industrial facilities at the landfill site
- dominated by industrial and commercial land uses
- views in the area restricted to foreground and middle-ground views in the South Road corridor
- some visually significant trees providing relief to the built form and highly modified landscape

The South Road Superway project — an elevated roadway along the South Road corridor — will significantly change the landscape character of this area.

Scenic quality rating

The scenic quality rating of the area is currently considered to be low. Pockets of vegetation and street trees and buffer planting offer some scenic quality but these are inconsistent with the character of the wider landscape zone. The scenic quality may improve as a result of the South Road Superway project.

Visual and landscape sensitivity

Visual sensitivity in the area is moderate to low, as there are no residential properties and views are contained to the existing road corridor. Views from the surrounding industrial estates are contained, with vistas to South Road limited to local road corridors and intersections. Businesses along South Road may be sensitive to visual change in the road corridor area.

10.3 Potential impacts

10.3.1 Construction

The construction phase would include activities that may impact the visual amenity of the area, such as:

- removal of existing vegetation
- site establishment works (e.g. site compounds, access points, hardstand areas)
- stockpile areas
- views of dust and spoil
- cutting and filling
- construction of other engineered structures (e.g. bridges and embankments).

Management of construction impacts would be necessary to ensure that these impacts are only temporary.

10.3.2 Operation

Potential operational impacts of the project on the landscape and visual amenity of the project area vary in each landscape character zone.

Landscape character zone 1 — Northern interchange

The Northern interchange will become the dominant landscape feature where the Northern Connector meets the Northern Expressway and Port Wakefield Road. The existing interchange will increase in size, with additional ramps and bridges being constructed.

The project corridor will cross Anjanto Road and Symes Road on a raised fill embankment. The project will create a physical separation between east and west for residential properties along these roads. Residents along Curnow Road will have views to the project corridor and Northern interchange.

Landscape character zone 2 — Waterloo Corner

Some mature trees, a visual feature of the area, would be removed, affecting the visual quality of the area and impacting on the landscape characteristics and scenic quality of the zone.

The greatest visual impact in landscape character zone 2 would occur near the Waterloo Corner interchange. Construction of road and rail overpasses would mean that some properties along the local roads in the area will have their views confined by the embankments of the interchange.

The Northern Connector would cross St Kilda Road on a raised fill embankment, creating a visual and physical barrier to the east, for residents on the western side of the route. Equally, residents to the east of the project would be visually cut off from the western side of the zone.

Landscape character zone 3 — Bolivar

Many mature trees within landscape character zone 3 will be removed. This would have a negative visual impact and significantly change the landscape character and scenic quality of the area.

The tree buffer currently screens views from Highway One Caravan and Tourist Park to Bolivar WWTP. Its disturbance would result in negative visual impacts for residents and visitors as it would significantly reduce the size of the visually important tree belt. Views to the Northern Connector corridor would be significant due to its proximity to residential areas.

Landscape character zone 4 — Little Para River and Dry Creek

Residents in the west of Globe Derby Park would be affected by the proximity of the road and rail corridor to the interchange. Road and rail embankments would disturb and interrupt distant views to the west and potentially visually impact middle ground and distant views from residential properties. The characteristics of low-lying

topography, distant views and abundant natural systems in the zone, would make the visual impact of the road and rail infrastructure significant.

Increased visual presence of the road and rail infrastructure as well as increased activity would vastly change the isolated and rural characteristics of the area.

Landscape character zone 5 — Cheetham Salt Ltd salt fields

Impacts on the scenic quality and landscape character of this area would be minimal due to:

- restricted access to the surrounding area
- few opportunities to view the Northern Connector
- absence of residential properties
- a highly modified landscape dominated by constructed salt fields.

Road users would experience extensive views across the salt fields and to the mangrove landscape to the west. Views would also extend south towards Adelaide, east to the Mount Lofty Ranges.

Landscape character zone 6 — North Arm Creek mangroves

The Northern Connector will cross North Arm Creek in two locations: the road corridor across the eastern extreme of the creek; the rail corridor further to the west.

Impacts on the scenic quality and landscape character of this remnant landscape would be significant due to construction of embankments and bridges through an otherwise relatively undisturbed mangrove ecosystem.

Landscape character zone 7 — Barker Inlet wetlands

The visual impact of the Northern Connector would be high in this landscape character zone. The project would significantly affect both visual and landscape qualities. Embankments and structures associated with the Northern Connector would become dominant features, due to their physical size and elevation.

The Northern Connector would divide the wetlands and extensive mangrove habitat to the west. This would affect the dynamic land systems of this unique landscape. Further, distant scenic views from the wetlands and its surrounding areas would be shortened.

Road users would see extensive views across the mangroves to the west of the route and out to the east, over Barker Inlet wetlands to the Adelaide Hills. The views would be expected to be of high scenic quality and a unique and distinctive part of the driver experience along the Northern Connector.

Landscape character zone 8 — Gillman

Construction of a new rail corridor through this flat, low lying area would have a low impact on the scenic quality of the zone due to its inaccessible nature and the

absence of potential viewers. An area of poor quality samphire vegetation would require removal but would not affect the visual amenity of the zone.

Landscape character zone 9 — Wingfield

The visual impact to the landscape character of zone 9 would be moderate. The Port River Expressway–Salisbury Highway road corridor is currently the dominant landscape feature. The completed South Road Superway, with its elevated roadway, will see a very different landscape character in the northern Wingfield area. Therefore, the Northern Connector’s southern interchange would have only a moderate visual impact.

Development associated with the Northern Connector and South Road Superway would be considered an upgrade of existing conditions and would provide a potential improvement in visual quality and experience for road users.

10.4 Management and mitigation

10.4.1 Planning and design

The visual impacts associated with the operation of the Northern Connector will be mitigated by appropriate urban design and landscaping in each landscape character zone.

Landscape character zone 1 — Northern interchange

Landscape and linear buffer plantings will minimise visual impacts on residential properties in the vicinity of the Northern interchange. Alternating linear planting within the interchange and on the embankment would break up the infrastructure and reduce its visual dominance in the landscape.

The interchange will provide an opportunity to improve the visual amenity through formal landscape treatment.

Planting to the north-east of the interchange would reflect the endemic mallee plant association that was once prevalent here. This planting would begin informally and become structured on approach to the interchange.

On the south-west side of the interchange, semi-structured linear planting of trees and alternating vegetation treatments would create a formalised point of interest and signify the beginning of the Northern Connector from the north.

Landscape planting around the interchange could improve the levels of landscape amenity. Large areas of planting in the landscape character area could have a significant positive effect by improving habitat and biodiversity values.

Landscape character zone 2 — Waterloo Corner

Landscape planting along the route and within Waterloo Corner interchange would aim to minimise visual exposure to residential properties. Extensive planting in the interchange would use low shrubs and mixed native grasses to minimise the visual

appearance of infrastructure. Surrounding the interchange, plantings could also improve biodiversity and habitat.

Strengthening and formalising the roadside planting along St Kilda Road at the junction with the Northern Connector would minimise views from residential properties to the project.

Tree buffers along Undo Road and Roberts Lane, which surround the SA Gun Club, would be retained where possible. Further, these will be strengthened by planting in the road corridor to integrate the interchange with its surrounding environment.

Waterloo Corner Road, to the east of Port Wakefield Road, features strong street tree planting along the road corridor, which will be duplicated on the western extension of this road over Port Wakefield Road. This would help to integrate the interchange with the existing road network.

Landscape character zone 3 — Bolivar

Mature trees in Bolivar WWTP tree buffer would be protected and retained where possible. Further, extensive buffer planting and strengthening of existing planting around the Highway One Caravan and Tourist Park would maintain the character of the park and help to minimise any visual impact on its residents.

The caravan and tourist park may require noise barriers to minimise the impact of the Northern Connector. Such noise barriers would be considered as an urban design element and their visual presence strategically managed and designed to integrate with the surrounding landscape and land use. Noise barriers would also reduce views to the Northern Connector from the caravan and tourist park.

Tree buffers between Bolivar WWTP and west of the Northern Connector corridor may be used to manage midge flies as well as minimising views to the WWTP.

Landscape character zone 4 — Little Para River and Dry Creek

Views over the mangrove forests would open scenic visual opportunities previously not available at a large scale.

The Northern Connector project could facilitate revegetation of the lower reaches of Dry Creek to become a feature of the Northern Connector journey. Remediation planting, in association with potential revegetation initiatives, at Little Para River and Dry Creek lower reaches, would increase visual amenity.

The visual impact of the Northern Connector on residential properties of Globe Derby Park would be minimised through extensive landscape treatments and buffer planting. Large stands of trees would help minimise views to the Northern Connector and associated infrastructure. Landscape treatment around the corridor would aim to blend the embankments with the surrounding environment using indigenous plant species. Organic patterns would be used to break the constant lines of the batters to minimise their visual dominance and visual impact.

Landscape character zone 5 — Cheetham Salt Ltd salt fields

Visual amenity could be improved in this area by the large areas inside the road corridor being used for water detention and planted with low-lying salt tolerant plant species native to the area. It would be difficult to establish deep rooted trees in the saline soils of the area.

Opportunities for highlighting interesting views to the west of the Port River estuary would be maximised by planting low growing vegetation.

Landscape character zone 6 — North Arm Creek mangroves

When travelling through this zone, road users would experience spectacular views of the North Arm Creek mangroves from the road corridor raised above them. Views to Barker Inlet north wetlands and Cheetham Salt Ltd salt fields would also enhance the journey experience through this zone.

Designing the bridge structures to minimise disturbance and impact to the mangroves, and encouraging mangroves to re-establish in areas where disturbance is unavoidable, would be the main focus for this zone.

Landscape character zone 7 — Barker Inlet wetlands

The Northern Connector route and Southern interchange have been designed with the aim of minimising the long-term impact on Barker Inlet wetlands.

The design of the interchange minimises the construction footprint and aims to reduce the area of embankments, which would subsequently reduce impacts on the wetland system. Embankment treatments would focus on reducing the visual scale of infrastructure and high quality urban design treatments would be considered in the design of the bridges. Plant species that are appropriate to the wetlands context would be used to rehabilitate the wetlands following construction works and introduce landscape amenity to the area.

The main focus of mitigation for the wetlands would be in offset wetlands to remediate any impacts to habitat, natural systems and biodiversity. Culverts and bridge structures would also be used to maintain connectivity in the wetlands.

Landscape character zone 8 — Gillman

Due to the narrow rail corridor through this zone and rail safety requirements, it is likely that any landscaping would be limited to dryland grassing or direct seeding with low chenopod species to stabilise the rail embankments.

In order to meet any offset requirements under the EPBC Act, some revegetation/ rehabilitation within Range and/or Magazine wetlands may also be carried out as part of the project.

Landscape character zone 9 — Wingfield

The streetscapes of northern Wingfield could be improved with Northern Connector project. Street trees and verge planting would improve the scenic quality of the area and improve visual and landscape amenity in the industrial precinct.

The impacts of the Southern interchange on the Wingfield region will be mitigated through sound urban design of infrastructure elements.

10.4.2 Construction

Visual impact would be highest during the construction phase and immediately after its completion. As the landscape matures and people adjusts to the changes in landscape character, perceived visual and landscape impacts would reduce.

Mitigation measures to reduce the visual impacts of construction would include:

- retaining existing trees and vegetation to help screen construction areas and activities
- protecting existing vegetation
- reducing unnecessary construction activities, such as vehicle movement or stockpiling of construction materials in areas of high visual and landscape amenity
- planting screening plants on embankments and surrounding interchanges as soon as practicable to reduce views of construction activities.

Protection of existing vegetation

Construction of the Northern Connector would necessitate removal of some areas of remnant native vegetation. All remnant vegetation in the corridor not directly affected by construction would be retained and protected.

Existing amenity plantings, in the form of tree lines used as wind breaks, visual buffers and feature plantings would be assessed for their consistency with the urban and landscape design proposal and their significance in the landscape character area, and thus their removal or retention.

Specific mitigation measures would be developed during the detailed design phase of the project.

10.4.3 Operation

The impacts following construction are permanent and would be ameliorated through the urban and landscape design response. They would be minimised by using urban and landscape design principles in treatment of embankments, interchanges and the surrounding road corridor.

These mitigation measures would include:

- mass planting of embankments to reduce their visual effect on the surrounding landscape quality and properties in the area
- dense mass planting of trees and vegetation to screen residential properties and reduce visual impact
- urban design features, such as noise walls and visual screens, used to reduce intrusive views and enhance the visual amenity and interest of the operating road corridor
- ongoing landscape maintenance and replanting would ensure plantings succeed and have the desired effects of mitigation and minimised visual impact.

Plant species

Indicative plant lists have been developed as a guide to the types of plants suitable and desirable for use in landscape treatments for the Northern Connector. Plants were selected for qualities including:

- prevalence in the project area
- being part of a known endemic plant association in the project area
- known to occur in the region.

Plants indigenous to both the local area and to Australia were selected for their hardiness and known ability to survive in the local climatic and environmental conditions. All plants were selected for their low water and maintenance requirements.

As the concept landscape treatment is developed, the indicative plant list (Appendix C) would be refined by investigating availability, suitability and performance of the species.

The list would also be further developed as more information becomes available on soil types and design details. This process would include consultation with the relevant authorities and the community. Where significant benefits under the Native Vegetation Act are an objective, only indigenous species would be used.

11 Noise and vibration

11.1 Introduction

The complete discussion of existing noise and vibration conditions, methodology and criteria for the noise and vibration assessment, and potential noise and vibration impacts from the project and measures to mitigate them can be found in Technical Report 1 — Noise and vibration.

11.1.1 Noise

Noise is a key issue for the Northern Connector project. The study area contains regions characterised by:

- significant road traffic noise from Port Wakefield Road
- rail noise from the Salisbury freight rail line
- very quiet background levels due to the predominantly rural setting.

For humans, sound has two main characteristics: volume (or intensity) and frequency (pitch). The most common unit for measuring the intensity of sound is the decibel (dB). Since the human ear is not equally sensitive to all parts of the audible frequency range, the decibel scale is modified to take this into account and uses A-weighted decibels, or dB(A).

However, the decibel scale does not bear a simple relationship to perceived loudness. If traffic volumes were doubled along a road, then the amount of noise energy would double, yet this would result in a 3 dB(A) increase, which can only just be detected by the human ear.

11.1.2 Vibration

Vibration effects may also cause some concern to residents, primarily during the construction phase of the proposed Northern Connector.

A number of factors can influence the effects of vibration including: the magnitude of the vibration source, particular ground conditions between the source and receiver, foundation-to-footing interaction and the large range of design of structures (e.g. dimensions, materials, type and quality of construction, and footing conditions). The intensity, duration, frequency and number of occurrences of vibration all play an important role in both annoyance levels caused and strains induced in structures.

Vibration generated from construction activities is characteristically greater in magnitude than that generated from operational road and rail traffic, particularly with a road or rail surface in good condition without potholes or significant surface irregularities.

Ground-borne vibration from traffic on arterial roads is not normally of a level that affects residents or buildings and is commonly confused with high levels of low frequency air-borne noise.

Ground vibration effects may:

- disturb occupants of buildings — vibration in which the occupants or users of the building are inconvenienced or possibly disturbed (human exposure)
- disturb contents of buildings — vibration where building contents may be affected (e.g. rattling, shaking or movements)
- affect structural integrity of the building — vibration that may compromise the integrity of the building or structure itself.

11.2 Assessment approach

11.2.1 Noise

The noise assessment methodology included:

- monitoring existing (background) environmental noise levels in the study area
- using a computer noise model to predict the future road and rail noise effect
- identifying the number of sensitive receivers predicted to be above noise criteria at least 10 years after project opening
- investigating measures to minimise the effect of noise from construction, road traffic and rail movements.

Sensitive receivers have been considered in this assessment if they are within 1 km of the Northern Connector route. At greater distances, traffic noise may be audible but is expected to be significantly below noise assessment criteria.

11.2.2 Vibration

The vibration assessment:

- identified appropriate human exposure and structural damage standards
- monitored existing vibration levels
- predicted the impact of vibration from construction and operation and, where relevant, compared the impact to human exposure and structural damage standards
- investigated measures to minimise the effect of construction vibration.

11.3 Policy and legislative requirements

11.3.1 *Environment Protection Act 1993*

Section 25 of the South Australian *Environment Protection Act 1993* states that ‘a person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practical measures to prevent or minimise any resulting environmental harm’.

Section 25(2) of the Environment Protection Act also specifies that regard must be given, amongst other things, to the ‘nature of the pollution or potential pollution, the sensitivity of the receiving environment, the financial implications of various measures, and the current state of technical knowledge in considering the application of the various devices’.

11.3.2 DTEI Road Traffic Noise Guidelines

The *Road Traffic Noise Guidelines* (DTEI 2007) set the criteria for assessing and treating road traffic noise from infrastructure projects for new roads or major upgrading of existing roads.

The adopted road traffic noise level criteria for the project are outlined in Table 11.1.

Table 11.1 Adopted road traffic noise level criteria

	Current noise exposure (dB(A))	External target criteria for 2031 (dB(A))
Daytime ⁽¹⁾ L _{eq,15h}	< 53	55
	> 53	Existing level plus 2 dB(A) or 65 (whichever is lower)
Night-time ⁽²⁾ L _{eq,9h}	< 48	50
	> 48	Existing level plus 2 dB(A) or 60 (whichever is lower)

(1) Daytime — the 15-hour period 7 am–10 pm

(2) Night-time — the 9-hour period 10 pm–7 am

Noise levels were predicted or measured 1 m from the most exposed window at a height of 1.5 m above floor level. Noise levels at this location are affected by reflections from the building façade, thus all predictions are to include a façade reflection factor of +2.5 dB to ensure consistency.

A flow chart outlining applicable criteria and the extent of reasonable and practicable noise mitigation measures is included in Attachment A of Technical Report 1.

11.3.3 DTEI management of noise and vibration

Major project construction works for the Department for Transport, Energy and Infrastructure (DTEI) are exempt from the *Environmental Protection (Noise) Policy*

2007 (Noise EPP), a policy under the Environment Protection Act, provided works follow the DTEI (2010b) *Management of Noise and Vibration — Construction and Maintenance Activities: Operational Instruction 21.7* (OI 21.7). It establishes guidelines for undertaking infrastructure works at night, which may impact noise and vibration sensitive receivers.

The noise level targets for sensitive receivers adopted for this project (from OI 21.7) are presented in Table 11.2.

Table 11.2 Construction noise level targets

Days	Time period	Long-term works — exceed 14 days dB(A) ⁽¹⁾	
		L _{eq} ⁽¹⁾	L _{max} ⁽¹⁾
Weekdays	6 am–7 am	55	75
	7 am–7 pm	All reasonable efforts to minimise noise ⁽²⁾	
	7 pm–10 pm	65	80
	10 pm–6 am	45	75
Saturday	Midnight–7 am	45	75
	7 am–7 pm	All reasonable efforts to minimise noise ⁽²⁾	
	10 pm–midnight	45	75
Sunday and public holidays	Midnight–7 am	45	75
	7am–7 pm	All reasonable efforts to minimise noise ⁽²⁾	
	10 pm–midnight	45	75

(1) See glossary for definition

(2) All reasonable efforts made to minimise noise from construction in accordance with Noise EPP

In areas where background noise levels at a sensitive receiver are greater than the noise level targets, the noise level target becomes the background noise level.

11.3.4 Assessment of noise from rail operations

The *Draft Guidelines for the Assessment of Noise from Rail Operations* (GANRO), released by the Environment Protection Authority (EPA) for public consultation in 2010, set noise criteria for assessing rail noise from new rail lines adjacent to residential locations.

These criteria address the typical equivalent continuous rail noise from all rail pass-bys across both the 15-hour daytime period (L_{eq,15h} criterion) and 9-hour night-time period (L_{eq,9h} criterion), as well as one-off maximum noise events from individual pass-bys (L_{max} criterion).

The external rail traffic noise criteria adopted at sensitive receivers adjacent to the proposed Northern Connector are shown in Table 11.3.

Table 11.3 Adopted rail noise criteria

Metric	New rail lines
Daytime $L_{eq,15h}$	60 dB(A)
Night-time $L_{eq,9h}$	55 dB(A)
L_{max}	80 dB(A)

11.3.5 Vibration

Human annoyance vibration criteria for operational road and rail movements are based on Australian Standard AS2670.2-1990: *Evaluation of human exposure to whole body vibration – Continuous and shock induced vibration in buildings (1 to 80 Hz)*. This standard is referenced in the GANRO and the applicable criteria for residential locations are shown in Table 11.4.

Table 11.4 Adopted road and rail vibration criteria for residential locations

Period	Peak particle velocity criteria
Daytime	0.3–0.6 mm/s
Night-time	0.2 mm/s

For construction, human annoyance vibration criteria can be impractical to achieve and OI 21.7 specifies limits based on structural damage criteria. The structural damage limits specified in OI 21.7 (Table 11.5) have been adopted as criteria for vibration from construction works.

Table 11.5 Adopted construction vibration criteria

Structure type	Peak particle velocity criteria
Commercial and industrial	20 mm/s
Residential	5 mm/s
Heritage-listed structures	3 mm/s

11.4 Existing environment

11.4.1 Road and background noise

Existing environmental noise levels were measured using noise loggers (Table 11.6) at eight locations around the project area (Figure 11.1) from Monday 8 December 2008 to Friday 12 December 2008 for at least 24 hours at each location under typical ambient conditions (i.e. no unusual traffic or meteorological conditions). Additional monitoring results from four locations adjacent to Port Wakefield Road in November–December 2006 were also used to assess the existing noise environment (Table 11.6).



Source: DEH, DTEI, DPLG

Figure 11.1 Noise monitoring locations



- Noise logger locations
- Northern Connector road
- Northern Connector rail
- South Road Superway
- Northern Expressway
- Existing railway
- Existing roads
- - - Spur line to Port Flat siding

Table 11.6 Environmental noise logging results summary

Ref no.	L ₉₀ day ⁽¹⁾	L ₉₀ night ⁽²⁾	L _{eq,15h}	L _{eq,9h}	L _{eq,24h}	Day peak L _{eq,1h}	Night peak L _{eq,1h}
1	45	40	60	60	60	66	65
2	46	40	57	45	55	66	52
3	54	48	68	66	67	71	70
4	38	37	56	45	54	68	53
5	54	43	64	61	63	66	66
6	52	49	62	60	61	67	63
7	40	37	48	43	47	52	50
8	43	40	49	46	48	55	55
9	61	51	67	64	66	69	70
10	64	62	66	63	65	68	68
11	65	62	71	67	70	74	74
12	-	49	-	53	55	57	53

(1) Daytime L90 measured 7 am–7 pm in accordance with construction noise level targets

(2) Night-time L90 measured 7 am–7 pm in accordance with construction noise level targets

The noise monitoring results suggest that:

- the majority of residents who will be affected by the Northern Connector in St Kilda and Waterloo Corner currently experience quiet background levels typical of rural areas
- higher background noise levels are experienced by residents closer to the existing road network where there is significant traffic volume, including Port Wakefield Road and Salisbury Highway.

All noise logger results, and correlated weather data, for each logging location are available in Technical Report 1 — Noise and vibration.

11.4.2 Road vibration

Generally, sensitive receivers in the project area are not exposed to any significant traffic vibration.

Measurements were taken adjacent to Port Wakefield Road at distances of 10 m and 20 m from the edge of the carriageway (before upgrade works began) in the Globe Derby Park area, near smooth and rough sections of the asphalt surface. The measurements characterise existing, and predict likely future, vibration levels.

Measurements ranged in magnitude from 0.02 to 0.3 mm/s. These vibration levels are indicative only, as transfer of vibration from the ground to the building foundation and other building elements is variable but not expected to change significantly.

In general, vibration levels within 10 m of a smooth road section are at or below the threshold of perception for ground vibration and are below night-time human exposure levels for residential areas (0.2 mm/s).

11.4.3 Rail noise

Under the current rail system, freight trains heading north from Adelaide use the rail line between Dry Creek and Salisbury, which then veers north-west adjacent to the Edinburgh Royal Australian Air Force base. A large number of properties are exposed to existing freight train noise in Mawson Lakes, Parafield Gardens, Salisbury Downs, Salisbury and Salisbury North, as well as Ottoway (for movements to and from LeFevre Peninsula). Properties adjacent to the proposed Northern Connector transport corridor are currently not exposed to rail noise.

Existing noise levels for freight train pass-bys were measured on the existing freight rail line at the now closed Moloney Road rail crossing at Virginia on 14 January 2009. Train speed at the measurement location was generally 90–110 km/h. The measured L_{eq} noise level due to rail pass-bys were in the range of 75–77dB(A) at a distance of 40 metres, averaged over the pass-by time. The measured maximum (L_{max}) rail noise level during a pass-by was 88 dB(A) at a distance of 55 metres.

11.4.4 Rail vibration

Sensitive receivers adjacent to the Northern Connector rail alignment are not currently exposed to any rail vibration. However, those adjacent to the existing freight rail alignment in the areas of Mawson Lakes, Parafield Gardens, Salisbury Downs, Salisbury, Salisbury North and Ottoway are exposed to vibration from both freight rail and passenger rail movements.

In order to determine the impact of rail vibration levels on existing properties in these areas, as well as future impacts, vibration levels were measured at the now closed rail crossing at Moloney Road, Virginia during freight train pass-bys on the existing freight rail line.

Measured peak vibration levels at distances of up to 45 m exceeded the criterion of 0.2 mm/s for residential areas during night-time. A significant number of existing properties are within 30–50 m of the existing freight rail line through Mawson Lakes, Parafield Gardens, Salisbury Downs, Salisbury and Salisbury North, and may be exposed to vibration above nuisance guideline levels.

11.5 Potential impacts of the project on existing conditions

Preliminary noise and vibration assessments are presented in this section. More detailed noise and vibration assessments, together with the identification of any mitigation measures, will be undertaken and determined during the detailed design phase of the project.

11.5.1 Construction noise

Noise generated by construction activities and equipment associated with the project would generally rise and fall as construction progresses along the route. Typical construction activities and equipment are identified in Chapter 9.

Without any noise mitigation, predicted L_{eq} construction noise levels would typically fall in the range 50–70 dB(A) at a distance of 200 m from general road and rail construction works.

Based on the noise level predictions, night-time construction work in the vicinity of sensitive receivers will be minimised, where possible. Where night-time construction works are necessary, and during daytime construction works, all reasonable and feasible noise mitigation measures (Section 11.6) will be implemented.

11.5.2 Construction vibration

The effects of ground vibration are classified into three categories: human exposure, building contents and building structures (Section 11.1).

In general, vibration criteria for human disturbance are more stringent than vibration criteria for effects on building contents and building structural damage. Hence, compliance with the more stringent limits for human exposure ensures compliance for the other two categories.

However, construction work is typically assessed against structural damage limits (Table 11.5) as in some cases compliance with human disturbance criteria may not be practical. Adjustments to the criteria are warranted in some circumstances, as undue restriction on vibration levels may prolong operations and result in greater annoyance. The human disturbance vibration criteria have been presented as goals only for the construction phase, though it is not envisaged that vibration produced by most construction work would cause adverse human disturbance.

Vibration and human disturbance

Residents nearest to road works may perceive vibrations, particularly during vibratory compaction of earthworks but only for a relatively short period because the earthworks plant moves often. Typically resident perception of vibration is accompanied by concerns of structural damage, thus increasing annoyance levels.

Residents will be informed and consulted to reduce concerns about potential building damage (Section 11.6). The community and stakeholder engagement program will address vibration annoyance or structural concerns, and may include dilapidation surveys for potentially affected residences.

Vibration effects on building contents

Typical ground vibration from road and bridge construction activities is approximately 8–100 hertz. Within this frequency range, building contents such as blinds and pictures would begin visible movement at 0.5 millimetres/second. At

vibration levels higher than 0.9 mm/s, windows, crockery and loose objects would rattle and be audible and annoying.

Residences within 50 m of construction activities such as compacting and piling, may experience some vibration effects on building contents. Given the distance of most residential buildings from the Northern Connector route, this vibration symptom is unlikely to affect most residents.

Residents will be informed and consulted before works with the potential to produce significant vibration begin near to their property, to address concerns about possible damage to buildings or their contents (Section 11.6).

Structural damage to buildings

The highest levels of vibration are typically generated by compactors, vibratory rollers and pile drivers. In most cases, the vibration levels generated are too low in magnitude to cause structural damage to buildings located more than 25 m from the construction activity. Heritage-listed buildings within 50 m of construction activity are considered for structural damage to reflect the increased significance and sensitivity of these buildings.

All residential buildings are located outside this 25 m zone, and heritage-listed buildings outside the 50 m zone from the Northern Connector corridor, thus structural damage is be likely.

11.5.3 Operational road and rail noise

Road and rail noise are traditionally assessed independently of each other because the two noise sources have different characteristics, and are assessed using different noise criteria. It is seldom that road and rail share the same transit corridor. The Northern Connector will have the benefit of keeping the two noise sources together, and potentially creating a narrower noise impact footprint.

11.5.4 Operational road traffic noise

The model of the existing road network with predicted 2017 road traffic volumes was used to predict the road traffic noise environment at noise sensitive locations should the Northern Connector not be constructed. Receivers were considered only if they were within 500 m of the Northern Connector. Results have been summarised for receivers in the project's Northern, Central and Southern sections (Figure 1.2).

Predicted traffic noise levels

Daytime traffic noise impacts in 2017, both before and after the opening of the Northern Connector, and in 2031 are outlined in Table 11.7. Note that these numbers are indicative only and would be reassessed in the detailed design phase.

Table 11.7 Daytime traffic noise impacts

Catchment (receivers)	Model scenario	Daytime noise level ($L_{eq,15h}$) in dB(A)				
		>70	65–70	60–65	55–60	<55
Northern (160)	2017 pre-opening of Northern Connector	3%	8%	8%	9%	72%
	2017 post-opening of Northern Connector	3%	1%	13%	26%	60%
	2031	0%	8%	19%	21%	53%
Central (193)	2017 pre-opening of Northern Connector	0%	32%	53%	13%	2%
	2017 post-opening of Northern Connector	0%	0%	32%	52%	16%
	2031	0%	1%	58%	34%	7%
Southern (347)	2017 pre-opening of Northern Connector	0%	2%	19%	26%	53%
	2017 post-opening of Northern Connector	0%	0%	9%	22%	69%
	2031	0%	1%	15%	24%	60%

Night-time traffic noise impacts in 2017, both before and after the opening of the Northern Connector, and in 2031 are outlined in Table 11.8. Note that these numbers are indicative only and would be reassessed in the detailed design phase.

Table 11.8 Night-time traffic noise impacts

Catchment (receivers)	Model scenario	Night-time noise level ($L_{eq,9h}$) in dB(A)				
		>65	60–65	55–60	50–55	<50
Northern (160)	2017 pre-opening of Northern Connector	10%	8%	8%	8%	66%
	2017 post-opening of Northern Connector	0%	8%	19%	19%	53%
	2031	4%	17%	19%	18%	43%
Central (193)	2017 pre-opening of Northern Connector	30%	51%	17%	3%	0%
	2017 post-opening of Northern Connector	0%	4%	56%	33%	8%
	2031	1%	39%	50%	9%	2%
Southern (347)	2017 pre-opening of Northern Connector	1%	16%	24%	21%	37%
	2017 post-opening of Northern Connector	0%	3%	21%	24%	52%
	2031	0%	9%	22%	25%	44%

Based on predicted 2031 daytime and night-time noise levels (Tables 11.7 and 11.8), 189 receivers are predicted to experience noise levels above noise

criteria (without mitigation in place) and 511 below noise criteria (Table 11.9). Note that these numbers are indicative only and would be reassessed in the detailed design phase.

Table 11.9 Summary of predicted 2031 future road traffic noise levels

Catchment (total receivers)	>8 dB(A) above criteria	5–8 dB(A) above criteria	3–5 dB(A) above criteria	1–2 dB(A) above criteria	Below criteria
Northern (160)	11	14	20	20	95
Central (193)	0	1	39	32	121
Southern (347)	4	4	8	36	295

Noise from Northern Connector road traffic would generally be perceived as a steady ‘hum’ during daytime periods, with noise levels rising slightly when heavy vehicles pass by. During the night-time period, the traffic hum would be perceived at a lower noise level with a more noticeable rise and fall during pass-by of heavy vehicles.

In the areas immediately surrounding Northern Connector interchanges, noise levels would contain more noticeable variations, particularly during low traffic periods, from braking and accelerating of vehicles leaving and entering the Northern Connector.

Where noise levels are predicted to be above relevant criteria, noise treatment measures in line with the *Road Traffic Noise Guidelines* (DTEI 2007) would be implemented for eligible receivers.

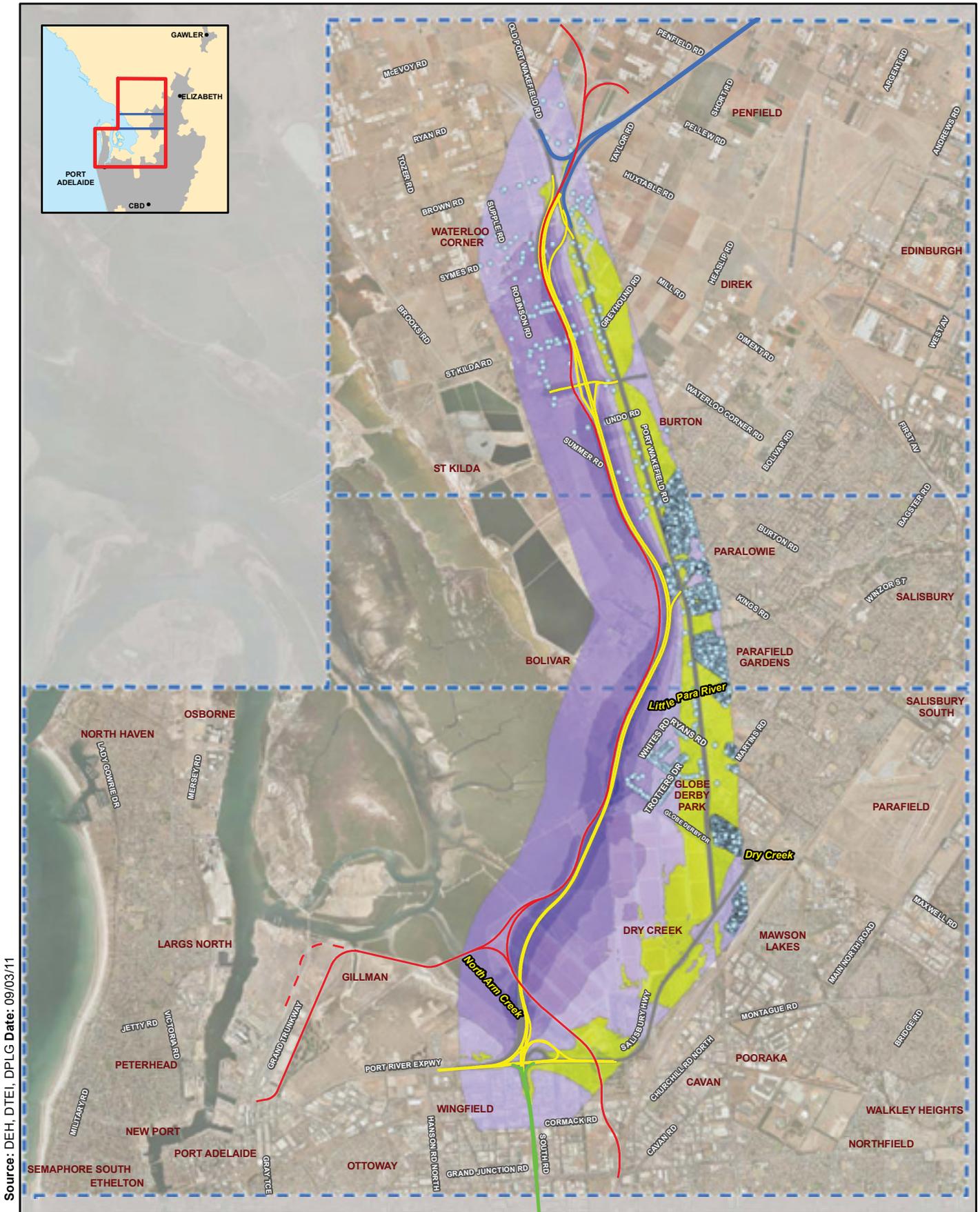
Changes in road traffic noise across the study area

The aim of the Northern Connector is to improve road and rail freight transfer by:

- attracting vehicle movements from congested urban road networks
- directing rail traffic more efficiently to the LeFevre Peninsula and Adelaide (Figure 1.2).

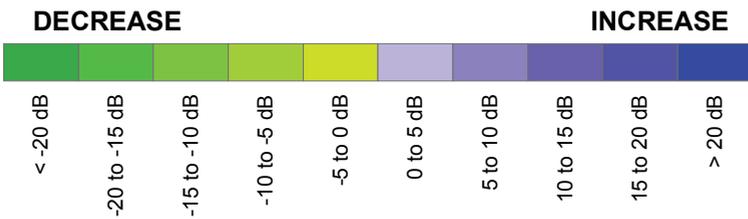
Residents living adjacent to Port Wakefield Road, between Taylor Road and Salisbury Highway, will have their perceived ‘loudness’ of existing traffic noise noticeably reduced. However, the Northern Connector would increase noise for residents in Globe Derby Park (west) and St Kilda (west), which are currently not exposed to any significant road traffic noise.

Figures 11.2 and 11.3 illustrates the daytime and nighttime changes in road traffic noise levels across the study area between 2017, before the Northern Connector opens, and future noise levels 2031, with the Northern Connector. For properties close to the Port Wakefield Road corridor, noise levels would be reduced by 0–5 dB(A). Properties near the Northern Connector corridor (typically in St Kilda and Globe Derby Park) can expect increases of 5–15 dB(A).

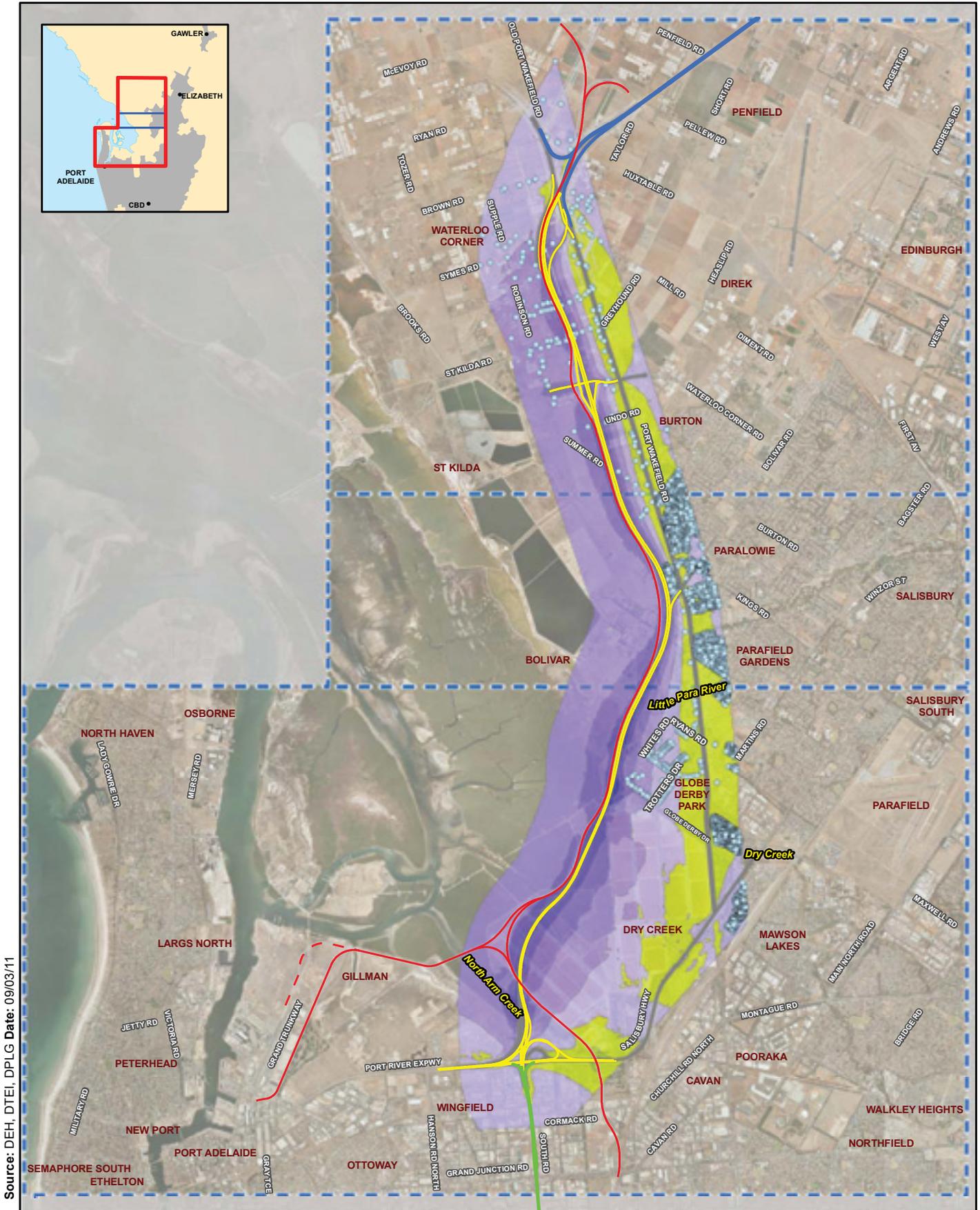


Source: DEH, DTEI, DPLG Date: 09/03/11

Figure 11.2 Change in daytime noise level - Road L_{eq}



- House (receivers)
- South Road Superway
- Northern Connector road
- Northern Connector rail
- - - Spur line to Port Flat siding
- Northern Expressway

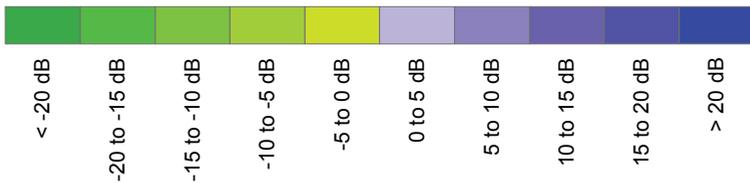


Source: DEH, DTEI, DPLG Date: 09/03/11

Figure 11.3 Change in night time noise level - Road Leq



DECREASE INCREASE



- House (receivers)
- South Road Superway
- Northern Connector road
- Northern Connector rail
- - - Spur line to Port Flat siding
- Northern Expressway

Overall, with the operation of the Northern Connector, a higher density of properties would experience reduced noise levels due to their proximity to Port Wakefield Road than would receive increases in road traffic noise from the Northern Connector.

11.5.5 Operational rail noise

Rail noise criteria

The rail noise criteria for all sensitive receivers adjacent to the Northern Connector route are:

- $L_{eq,15h}$ 60 dB(A)
- $L_{eq,9h}$ 55 dB(A)
- L_{max} 80 dB(A).

Predicted rail noise levels

The noise model of the Northern Connector rail alignment, including the predicted 2027 train volumes, was used to predict future rail noise levels at the nearest sensitive receivers.

The noise model predictions indicate that, without noise mitigation, rail noise levels from movements on the Northern Connector corridor are expected to:

- exceed the daytime $L_{eq,15h}$ criterion of 60 dB(A) by 1 dB(A) at one receiver
- exceed the night-time $L_{eq,9h}$ criterion of 55 dB(A) by 1–5 dB(A) at three receivers
- exceed the L_{max} criterion of 80 dB(A) by 1–9 dB(A) at five receivers.

All receivers where an exceedance is predicted are in the Northern catchment.

The Northern Connector would also reduce rail noise levels for many residences adjacent to the existing freight rail line through the Ottoway and Salisbury areas. Freight rail currently travelling through the suburban areas east of Port Wakefield Road will be diverted to the Northern Connector corridor. A significant number of residences are within 30–50 metres of the existing freight rail line, and diverting the rail to the Northern Connector will considerably reduce the noise impact on them.

Table 11.10 compares predicted 2027 rail noise levels to predicted 2017 rail noise levels without the Northern Connector for the closest sensitive receivers in those areas currently exposed to freight rail noise.

Table 11.10 Comparison of predicted 2017 and 2027 rail noise levels

Area	Model scenario	Predicted noise level in dB(A)		
		Daytime $L_{eq,15h}$	Night-time $L_{eq,9h}$	L_{max}
Mawson Lakes	2017 pre-opening	58–61	55–56	83–86
	2027 with NC	55–61	49–53	59–70
Parafield Gardens	2017 pre-opening	60–64	55–60	83–89
	2027 with NC	59–63	51–56	69–74
Salisbury Downs	2017 pre-opening	60–62	55–57	84–86
	2027 with NC	59–61	51–53	68–70
Salisbury	2017 pre-opening	63–65	58–59	85–90
	2027 with NC	62–64	55–57	72–75
Salisbury North	2017 pre-opening	59–60	58–59	88–90
	2027 with NC	<50	<50	<60
Ottoway	2017 pre-opening	53–57	52–56	81–87
	2027 with NC	<50	<50	81–87

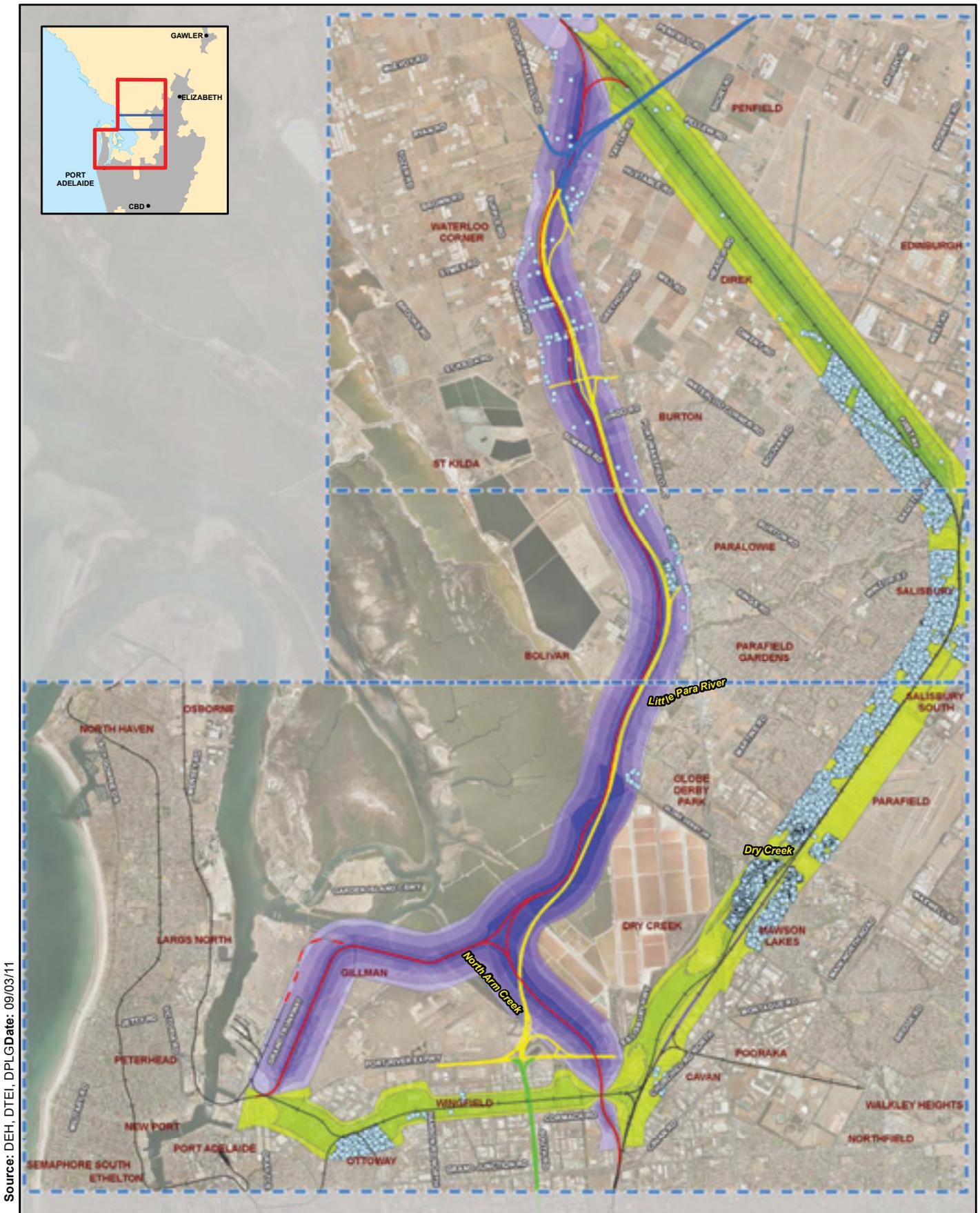
Changes in rail noise across the study area

The predictions indicate that the Northern Connector would result in rail noise reductions in residential areas currently exposed to freight rail noise in the study area.

Smaller passenger trains would, and some freight trains may, continue to operate on the existing rail line but residences would still experience a considerable reduction in rail noise.

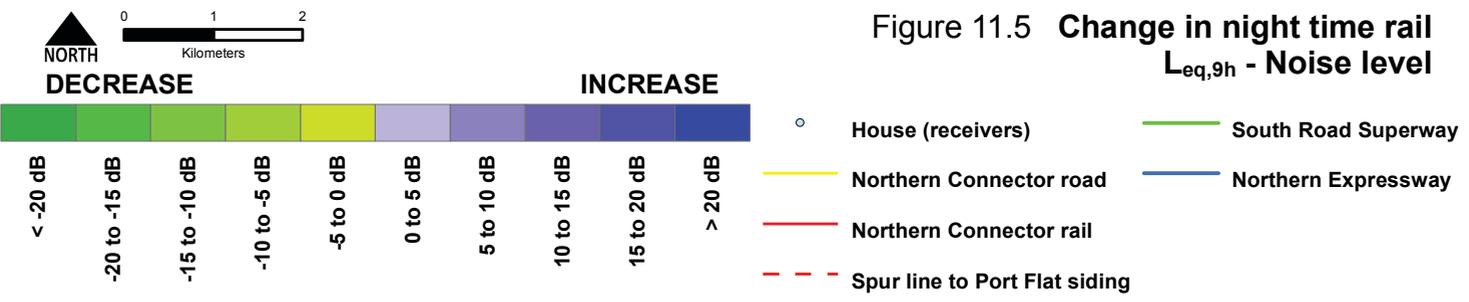
Figures 11.4 and 11.5 illustrate the change in rail noise levels between 2017, before the Northern Connector opening, and future noise levels (2027 with the Northern Connector). The figures indicate particularly significant daytime and night-time rail noise reductions for areas of Salisbury North; considerable reductions of up to 5 dB(A) for daytime and night-time L_{eq} levels, and 10 dB(A) for maximum L_{max} noise levels, are predicted for the other areas.

Residences in Globe Derby Park and St Kilda would be marginally impacted by rail noise from the Northern Connector. For most residents, rail noise would largely be 'masked' by the constant hum of road traffic noise. It would be audible for short periods of time at the nearest residences. During quieter road traffic periods (e.g. during the early hours of the morning) rail noise would become marginally more noticeable, although not enough to increase the overall equivalent continuous road traffic noise level.



Source: DEH, DTEI, DPLG Date: 09/03/11

Figure 11.5 Change in night time rail $L_{eq,9h}$ - Noise level



11.5.6 Operational road vibration

It is anticipated that the surface of the Northern Connector road would be smooth at opening. As the road ages, its condition may deteriorate to a rough surface, leading to a marginal increase in the generated vibration levels.

The width of the Northern Connector corridor (Figure 8.2) means that no vibration sensitive receivers would lie within 30 m of the road edge. Based on existing vibration levels measured adjacent to Port Wakefield Road, ground vibration levels from road traffic at the nearest sensitive receivers are expected to comply with both nuisance guideline levels and structural damage criteria (Section 11.3).

Upon the opening of the Northern Connector, properties within 20 m of the Port Wakefield Road edge would also experience a significant decrease in vibration events due to a decrease in the number of heavy vehicle pass-bys.

11.5.7 Operational rail vibration

The nearest sensitive receivers to the Northern Connector rail corridor are located approximately 40 metres away from the rail corridor. At these distances, vibration levels due to freight rail pass-bys are expected to comply with both human annoyance and structural damage vibration criteria (Section 11.3).

The project would also divert freight rail away from the residential areas of Mawson Lakes, Parafield Gardens, Salisbury Downs, Salisbury, Salisbury North and Ottoway, significantly reducing the impact of vibration from rail pass-bys on residents in these areas.

11.6 Management and mitigation

A number of different possible design strategies to reduce the noise impact of the Northern Connector during construction and after project opening. Specific noise mitigation measures will be determined in the detailed design phase of the project.

11.6.1 Planning and design

Noise and vibration impacts were considered during the route assessment phase of the project. The Northern Connector route was chosen taking into account the number of sensitive receivers located near the project, and gives the best overall noise outcome across the study area.

11.6.2 Construction

Noise

A detailed noise and vibration management plan will be developed in accordance with OI 21.7 before construction begins. It will outline reasonable and feasible noise and vibration mitigation measures to be implemented by the appointed contractor.

Proactive noise control strategies to minimise noise during construction may include temporary acoustic barriers, enclosures, silencers or the substitution of alternative construction processes. All reasonable and feasible noise mitigation methods would be identified by the site supervisor during works, particularly outside daytime hours.

Noise level emissions and potential annoyance depend significantly on the condition of equipment, type of operation, its duration and the time of day it is conducted. All major items of plant would be checked at the start of works on site and thereafter every six months and following major service.

Generally, most residences identified as affected by construction noise will also be affected by operational traffic noise. Noise mitigation treatment for reducing operational traffic noise will be implemented to reduce noise during construction as well.

Mitigation measures can generally be implemented in three key areas when working close to sensitive receivers:

- site management
- equipment management
- sensitive receiver noise control.

Site management

Typical mitigation measures for managing noise levels at construction sites are to:

- locate noisy plant as far away as possible from noise sensitive receivers
- select and locate site access roads as far away as possible from noise sensitive receivers
- schedule night work that creates the most noise early in the night, where possible, to minimise impact on noise sensitive receivers
- take care not to drop materials causing peak noise events, including materials from a height into a truck
- orientate plant known to emit noise strongly in one direction, if practicable, so that the noise is directed away from noise sensitive areas
- shut down, or throttle down to a minimum, machines that are used intermittently in the periods between works
- concentrate noisy activities at one location, where possible, and move to another as quickly as possible

- avoid truck movements on residential streets, where possible
- minimise the reversing of vehicles to reduce signal noise
- minimise vehicle and equipment queuing and idling near noise sensitive receivers
- ensure that truck operators clear tailgates and lock them at the point of unloading
- do not use vehicle warning devices such as horns as signalling devices, unless necessary
- use two-way radios at the minimum effective volume
- implement worksite induction training, educating staff on noise sensitive issues and the need to make as little noise as possible, and avoid shouting and whistling
- install temporary noise barriers, where practicable
- locate equipment to take advantage of the noise barriers provided by existing site features and structures
- minimise the noise of packing up plant and equipment and departing from the site when work is complete.

Equipment management

Typical mitigation measures for managing equipment noise levels are to:

- install broadband reversing alarms to noisy items of plant that would be reversing frequently or at night-time
- ensure equipment has quality mufflers installed
- ensure equipment is well maintained and fitted with adequately maintained silencers that meet design specifications
- ensure silencers and enclosures are intact, rotating plants are balanced, loose bolts are tightened, frictional noise is reduced through lubrication, and cutting noise is reduced by keeping equipment sharp
- use only the necessary power to complete the task
- while considering occupational health, safety and welfare requirements, fit trucks, loaders and bobcats with alternative reversing alarms that are less annoying in character (either smart or broadband alarms)
- rubber-line contact points of loaders and bobcats fitted with articulated buckets to ensure that noise levels are minimised during release of materials

- modify equipment, for example improve exhaust systems, stiffen panels to stop vibrations, apply noise dampening materials to panels to reduce noise transmission and fix resilient materials between contact surfaces
- use traffic practice controllers to prevent vehicles and equipment queuing, idling or reversing near noise sensitive receivers.

Sensitive receiver noise control

Typical mitigation measures for managing noise levels at sensitive receivers would be to:

- if possible, install any house treatment required to minimise operational road traffic noise as early as possible in the construction process
- consult with affected residents to help develop acceptable noise management strategies
- provide an easily accessible and well-publicised complaint hotline, and develop suitable complaint handling procedures to effectively deal with any issues raised during the work.

The proposed mitigation measures may not necessarily result in meeting construction noise goals at all times. They should reduce levels to those that most noise sensitive receivers would find acceptable.

In some cases, a balance between a higher acceptable noise emission to enable a faster construction progress may be preferred by the community to ultimately reduce the perceived noise impact. That is, shorter duration of greater noise level may be better than a longer term, lower construction noise level.

Consultation with affected receivers throughout the construction phase is an essential part of any mitigation plan. All affected residents would receive clear communications about the envisaged duration and times of night-time operation to alleviate surprises and concerns about when it is going to stop.

Vibration

A detailed noise and vibration management plan would be developed before construction begins, outlining vibration mitigation measures to be implemented by the appointed contractor, if required. Mitigation would typically include:

- vibration monitoring at selected structures closer than 25 m to construction activities that are known to generate high ground vibration levels
- regular community (or affected resident) updates advising when and where construction activities may generate perceptible levels of vibration
- minimising vibration energy (i.e. reduced piling hammer drop distance or compactor displacement setting) as necessary depending upon receiver distance.

A building condition inspection would be undertaken before construction where a construction activity may cause damage through vibration (e.g. pile driving, dynamic compaction, demolition of structures) or if the items are located within the specified distance from construction activity (Table 11.11). Building condition inspection requirements would be determined during the detailed design phase.

Table 11.11 Distance from construction work for building condition inspection

Activity	Distance ⁽¹⁾
Pile driving	100 m
Vibration compaction	> 7 tonne plant: 50 m
Vibration compaction	< 7 tonne plant: 25 m
Demolition of structures	50 m

(1) Distance would be double that specified for heritage-listed buildings

11.6.3 Operation

Controlling vehicle noise at the source

Ideally the most effective way of minimising noise from road traffic and rail is to control vehicle noise at the source, where feasible, by:

- making vehicles quieter
- installing 'low noise' road surfaces
- modifying the road gradient
- appropriate rail alignment design
- appropriate rail construction
- reducing the design speed
- land-use planning and development controls
- roadside noise walls and mounds.

Quieter vehicles

For maximum effectiveness, vehicle noise management needs to include design, education and enforcement components.

DTEI actively supports and/or is involved in the following programs to achieve quieter vehicles:

- national processes for developing transport, vehicle or infrastructure noise standards or guidelines, particularly motor vehicle noise standards
- national processes for developing in-service transport vehicle noise standards, particularly those for motor vehicles (and champions the need to reflect improvements achieved in new vehicle noise standards).

'Low noise' road surfaces

For traffic as a whole, road tyre noise appears to dominate at around 70 km/h. This means that in areas with posted speeds of 70 km/h or more, the reduction of road tyre noise can be a useful way to minimise traffic noise.

The type of road surface can have a significant impact on traffic noise generated by pavement surface–tyre interactions.

The Northern Connector is currently proposing to use stone mastic asphalt adjacent to existing sensitive receivers to reduce the pavement noise emissions. Stone mastic asphalt reduces noise by the order of 1 dB(A) relative to dense graded asphalt and 5 dB(A) relative to a concrete surface.

Modifying the gradient

Reducing the road gradient can have a positive effect on road traffic noise levels, as acceleration noise and engine/exhaust brake noise are both reduced. A 5% reduction in road gradient would reduce L_{eq} traffic noise levels by about 1.5 dB(A). A similar reduction in the rail gradient will also reduce L_{eq} rail noise levels, depending on the power used by the locomotive to travel up or down a gradient.

The relatively flat gradient over the Northern Connector route does not require reduction.

Appropriate rail alignment design

Rail alignments have been designed to minimise the occurrence of wheel and brake squeal. Rail curves near to residential locations will have a radius of greater than 400 metres to prevent maximum noise events. Braking on the high speed alignment is also unlikely.

Freight train warning horns represent the worst case maximum noise event and they cannot be removed for safety reasons. However, the rail design significantly reduces the likelihood of warning horns being used by removing level crossings.

Appropriate rail track construction

Track construction can have a considerable effect on the noise and vibration emitted by rail vehicle pass-bys. For example, the use of continuously welded rail rather than jointed rail can reduce the noise and vibration generated when vehicles pass across joints in the rail line. The Northern Connector freight rail line would be constructed from continuously welded rail.

Land-use planning and development controls

Future road traffic noise problems can be avoided through zoning mechanisms that do not permit noise-sensitive land uses, or those that have not been designed in accordance with good acoustic principles, along transport corridors. Agricultural, recreational, commercial and light industrial land uses can provide effective buffer zones between busy roads and rail lines, and residential communities.

DTEI has no control over development approvals outside transport reserves but takes an active role in advising other authorities preparing planning instruments.

Roadside noise walls and mounds

Acoustic barriers immediately reduce road and rail traffic noise at the shielded properties once barrier construction is complete. Traffic noise barriers, in the form of 'noise walls' or mounded earthworks, must break the lines-of-sight between road traffic noise sources — including reflections of noise from solid walls — and the noise-sensitive receiver, to gain maximum effectiveness. However, barriers of a lower height can still reduce noise.

The acoustic effectiveness of a barrier depends on its density, height, length and location. The higher the barrier (compared to the direct line-of-sight from the source to the receiver) and the closer its location (to either the source or the receiver), the greater the noise attenuation. The barrier also needs to have a sufficient length.

Roadside barriers, as distinct from barriers close to dwellings, usually have to shield an appreciable length of road to be effective. They can, therefore, be efficient in attenuating noise for groups of residences but would not be cost-effective for single structures and may be ineffective where openings are required for driveway access.

Noise walls can be constructed using timber, pre-cast concrete panels, lightweight aerated concrete, fibre cement panels, transparent acrylic panels or profiled steel cladding. Dense vegetation screen planting has visual and privacy benefits but provides only minor acoustic attenuation — about 1 dB(A) for a 10 m depth. For significant noise attenuation, a solid barrier (e.g. earth mounding, noise wall, cutting) is required.

The need for any roadside noise barriers as a noise treatment option will be considered during the detailed design phase of the project. It is likely that a roadside noise barrier will be installed adjacent the Highway One Caravan and Tourist Park to minimise road noise from the Northern Connector. The need for and extent of any barrier will be determined during the detailed design phase of the project.

Controlling noise at the receiver

Even with effective vehicle controls, road traffic noise is still emitted. Management strategies applied at the receiver would include:

- careful environmental assessment to identify existing and potential road traffic noise problems and the most effective solutions
- noise mitigation treatments near and inside existing noise-sensitive buildings, or their conversion for less sensitive uses.

During the detailed design phase a range of treatment measures would be agreed with the owners of eligible properties.

Noise barriers close to sensitive receivers

Noise barriers, such as mounds and noise walls, are most effective when located either close to the road traffic stream or to the affected noise sensitive receivers.

With the consent of owners, acoustic barriers can sometimes be located inside a residential property boundary, at those residences that exceed the noise criteria, for maximum shielding of the dwelling. They might be designed to form a courtyard, providing some benefit as an outdoor area near the dwelling.

This approach would reduce the extent of barriers otherwise required and is the most cost-effective solution for isolated, noise-exposed residences.

Noise mitigation treatment of existing sensitive receivers

Individual dwelling treatments can be provided in lieu of, or in conjunction with, noise control measures such as low noise road surfaces, noise barriers and barriers near the dwellings. Any such acoustic architectural treatments will require extensive consultation with, and the agreement of, all affected parties.

Building treatments will generally be considered only when external road traffic or rail noise criteria cannot be achieved at the premises and other measures are impractical or not cost effective. Mitigation measures will be designed to achieve the internal noise levels that would have prevailed had the external road traffic or rail noise criteria been achievable. Most buildings will achieve an internal noise level 10–15 dB(A) below the external noise level with the windows open, without requiring additional treatment.

Approaches to the acoustic treatment of buildings will depend on expected noise levels and eligibility for treatment. Treatment measures would be agreed with the owners of those properties considered eligible for noise treatment, during the design phase of the project.

12 Non-Aboriginal heritage

12.1 Introduction

12.1.1 Assessment approach

This non-Aboriginal heritage assessment reviewed the heritage registers and databases of:

- National Heritage List
- Commonwealth Heritage List
- Register of the National Estate
- South Australian Heritage Places Database — State and local heritage places.

12.1.2 Policy and legislative requirements

Three pieces of legislation apply to non-Aboriginal heritage.

Australian Government legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of matters of national environmental significance:

- World Heritage properties
- National Heritage places
- wetlands of international significance
- listed threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- nuclear actions (DEWHA 2008a).

National and Commonwealth heritage items/places are protected by the EPBC Act, which provides a national scheme of environment and heritage protection and biodiversity conservation.

The EPBC Act covers the following heritage lists:

- National Heritage
- Commonwealth Heritage
- Register of the National Estate

- Overseas places of historic significance to Australia
- World Heritage.

South Australian Government legislation

Heritage Places Act 1993

The Heritage Places Act makes provision for the identification, recording and conservation of places and objects of non-Aboriginal heritage significance and establishes the South Australian Heritage Council. The Act allows for the identification and protection of places of heritage significance to South Australia. The South Australian Heritage Register lists all places of heritage significance to South Australia. Heritage places and objects must meet criteria outlined in section 16 of the Act. Once registered, state heritage places are protected under both the Heritage Places Act and the Development Act.

Development Act 1993

Councils are required to align with the goals of the Planning Strategy when formulating their development policies, and take the full range of social, economic and environmental goals in the Planning Strategy into account. Council's heritage policies are documented in development plans for both local and state heritage places and areas (Department of Planning and Local Government 2008). Approval is required under the Development Act to affect state and local heritage places. If a listed heritage place is to be affected, a development application must be lodged for assessment by the relevant planning authority (i.e. local council or Development Assessment Commission).

Local councils are responsible for all places of local heritage significance managed under the provisions of the Development Act and used in the relevant development plan.

12.2 Existing conditions

12.2.1 Historical overview

The Northern Adelaide Plains were inhabited by the Kaurna people before European contact. This area was not initially sought out by European settlers due to the scarcity of surface water. The first settlements were based around rivers in the area — the Little Para, South Para and Gawler rivers. By the 1840s, several sheep and cattle stations had been established (Wood 2005).

The Northern Connector would be located in three city councils: City of Port Adelaide Enfield, City of Salisbury and City of Playford.

City of Playford

The corporation of the City of Playford was formed in 1997 by the amalgamation of Munno Para (established 1853) and Elizabeth (established 1955). The city was

named after Sir Thomas Playford, South Australian Premier 1938–1965, who was largely responsible for the industrialisation of South Australia.

Wheat farming and gold mining in the area led to its economic development, which was supported by a housing development program introduced in the 1950s. Strong migration during the 1950s and 1960s contributed to the prominent horticultural activities in the Virginia and Angle Vale areas (City of Playford 2008a).

City of Salisbury

In 1847, John Harvey, a Scot who had migrated to the South Australian colony, purchased land along Little Para River. In 1848, he began selling allotments for the township of Salisbury, named after the English city near his wife's home town. The population was 400–500 by 1881 (City of Salisbury 2008a).

Salisbury's most notable industries were flourmills and windmills (Paternoster Engineering Works) and its main crops were oranges, wheat, hay and dairy produce.

In 1940, the Australian Government built a munitions factory at Penfield. Workers migrated to live near the factory and the population of the area doubled. Changes in transport, immigration and technology, and population growth after World War II, led to the dramatic expansion of the area. The population grew from 2,385 in 1933 to 4,160 in 1947, 86,451 in 1981 and 110,000 in 2001 (City of Salisbury 2008a).

City of Port Adelaide Enfield

Port Adelaide was historically the gateway for settlement, trade and commerce in South Australia, as the Port River was the entrance for explorers into South Australia. The Port Adelaide area was first sighted in 1831 by Captain Collet Barker and discovered in 1834 by Captain John Jones. In 1837, Harbour Master Captain Thomas Lipson took up residence at Port Creek and Port Adelaide was officially claimed a harbour on 6 January 1837 (Flinders Ranges Research 2008).

Many emigrants to South Australia first lived in Port Adelaide and old colonial buildings are still present near the wharves today (City of Port Adelaide Enfield 2008a). Most settlers landed at Port Adelaide and then walked to Adelaide, where they settled (Flinders Ranges Research 2008).

Port Adelaide was proclaimed a corporate town in 1855. At this time it had a population of 1,500 and handled approximately 300 ships a year. By 1900, this number had increased to 1,000 ships a year (Flinders Ranges Research 2008).

A section of Port Adelaide is now a State Heritage Area (declared on 29 April 1982).

In 1853, an area of approximately 130 km² was incorporated into the District Council of Yatala. In 1868 this district was divided into two: the District Council of Yatala North and the District Council of Yatala South. The latter later became the District Council of Enfield, renamed in 1953 as the City of Enfield. The City of Port Adelaide Enfield, established in 1996, is now one of the largest metropolitan councils in South Australia (City of Port Adelaide Enfield 2008b).

Enfield was predominantly a farming area; the land along the River Torrens was very fertile and the northern reaches grew wheat and grains. This area is known for the heritage interest areas of:

- Sunnybrae farm
- site of the first waterborne sewerage system in Australia
- Yatala Gaol
- Sir Ross and Keith Smith flight landing site
- Klemzig, the German village formed by immigrants fleeing persecution in Prussia (City of Port Adelaide Enfield 2008b).

12.2.2 Registered sites

Australian and South Australian heritage databases were searched to identify listed national, state and local heritage sites and areas.

Australian Heritage Database

The Australian Heritage Database (DSEWPC 2011a) compiles heritage places from the following lists and registers into one database and search tool:

- Register of the National Estate
- Commonwealth Heritage List
- National Heritage List
- World Heritage List
- List of Overseas Places of Historic Significance to Australia.

A search of the database covered all suburbs in the project area, as well as surrounding suburbs. The places identified in the vicinity of the project area were:

- Penrice area — an indicative place on the Register of the National Estate (i.e. data supporting the application is with the Australian Heritage Council but a decision has not yet been made on whether it should be entered on the register (DSEWPC 2011b))
- Port Adelaide and Gawler Reach — a nominated place on the National Heritage List (i.e. the Minister's delegate has received a nomination on the approved form and initially assessed data adequacy; the nomination either will be or has been referred to the council for assessment (DSEWPC 2011b))
- Port Adelaide, Port Adelaide River, Waterfront and Adelaide Dolphin Sanctuary currently identified on the National Heritage List as: Nomination now ineligible for proposed priority assessment list. Under the EPBC Act, the Australian Heritage Council can only assess places for the National Heritage List if the places are on the council's assessment work plan (the

'priority assessment list'). The Minister sets this work plan each financial year. A nomination becomes ineligible if it has been considered for two consecutive work plans but not included. However, a nominated place ruled ineligible in this way can be re-nominated, thereupon becoming eligible again for consideration (DSEWPC 2011b).

No places are formally listed on the Australian Heritage Database. Should these or other places become listed and protected on the lists, appropriate approvals for affecting the heritage places would be sought.

South Australian Heritage Places Database

The South Australian Heritage Places Database, developed by the South Australian Department of Planning and Local Government, in conjunction with the Department of Environment and Natural Resources, Heritage Branch, covers both state and local heritage places.

A search of the database using the online search tool (Department of Planning and Local Government 2011) covered all suburbs in the project area, as well as surrounding suburbs.

One listed State heritage place occurs in the project area: the Dry Creek Explosives Magazine and Earth Mounds. No local heritage listed places would be affected by the project.

Dry Creek Explosives Magazine and Earth Mounds

The Dry Creek Explosives Magazine and Earth Mounds are located north of Magazine Road (just off Salisbury Highway) south-west of Cheetham Salt Ltd salt fields (Figure 12.1). The explosives magazine falls under the economic development heritage theme, sub-theme: explosives; and holds the following significant interest:

- *historical* — the first repository for explosives imported into South Australia; built in 1903 as a replacement for a former silted magazine at North Arm, with the growth of the explosives trade; each of the 10 magazines has a 30 tonne capacity and was built on a 287 acre reserve
- *architectural* — significant for their design, construction and the manner in which they reflect the dangerous nature of materials stored and measures taken to minimise accidents: 10 single-storey buildings in a row with painted corrugated galvanised iron walls and hipped roofs with large vents, each surrounded by earth mounds on three sides (Donovan and Associates 1991).
- *environmental* — in an isolated location on former swamp lands.

12.3 Potential impacts of the project on the existing conditions

12.3.1 Construction

The Dry Creek Explosives Magazine and Earth Mounds site is located approximately 1.2 km to the east of the Northern Connector road corridor; and 300 m to the east of the rail corridor (Figure 12.1). It would not be directly affected by the project.

Construction activities that result in the highest vibration levels are generated by compactors, vibration rollers and pile driving. In most cases, the generated vibration would not cause structural damage to buildings greater than 25 m from construction areas. Given that the distance to both the road and rail would be more than 300 m, structural damage to the Dry Creek Explosives Magazine and Earth Mounds during construction is not probable.



Figure 12.1 Location of listed non-Aboriginal heritage items



- Northern Connector road
- Northern Connector rail
- Northern Expressway
- Non-Aboriginal heritage site (Dry Creek explosives magazine and earth mound)
- - - Spur line to Port Flat siding
- South Road Superway
- Existing roads
- + + + Existing railway

12.3.2 Operation

The vibration assessment (Section 11.5) indicated that structural damage criteria were not likely to be exceeded at distances greater than 40 m from the rail line. Therefore, it is unlikely that vibration from operation of the project would affect the Dry Creek Explosives Magazine and Earth Mounds.

The existing aesthetic value of the Dry Creek Explosives Magazine and Earth Mounds site is quite low. The site is located in former swamp lands (Section 12.2). The surrounding area is industrial salt fields, and waste activities and a gas Epic Energy station are located nearby. There is construction waste on the site itself. It is unlikely that the Northern Connector would have any adverse effect on the visual amenity of the site. Heritage status would not be affected by the project.

12.4 Management and mitigation

12.4.1 Planning and design

During the selection of the Northern Connector route, location of non-Aboriginal heritage items was one of the identified constraints. The route was selected to avoid the listed heritage sites

12.4.2 Construction

No direct impacts from construction are expected on the Dry Creek Explosives Magazine and Earth Mounds (Section 12.3.1)

12.4.3 Operation

No mitigation measures are proposed for the Dry Creek Explosives Magazine and Earth Mounds, as it is not expected that there would be any adverse impacts on them from operation of the project.

13 Socioeconomic impacts

13.1 Introduction

The assessment methodology, existing conditions, potential impacts and proposed mitigation measures for socioeconomic issues associated with the project are discussed within this chapter.

13.1.1 Assessment methodology

The social impact of the project was assessed by examining the social characteristics of the areas surrounding the Northern Connector route. Social profiles of the local government areas (LGAs) and suburbs through which the project would traverse are based on data from the Australian Bureau of Statistics 2006 Census (ABS 2006) (2006 data is the most recent Census data available). The data describe the social characteristics of the LGAs compared with social characteristics of the overall Adelaide region and South Australia.

Data for the social characteristics component was gathered from consultation, site inspection, technical studies, and internet and desktop research. The character, values and structure of the communities likely to be affected by the project are assessed based on direct observation.

Examination of the project's potential impacts indicated that many of the broader and local social and economic impacts would be felt by communities in close proximity to the project. Most of this assessment, therefore, discusses the impacts of the project on the local community, including the suburbs immediately adjacent to the project. Impacts at a regional and local scale are discussed where relevant.

The methodology and key tasks used to identify and assess potential social impacts followed the methodology outlined in *The concepts, process and methods of social impact assessment* (Burdge 2004).

Description of social impact methodology

1. Social profile of the area

Identify and examine the existing community profile of the three LGAs (Port Adelaide Enfield, Salisbury and Playford) (regional level), and the primary community (local level), including review of existing Australian Bureau of Statistics Census data.

2. Predicted future social profile of the area examination

Review local and South Australian Government strategies and plans for the Northern Adelaide region, including the *Strategic Infrastructure Plan for South Australia* (Government of South Australia 2005), *South Australia's Strategic Plan* (Government of South Australia 2007a) and *The 30-Year Plan for Greater Adelaide*

(Department of Planning and Local Government 2010a), with a focus on current and future release areas.

3. Social impact identification and assessment

Predict social impacts of the project, during construction and operation, based on existing and future social profiles, and outcomes of investigations on the biophysical environment and consultation.

Identify social changes likely to occur as part of the project, such as changes in land uses, potential community severance, environmental amenity, property acquisition and social fabric.

Determine the significance of the impacts (both negative and positive) by comparing the existing scenario with the scenario incorporating the project.

4. Managing social impacts and change

Identify measures to manage negative construction impacts and social change, and to enhance social benefits.

13.1.2 Policy and legislative requirements

The legislation relevant to the socioeconomic assessment, and in particular property acquisition associated with the project, are the South Australian:

- *Highways Act 1926*
- *Land Acquisition Act 1969.*

These Acts and how they affect the project are discussed in Section 14.1.3.

13.2 Existing conditions

13.2.1 Regional context

The project is located in the City of Playford, City of Salisbury and City of Port Adelaide Enfield, whose boundaries are shown in Figure 13.1.

In general, the project is located north and north-west of metropolitan Adelaide. In this area, population growth rates in 2001–2006 were higher for each LGA than the Adelaide Statistical Division (SD: approximating the Adelaide metropolitan area) and South Australia.

13.2.2 Population and culture

Playford LGA

The City of Playford, to the north of metropolitan Adelaide, covers an area of 354 km². The suburbs in the LGA directly affected by the project corridor include parts of Waterloo Corner and Virginia (Figure 13.1). Land use in the LGA includes



Source: DEH, DTEI, DPLG

Figure 13.1 Local Government Areas and suburbs in the project area



- Northern Connector road
- Northern Expressway
- Existing roads
- Playford LGA
- Northern Connector rail
- South Road Superway
- Existing railway
- Port Adelaide Enfield LGA
- Salisbury
- Spur line to Port Flat siding

residential, rural, industrial, horticultural, agricultural, commercial and conservation areas. The LGA had a population of 70,010 in 2006; an increase of 4.6% from 2001.

The median age is 34 years, the lowest of each of the comparative areas. The occupancy rate is 2.6 persons per dwelling, slightly higher than the South Australian average. The LGA has a higher proportion of population aged under 25 years (38.1%) and a comparative level of family households (41.4%).

Median household income for the Playford LGA was \$719 per household per week, compared to the Adelaide SD with \$924 and South Australia with \$887 per household per week.

The City of Playford's Development Plan (2010) has identified parts of the Northern section of the project corridor (Waterloo Corner and Virginia) as an intermodal zone, including rail–road freight terminal facilities, and unloading and warehousing areas for shipping containers and goods. Encompassing the intermodal zone is the existing primary production zone associated with the horticultural industry, which is well known as a 'foodbowl' that contributes over 60 products including fresh vegetables, flowers and wine (City of Playford 2010) to Adelaide and surrounding areas.

Salisbury LGA

Salisbury LGA is characterised by residential development, accounting for 10.7% of the Adelaide SD population in 2006. In 2006, Salisbury LGA had a population of 118,424 persons, an increase of 6.8% from 2001. Its population is also slightly younger than the Adelaide SD and South Australia average, with a median age of 35 years. The suburbs in Salisbury LGA directly affected by the project corridor include Globe Derby Park, parts of Dry Creek, Bolivar, parts of Waterloo Corner and St Kilda (Figure 13.1).

The more than 43,000 household dwellings in Salisbury LGA have an average occupancy rate of 2.6 persons. This is higher than each of the comparative areas, with the exception of the Playford LGA. The higher occupancy rate also correlates to the higher percentage of family households in the LGA. The residential area is largely concentrated to the east of Port Wakefield Road and is interspersed with small industrial developments (Government of South Australia 2007b). The level of home ownership is higher than in comparative areas, with 43.4% of dwellings 'being purchased'.

The median income of households in Salisbury LGA is similar to the South Australia figure, with \$875 and \$887, respectively, per household per week.

The Salisbury LGA Development Plan (July 2010) outlines its plan for meeting the increased demand and housing needs of metropolitan Adelaide through increasing dwelling density across the LGA.

Port Adelaide Enfield LGA

Port Adelaide Enfield LGA is characterised by a mix of industrial and residential land uses and is home to 9.3% of the Adelaide SD population. The suburbs in the Port

Adelaide Enfield LGA directly affected by the project include Wingfield and parts of Dry Creek (Figure 13.1). In 2006, Port Adelaide Enfield LGA had a population of 102,969 persons, an increase of 4.2% from the 2001 census. The median age (38 years) is more closely aligned to the Adelaide SD and South Australia, at 38 years and 39 years respectively.

The LGA has more than 40,000 household dwellings with an average household size of 2.3 persons, slightly lower than the Adelaide SD and South Australia average (2.4 persons per household). Separate dwellings were the predominant type of dwelling in the LGA (73.3%), lower than both Adelaide SD (76.9%) and South Australia (79.9%). The remainder of the dwellings in the LGA were a balanced mix of attached and apartment type dwellings. The proportion of rented dwellings (34.8%) is higher in Port Adelaide Enfield LGA, and the 26.7% and 26.2% for Adelaide SD and South Australia respectively.

Education levels in Port Adelaide Enfield are slightly higher than the comparative areas, with 40.8% of the population having completed high school. The median weekly household income for the LGA was \$727 per week, lower than the Adelaide SD with \$924 and South Australia with \$887.

The City of Port Adelaide Enfield Development Plan (2010a) outlines a strategy to increase both the number of dwellings and the density of the LGA, as well as preserve the existing and planned lands allocated for industrial development. Areas of concentrated industrial development in the LGA occur mostly to the north of Grand Junction Road. The City of Port Adelaide Enfield has a strong commitment to the realisation of the Port Adelaide Centre and in 2006 endorsed the *Port Adelaide Centre Vision and Framework* to help guide growth, development and decision making over the next 25 years (Hassell 2006).

13.2.3 Regional growth

South Australian policy review: regional growth

The 30-Year Plan for Greater Adelaide (Department of Planning and Local Government 2010a) outlines a vision for the future growth of Greater Adelaide by planning regions (including Northern Adelaide region), with a focus on South Australia's housing, population and employment–land needs (see Chapter E: Regional Targets and Direction of the Plan). The Housing and Employment Land Supply Program (HELSP) supplements the 30-Year Plan and monitors its implementation to achieve a 25-year rolling supply of land for residential and commercial and industrial purposes. The HELSP report (Department of Planning and Local Government 2010b) combines the former Metropolitan Development Program and the Industrial Land Strategy into one annual report, integrating the planning of housing and employment in Greater Adelaide.

Both the 30-Year Plan and the HELSP report broadly indicate that the Northern Adelaide region is expected to grow over the coming years and is a prime location for maximising opportunities. Over the next 30 years, Greater Adelaide will house 560,000 more people in nearly 258,000 new dwellings and accommodate 282,000 new jobs. The Northern Adelaide region, containing Playford, Salisbury, Tea Tree

Gully, and Port Adelaide Enfield LGAs, and the proposed Northern Connector, is placed to feature significantly in providing for this growth with 169,000 people, 67,600 dwellings and 79,000 jobs.

The implications for the Northern Adelaide region and thus for the Northern Connector are:

- specific regional targets will be determined by the demand for industrial and residential land
- urban expansion over the next 30 years is expected in Buckland Park, Roseworthy, Concordia, Two Wells, Angle Vale and Virginia
- transit oriented development principles will be adapted to a master-planning process that determines development criteria and land controls to be inserted into a structure plan
- major development projects will be articulated, including the relationship of various land uses associated with the model of sustainable development practices to major development opportunities
- a minimum level of service and the means to optimise infrastructure provision will be determined
- development will be strategically located near essential transport infrastructure (such as Adelaide Airport and Outer Harbor) and supported by transport infrastructure, such as the Port River Expressway and Northern Expressway.

Growth and development in the Northern Adelaide region is also supported by planned and recent infrastructure development, including:

- Northern Expressway
- Port River Expressway
- North–South Corridor, including South Road Superway
- Outer Harbor channel deepening
- Elder Smith Road.

13.2.4 Local context

Demographic context

The suburbs through which the project corridor extends are identified below.

The project corridor would be adjacent to the suburbs of Burton, Dry Creek, Gepps Cross, Mawson Lakes, Parafield Gardens, Paralowie and Penfield (Figure 13.1).

Northern section

The Northern section takes in most horticultural areas in the total project area, and includes the suburbs of St Kilda, Waterloo Corner and Virginia.

St Kilda is a small suburb to the north of Waterloo Corner, bounded to the east by Port Wakefield Road and to the west by the sea. In 2006, its population of 245 had a median age of 40 years and a median household income of \$682. While St Kilda had a low unemployment level (only 3.0% in 2006), 47.1% of the population was not in the labour force. St Kilda is a small coastal community characterised by market-garden farming and other horticultural holdings to the east.

Waterloo Corner, south of St Kilda, is also bounded by Port Wakefield Road to the east and the sea to the west. In 2006 the suburb had a population of 849, with a median age of 50 years and median weekly household income of \$586. The dominant occupation was 'manager' (25.2%) and 'agriculture', 'forestry' and 'fishing' were the most common industries of employment. The unemployment rate was higher than St Kilda at 7.1% but over 50% of the population were not in the labour force. Existing land uses include a variety of horticultural pursuits, including market gardening and orchards. Greenhouses are a dominant feature of the landscape. Dwellings are located on horticultural and rural-residential sized allotments with some horse-keeping activities and trotting track facilities (KBR 2007).

Virginia, located to the east of Port Wakefield Road, had a population of 1,433 in 2006, with a median age of 38 years. The median weekly household income was \$735. The dominant industry of employment was 'agriculture', 'forestry' and 'fishing' (26.4%). The unemployment rate was 6.6% with 38.5% of residents part of the workforce.

Central section

The Central section of the project encompasses the area around Bolivar Wastewater Treatment Plant (WWTP) in the suburb of Bolivar in Salisbury LGA. Of the small population of 120 people in Bolivar, over 95% were identified as long-term residents of the Highway One Caravan and Tourist Park on Port Wakefield Road. The suburb also has a small number of rural-residential properties.

The median age of Bolivar residents was 52 years in 2006; median household income was \$594 per week. The most common occupations for Bolivar residents were 'machine operators and drivers' (39.7%), while the 'manufacturing' industry employed 27.1% of Bolivar residents. The unemployment level was 9.0% in 2006, with 35.6% of the population in the labour force.

Southern section

The Southern section of the project corridor includes the suburbs of Globe Derby Park in Salisbury LGA, and Dry Creek and Wingfield in Port Adelaide Enfield LGA.

Globe Derby Park is a rural-residential area, located to the west of Port Wakefield Road and to the east of the project corridor. Land uses include small horticultural land holdings and associated activities aligned with the Globe Derby Park horse

trotting complex. In 2006, the population of 313 persons had a median age of 48 years and a weekly median household income of \$979. The most common occupation was ‘technicians and trade workers’ with 16.2% and the most common industry for employment was ‘transport and warehousing’. Globe Derby Park is a small community with close ties to the harness racing track.

Dry Creek, located at the southern end of the project corridor, has a population of 220 in 2006 and approximately 90 dwellings. The median weekly household income was \$620 per week. The unemployment level was 6.0% in 2006, with 24.4% of the population employed in the ‘manufacturing’ industry.

Wingfield, at the southern end of the project corridor, had a population of 499 in 2006. Median weekly household income was \$607 per week; unemployment was 12.3% and 28% of the population were employed by the ‘manufacturing’ industry’.

Other localities

Overall, suburbs located to the east of Port Wakefield Road — Burton, Mawson Lakes, Parafield Gardens, Paralowie and Penfield — have a different demographic and social character from those to the west.

The population of Parafield Gardens and Paralowie totalled more than 14,000 in 2006 (Dry Creek had 220). In these suburbs, the median age was lowest in Burton at 28 years and highest in Penfield at 53 years.

Mawson Lakes had the largest median household income, at over \$1,433 per week. Paralowie and Burton also had higher median household incomes at \$1,005 and \$996 per week respectively (South Australia: \$877), coupled with a higher representation of family households and larger average household sizes.

Penfield had the lowest weekly household income at \$548 per week. This correlates with the high number of the population not in the labour force, the higher levels of couple-only households and the high level of household ownership. The population of Penfield is more likely to be representative of an area of ‘empty-nest’ households.

13.2.5 Key economic drivers

Various industries located in the Northern Adelaide region provide employment and economic activity in the region. The Northern Adelaide Employment & Skills Formation Network identifies the Northern Region as having a unique role in industry and employment in the South Australian context with a mixture of industry and workforce opportunities. The most noted industry in the Northern Region is manufacturing; other industries exist to diversify the employment opportunities in the Northern Region.

The industries of note for the Northern Region include:

- *Manufacturing* — in 2009, manufacturing contributed nearly 70% of South Australia’s merchandise exports, nearly 14.5% of Gross South Australia Product and about 14% of total employment; it is the Northern Adelaide

region’s most important industry accounting for over 20,000 jobs and a 28% share in the Greater Adelaide context

- *Automotive manufacturing* — with Adelaide being in the top 20 most cost-competitive cities in the world for automotive manufacturing and Australia’s least costly place to setup and do business (KPMG 2008), investment and expansion is expected to continue, particularly in the northern areas surrounding GM Holden Ltd’s 90 ha automotive precinct at Edinburgh Parks; the downturn in automotive sales from the global financial crisis, resulted in decreased production in the automotive industry but the Holden factory in the Northern Region has since recovered and replaced the lost shifts at the assembly plant
- *Defence industry* — the region contains more than 200 prime contractors and small-to-medium enterprises (including ASC, BAE Systems and Navantia Reference); responsible for winning 30% of the Australian defence capital budget; the industry generated \$1.08 billion gross value added in 2002–03; most defence companies are located in defence precincts at Technology Park, Mawson Lakes, Edinburgh Parks or Techport Australia
- *Mineral and energy resource developments* — create significant infrastructure, jobs and spill-over activities; flow-on benefits for transport, construction and manufacturing industries through demand for freight, chemical products, fabricated metal products and other machinery and equipment are likely to increase the demand for industrial land in metropolitan Adelaide
- *Food* — a major sector of the SA economy; food processing industry requires large allotments in proximity to growing areas (Virginia horticultural region–Adelaide Hills–McLaren Vale) that are well connected to the freight network
- *Transport and storage sector* — requires large premises with high ceilings to use vertical storage space and good access to the freight network to efficiently transport goods; the proposed intermodal facility at Penfield would bring a needed boost to this sector and the Northern Connector would give further impetus to the intermodal facility.

Of the total number of jobs in Greater Adelaide, 19% are located in the Northern Adelaide region (Government of South Australia 2008a). The industries of greatest importance to the Northern Adelaide region are outlined in Table 13.1 (ABS 2006).

Table 13.1 Most important industries in the Northern Adelaide region*

Industry	Employment (people)	Percentage of employment in Northern Region
Manufacturing	25,652	17.3%
Retail trade	23,900	16.1%
Wholesale trade	12,774	8.6%
Government administration and defence	8,417	5.7%

Education	8,499	5.7%
Health and community services	17,469	11.8%

* ABS 2006

The investment in new infrastructure associated with the Northern Connector, combined with accessibility improvements for the above industries, leads to the direct and indirect benefits (Section 13.3.1).

Horticulture

The project would be located in or adjacent to some of South Australia’s leading primary production districts. High levels of production are made possible through a combination of favourable natural resource conditions, multiple water supply options, major private and public investment in infrastructure, and access to a large labour supply. This combination of factors is all the more significant in places like the Virginia Horticultural District, the Barossa and north of the Gawler River because of their proximity to local markets and to major state and interstate freight routes and distribution facilities (PIRSA 2004).

The Virginia Horticultural District — more than 700 ha concentrated mainly around the township of Virginia — is the largest concentration of greenhouse structures in Australia (Lucas Group 2007). It is one of South Australia’s major horticultural production areas. Gross food revenue (excluding wine) from the Northern Adelaide region in 2005–06 was valued at \$829 million, or 10% of the South Australian total (PIRSA 2006).

The Northern Adelaide region produces a range of mainly vegetable crops in greenhouse, hydroponic and field production systems. Food processing in the Northern Adelaide region was valued at \$507 million (wholesale value) in 2005–06. Livestock and horticulture represent 49% and 45% of food and beverages processed in the Northern Adelaide region respectively. Wine (4%) and field crops (2%) make up the remaining food and beverages processed (PIRSA 2006).

Tourism

The project is located in the vicinity of a number of tourist attractions:

- Globe Derby Park Trotting Track — harness racing track located to the west of Port Wakefield Road
- St Kilda Mangrove Trail and Interpretive Centre — designed for educational awareness of the mangrove and local marine environment
- St Kilda Adventure Playground — attracts families for picnics and barbeques, and offers a range of specially designed play equipment
- Adelaide International Raceway
- Greenfields wetlands and Watershed Sustainability Centre.

Tourism in the Barossa and Mid North is also expected to grow, particularly from the expected northern suburb population growth.

13.3 Potential impacts of the project on the existing conditions

Overall, impacts and benefits from the project can be categorised as:

- State-wide and regional economic benefits
- impacts on the local community
- impacts on the local economy.

Benefits of the project are identified in chapters 3, 4 and 5.

13.3.1 State-wide and regional ‘flow-on’ economic benefits

As a major infrastructure project, the Northern Connector would generate substantial jobs and supporting activities over the course of its construction. Economic impacts from the construction phase are substantial with a further impact being felt once the project is completed leading to significant ‘flow on’ social and economic benefits. The potential for large scale benefits derives from the project providing a more efficient direct link from one of South Australia’s largest economic regions to the Port of Adelaide, other key residential and industrial growth areas, employment hubs, and key intra-state and interstate destinations.

‘Flow-on’ economic benefits are determined by taking into account a number of pre-existing drivers and opportunities, such as the forecast development of Adelaide’s Northern Adelaide region. These drivers create conditions for investment in the project to lead to direct or indirect/induced effects.

While the employment benefits from the construction phase are expected to be significant, significant ‘flow on’ social and economic benefits associated with productivity and job creation for industries through improved accessibility to opportunities are also likely.

The improved accessibility resulting from the development of the Northern Connector would bring regional benefits to potential industrial and commercial development such as:

- less construction of trunk and secondary civil infrastructure (e.g. sewerage, community halls) than adjacent areas
- unlocking commercial and industrial development opportunities along the corridor, including the Economic Development Precinct in Gillman and Defence SA in Port Adelaide

- better industry relationship between Gillman and Port Adelaide industrial precincts, Osborne Maritime Precinct, Technology Park at Mawson Lakes and the freight transport network
- access to safe and efficient interchanges that are well served by the combination of Port Wakefield Road and the Northern Connector
- increased productivity through a decrease in rail operating costs for this section of the interstate rail line due to faster, unimpeded travel and improved connections to intermodal freight terminals
- Diversifying economic capabilities through improved transport connections to industry in northern Metropolitan Adelaide. This would make the area more attractive to associated industry and suppliers of parts and services to support industry, and therefore diversify the area's economic capability
- providing sufficient capacity on the road network to cater for key movements of a labour force to be located north of Adelaide to link with key employment hubs associated with industry in the Greater Edinburgh Parks, Gillman and Port of Adelaide.
- improved access to interstate transport networks (e.g. Sturt Highway) and the North-South Corridor
- improved retail/commercial sector in the region through demand generated by growth along the corridor
- improved road and rail delivery times and increased cost efficiency, providing a competitive edge

An efficient road system would underpin the competitiveness of traditional South Australian industries, such as manufacturing, and would encourage the development of new industries.

13.3.2 Impacts on the local community

During construction and operation the local community could feel the impacts of:

- severance, social cohesion and access
- amenity
- property acquisition
- property access
- social fabric.

Severance, social cohesion and access

Community severance can be in the form of:

- physical barriers — such as the introduction of new traffic infrastructure

- psychological or perceived barriers — such as traffic noise or road safety fears
- social cohesion barriers — such as the disruption of ‘neighbourhood lifestyle’ or inhibition of social interaction (James et al. 2005).

Community severance can be described as the cumulative impact of psychological and physical barriers to movement and social participation created by transport infrastructure (Social Exclusion Unit 2003). Large linear infrastructure, such as the Northern Connector, can potentially reduce accessibility to key services and change local social networks and community cohesion. Communities may not want to move through or travel outside of the local area. The potential severance and access impacts along the project corridor are characterised by local road closures and upgrades. The road closures may impact on social cohesion and interactions as access in and between communities becomes limited. In contrast, reduced travel times and increased accessibility to other areas can contribute to greater social cohesion, for example with the remainder of the Adelaide region.

Northern section

In the suburb of Waterloo Corner, some local road closures would limit access for residents to the west of the project. Access to community facilities may also be impacted including easy access by pedestrians and private vehicles to the South Australian Gun Club, Southern Go Kart Club and St Kilda Beach.

Central section

In the suburb of Bolivar, access and severance is limited to the Bolivar WWTP. An interchange has been proposed at this location to allow access to the area and to the area adjacent to the Whitehorse Inn and Highway One Caravan and Tourist Park. As there are no residential properties, other than the caravan and tourist park, affected in the Central section, the impacts from severance and changes to social cohesion are limited.

Southern section

The project would remove Port Wakefield Road from the National Network. The need for current access restrictions to and from Port Wakefield road would be reviewed and if eased residents would have greater access to services and community facilities to the east of Port Wakefield Road.

The Northern Connector would not create severance or alter the access to any communities in the Southern section.

Amenity

Environmental amenity relates to impacts during construction and operation. Construction impacts are temporary while the project is being built; operational impacts would be more permanent.

During construction, amenity impacts on the local community would include:

- visual impacts
- noise and dust from construction activities.

Environmental impacts from the operational use of the road and rail component would include:

- noise and vibration from operation of road and/or rail (see Technical Report 1 — Noise and vibration)
- visual impacts.

Environmental impacts from the Northern Connector at Barker Inlet wetlands are assessed in Chapters 17 and 18.

Property acquisition

Once the project is funded, the land required for the project would be acquired under the South Australian Highways Act. Under section 39D of the Act, ‘the Minister may acquire land by agreement or compulsorily for the purposes of an authorised project; and may acquire personal property by agreement for the purposes of an authorised project’. The Land Acquisition Act applies in relation to the acquisition of land under this section.

Over 60% of the land required for the Northern Connector is in the ownership of local, state and Commonwealth government, Cheetham Salt Limited and Australian Rail Track Corporation. Less than 40% of the land required is held in private ownership. Approximately 165 land parcels will be impacted by the Northern Connector acquisition corridor, including approximately 20 houses.

The preferred approach for property acquisition is by negotiated purchase between the Department for Transport, Energy and Infrastructure (DTEI) and the property owner. The Minister for Transport gives approval for DTEI to offer compensation in accordance with the provisions of the Land Acquisition Act. The Act allows for compensation to cover reimbursement of reasonable professional fees, cost of relocation and any other losses in addition to the fair and reasonable market value of the property itself.

If a negotiated agreement on price and other compensation items cannot be reached, then DTEI may acquire the property by compulsory means. Compulsory acquisition is a statutory process under the Land Acquisition Act, which allows DTEI to acquire the land necessary to provide an efficient road system. It also provides the legal means for reaching agreement about the amount of compensation payable if an agreement cannot otherwise be negotiated.

If affected parties object to the proposed acquisition or wish to vary the amount of land to be acquired, there is a legal process that must be followed. The relevant procedures are set out in the Land Acquisition Act and are summarised in the *Property Acquisition Guide* (DTEI 2006).

The Northern Adelaide region has been marked for future development (Section 13.2.5) and demand and growth is expected to continue. Home buyers purchasing

properties in potential new release areas would see the project as positive, providing access to outside areas and minimising the need for private motor vehicle use, through greater residential density and potentially greater demand for public transport.

Once the project is in operation, community amenity and access to public transport would improve and the project is unlikely to have a negative impact on property values.

Social fabric

Social fabric can relate to the make-up of an area. Changes and impacts on the social fabric of communities in the project area relate specifically to changes to:

- demographic composition
- access to employment
- education and access to existing social structures.

Northern section

In the Northern section, the current horticultural and agricultural focus of St Kilda and Waterloo Corner provides a rural–residential character to these well established small market farms. The visual landscape of the area is dotted with greenhouses and processing sheds and provides a lifestyle for some agribusiness farms. The community is reliant on access from St Kilda Road to Port Wakefield Road for access to other areas.

Impacts on the community in the Northern section would incorporate the loss of properties including established market farms and horticultural holdings.

Central section

In the Central section, the small suburb of Bolivar is largely associated with the Bolivar WWTP and the Highway One Caravan and Tourist Park, which provides affordable permanent residential accommodation to the west of Port Wakefield Road. Its residents are, to some extent, already isolated from the commercial and social facilities to the east of Port Wakefield Road.

The impacts on the social fabric of the Central section would be minimal. Most residents in this area reside in the Highway One Caravan and Tourist Park, which would be impacted only by noise from the project.

Southern section

In the Southern section, the suburb of Globe Derby Park is well known as the harness racing home of Adelaide. The area has a thriving equine-associated local economy. Local roads are largely used by the harness racing community and access to the area and maintenance of access in the area has been identified as important to the community.

The impacts to the social fabric of the Southern section, in particular Globe Derby Park, relate to the equine industry and community around Globe Derby Park (western area).

Overall, impacts of the project on the social fabric of the local area would incorporate changes to the existing community structure due to potential land use changes in the wider area surrounding the project. The Northern Connector would improve accessibility to the Northern Adelaide region, which is earmarked for planned population growth (Section 13.2.5).

Tourism

The project is not expected to have any immediate or short-term impacts on the tourist attractions listed in Section 13.2.5 but it may improve access to the area for tourists.

13.3.3 Impacts on the local economy

Potential impacts of the Northern Connector on the local community would include:

- horticultural impacts
- impacts on land values
- impacts on commercial land values.

13.3.4 Horticultural impacts

The construction of the Northern Connector would require partial or full acquisition of some agricultural and horticultural allotments in the project footprint. Some agricultural and horticultural production would be lost.

The location of the route indicates a potential production loss of \$2.3 million per annum and an initial lost capital cost of \$5.1 million. Most of these losses would result from impacts on greenhouses, which have higher production and capital values. However, of the 700 ha of greenhouses in the Virginia horticultural area only 1.3% (9 ha) would be immediately and directly affected by the project footprint. The potential impacts of a 'conglomeration' or 'cluster' effect are not taken into account.

The final figures do not consider the potential impact on the unaffected portion of an allotment. The loss of land on allotments may have impacts on the viability of operations due to severance and access to on-site infrastructure, which in turn could have impacts on farming and business operations. The estimated loss of production assumes 'business as usual' during operation. However, each allotment would be affected to varying degrees, and the viability of operations after project development is allotment-specific and difficult to measure.

13.3.5 Land values

Most of the numerous studies on the effects of transportation improvements on real estate values analyse the effects of expressway expansions or construction on residential sale prices, with the goal of establishing the economic impacts of road and/or rail construction.

Urban economic theory predicts that if roads or rail improve accessibility, that accessibility premium would be reflected in higher land prices. Empirical results suggest that improvement type, proximity, parcel location at key network points (e.g. corner parcels) and timing of construction and completion play key roles in property valuation.

Property values may change in the vicinity of the project. The impact of the Northern Connector would vary with distance from and accessibility to the interchanges.

Assumptions derived from the Transportation Research Board paper, *Impact of Highway Improvements on Property Value in Washington State* (Palmquist 1998), indicate that, subject to the economic situation, accessibility to the Northern Connector interchanges and a number of other factors, residential properties located within a 0–1 km range of the project route are anticipated to benefit the most from increased accessibility and, therefore, are expected to benefit in terms of increased property values.

As well as improved access to the Northern Connector in the immediate area (i.e. less than 1 km), the wider region could also benefit in terms of increased property values.

13.3.6 Commercial land values

Palmquist (1998) illustrated that industrial and commercial land values were also expected to increase, depending on the level of accessibility. The suburbs with the most significant commercial land in a 0–1 km range of the Northern connector are:

- Burton
- Wingfield
- Gillman
- Paralowie
- Waterloo Corner
- Parafield Gardens.

13.4 Management and mitigation

13.4.1 Planning and design

The community has a number of preconceived ideas about the extent and impacts of the project. Therefore, ongoing consultation about the design and environmental impacts will be undertaken to ensure that incorrect perceptions are addressed and, where feasible, mitigated.

Impacts on local community severance, social cohesion and access have been considered through the planning and design of the Northern Connector. The route and location of the Waterloo Corner interchange has minimised community impacts, and will continue to provide access to Port Wakefield Road for areas west of the Northern Connector. Before construction, accommodation works would be undertaken to ensure that continued access would be available to severed land.

Impacts on the visual amenity of local communities have been considered during the planning and design phase of the project (see Chapter 10).

13.4.2 Construction

Community and stakeholder engagement will be a key component of managing construction impacts. Current consultation will continue throughout the construction phase. A community and stakeholder engagement plan will be prepared to ensure affected stakeholders and community are regularly informed about construction activities. A community liaison representative will be allocated specifically to deal with public enquiries and manage the consultation process during construction.

Table 13.2 lists possible measures for managing social impacts during construction. Noise, dust, visual and traffic management measures during construction are detailed in their relevant chapters in this Project Impact Report.

Table 13.2 Managing social impacts during construction

Potential impact	Potential management measure
Individual property access	<ul style="list-style-type: none"> ▪ Consult with landowners of properties before entering, to ensure they have given permission, and understand accommodation and construction works, including restoration and reinstatement ▪ Determine private property access including an access/lease agreement or private property construction plan, or similar, depending on the type of work required
Area access	<ul style="list-style-type: none"> ▪ Make alternative arrangements for areas that may have limited or changed access during construction ▪ Provide a suitable alternative if access is to be cut off
Utility service interruptions	<ul style="list-style-type: none"> ▪ Schedule required service interruptions to avoid peak demand times (i.e. early morning, evening, weekends) to minimise the impact on businesses and residents ▪ Notify residents and businesses beforehand of scheduled service interruption, through door knocks or calling cards

Potential impact	Potential management measure
Aesthetics during construction	<ul style="list-style-type: none"> ▪ Keep construction sites clean and tidy ▪ Properly contain all waste in waste containers away from publicly visible areas ▪ Frequently clean footpaths and roads of dirt
Safety	<ul style="list-style-type: none"> ▪ Securely fence, or close off from public access, all construction areas ▪ Advertise in local newspapers and notify local residents and businesses to inform them of construction areas, duration of works and safety hazards
Timing of work	<ul style="list-style-type: none"> ▪ Schedule work for minimal impact on the community ▪ Consult with the community to communicate times of construction activities
Night work required	<ul style="list-style-type: none"> ▪ Undertake all works in line with DTEI's Construction Noise and Vibration Operational Instruction (see Chapter 11) ▪ Notify residents and local businesses by door knocking or letter box drops of required night work
Site staff behaviour	<ul style="list-style-type: none"> ▪ Induct all construction staff and make them aware of expected behaviour when dealing and interacting with public ▪ Report all complaints made to site staff to site supervisor ▪ Site staff to carry contact details of site supervisor and community relations representative, to provide to members of the community or for staff to call to resolve issues on the spot

Impacts during construction, which would relate to inconvenience to residents and commuters and potential environmental impacts to primary communities, are expected to be temporary in nature.

13.4.3 Operation

The operation of the Northern Connector are expected to be a positive outcome for the area, as existing suburbs may be revitalised (due to increased accessibility). The improved accessibility would allow members of the community to interact more easily within and outside the area. Current activities would continue but the area, amenity and infrastructure would be enhanced. There will also be an improvement in amenity (noise) along Port Wakefield Road and the existing train line through Salisbury.

There may be some noise impacts adjacent to the Northern Connector due to the operation of the road and rail. They would be managed and mitigated to minimise potential impacts by the measures proposed in Chapter 11.

14 Planning, zoning and landuse

14.1 Introduction

The assessment approach, relevant planning strategies, policies and development plans, existing landuse conditions, potential impacts and proposed mitigation measures can be found in full in Technical Report 2 — Planning, zoning and landuse.

14.1.1 Assessment approach

The planning, zoning and landuse assessment reviewed:

- South Australian and local planning strategies
- key relevant South Australian and Australian Government legislation
- relevant development plans and current/proposed amendments
- key land uses and development projects in the region
- existing land uses along and adjacent to the Northern Connector corridor

The assessment also considered:

- potential impacts and benefits of the project, including possible land development opportunities
- potential management and mitigation measures.

14.1.2 Planning strategies

South Australian Government

The following South Australian planning strategies were reviewed:

- National Charter of Integrated Land Use and Transport Planning (Section 3.1.1)
- Adelaide Urban Corridor Strategy (Section 3.1.2)
- South Australia's Strategic Plan (Section 3.1.3)
- The 30-Year Plan for Greater Adelaide (Section 3.1.4)
- Housing and Employment Land Supply Program (Section 3.1.5)
- Strategic Infrastructure Plan for South Australia (Section 3.1.6)
- Housing Plan for South Australia (Section 3.1.7)
- Development of horticulture industries on the Adelaide plains (Section 3.1.8)

These strategies and how they relate to the project are discussed in Section 3.1.

Local

The *Local Government Act 1999* requires that each local government authority in South Australia develop and adopt plans to manage their area. These plans are collectively called strategic management plans and they:

- identify the council's objectives for the area over a period of at least four years
- set out the council's directions, priorities and strategies
- shape annual budgetary deliberations
- guide the formulation of other plans and strategies, and in particular, the council's 10 year financial plan
- integrate the council's proposals with South Australian and regional plans and strategies (where appropriate)
- ensure consistency with the Planning Strategy and relevant development plans.

The local planning strategies reviewed as part of this assessment were those of the local government areas in which the project would be located:

- City of Playford, Playford Community Plan (no date)
- City of Salisbury (2008b), Salisbury City Plan 2020 — Salisbury, Sustainable Futures
- City of Port Adelaide Enfield (2010b), Port Adelaide Enfield City Plan 2010–2016.

City of Playford

The Playford Community Plan establishes a collective direction for the council area and contains three goals:

- community wellbeing — to improve and support the wellbeing, health and safety of the Playford community
- economic prosperity — to improve economic prosperity of the region
- environmental care — to secure a sustainable future for Playford's community and environment through leadership innovation, collaboration and engagement.

The principal objectives in the plan for achieving economic prosperity are to:

- create liveable and accessible communities
- encourage a growth in local business investment
- strengthen the role and function of the Elizabeth Regional Centre
- create a world class industry precinct at Greater Edinburgh Parks.

The Council has also recognised the significant growth potential of the area, with developments such as Playford North, Blakeview and Buckland Park. The city's population is forecast to increase by approximately 50,000 residents over the next 20 years.

The Northern Connector would support many objectives of the Community Plan by:

- creating better access for the community
- encouraging economic investment
- facilitating the principles of environmentally sustainable development by providing rail infrastructure.

City of Salisbury

The *Salisbury City Plan 2020 — Salisbury, Sustainable Futures* (City of Salisbury 2008b) presents a long-term sustainable vision for the City of Salisbury that recognises links with *South Australia's Strategic Plan* and the Planning Strategy. The City of Salisbury has structured its planning process around four key directions:

- shaping the future
- sustaining our environment
- the living city
- Salisbury success.

The City Plan recognises potential development outcomes in the council area. Of particular relevance to the project are:

- the proposal to develop the Northern Connector for road and rail purposes
- potential urban development of land west of Port Wakefield Road in the vicinity of Bolivar Wastewater Treatment Plant (WWTP) and St Kilda township — recognising this area for 'possible long-term residential mixed use development'
- potential industrial development in the Greater Edinburgh Parks development (including the intermodal facility at Direk).

The City Plan also contains the following specific objectives relevant to the project:

- Key Direction 1: Shaping the future
 - Objective 6 — facilitate the long-term supply of industrial and commercial land
 - Objective 7 — ensure infrastructure supports development
 - Objective 8 — facilitate the delivery of an integrated transport network.

Under the 'strategic initiatives' for Key Direction 1, Council states that the flow-on effects of the Northern Connector for adjacent development opportunities would be significant.

- Key Direction 2: Sustaining our environment
 - Objective 1 — conserve and promote biodiversity, natural habitats and open space
 - Objective 5 — facilitate and encourage development that incorporates sustainability initiatives
 - Objective 6 — enhance the amenity of the city through street and open space urban design and landscaping.

These objectives are particularly relevant in the route location and design of the project, particularly recognising the important biodiversity habitats in the project area.

- Key Direction 3: The living city
 - Objective 2 — ensure services and infrastructure meet community needs
 - Objective 5 — enhance housing availability in the City of Salisbury.

Under the ‘strategic initiatives’ for Key Direction 3, Council states that opportunities for increasing population and housing availability that need to be pursued include infill ‘greenfields’ development in areas such as west of Port Wakefield Road and the Penfield areas in Edinburgh Parks.

Under the ‘targets and indicators’ section for Key Direction 3, Council has stated that it seeks to achieve sustainable population growth and diversity — increasing the population of Salisbury from 118,422 (2006) to 170,000 before 2030.

City of Port Adelaide Enfield

The Port Adelaide Enfield City Plan 2010–2016 sets future directions for Council and takes a long-term view, with a vision for the city to the year 2020.

The City Plan follows five key themes that reflect the community’s priorities:

- a strong and diverse economy
- a vibrant and resilient community
- a unique, healthy and sustainable environment
- a great place to live, work and play
- committed and accountable governance.

Specifically, the goal of the urban development and transport theme is to develop ‘a vibrant and attractive City that is well-planned and accessible, with safe and healthy places to live, work and play’.

Objectives to achieve this goal that are relevant to the project include:

- an integrated transport system that is safe, efficient, convenient and sustainable, and that encourages the use of alternative forms of transport
- Port Adelaide Enfield urban development issues represented in strategic land use planning at a State level.

14.1.3 Relevant legislation

The following key Australian and South Australian Government legislation may be relevant to the project:

- *Highways Act 1926*
- *Land Acquisition Act 1969*
- *Development Act 1993*
- *Roads (Opening and Closing) Act 1991*
- *Environment Protection and Biodiversity Conservation Act 1999* (Chapters 17 and 18)
- *Environment Protection Act 1993* (Chapter 19)
- *Aboriginal Heritage Act 1988* (Chapter 16)
- *Heritage Places Act 1993* (Chapter 12)
- *Native Title Act 1993* and *Native Title (South Australia) Act 1994* (Chapter 16)
- *Coast Protection Act 1972* (Chapter 21)
- *Adelaide Dolphin Sanctuary Act 2005* (Chapter 18).

Highways Act 1926

The Highways Act establishes the:

- functions and powers of the Commissioner of Highways
- framework for construction and maintenance of specified roads and works in South Australia
- mechanisms to undertake authorised transport infrastructure projects.

Specifically in relation to the project, Division 2 of the Act provides the mechanism for the Governor to declare an ‘authorised project’, allowing for:

- acquisition of property for the purpose of the project under the Land Acquisition Act
- closure of roads or railway lines
- specific exemptions for obtaining approvals under the Development Act.

Land Acquisition Act 1969

The Land Acquisition Act applies to the parcels of land that would be compulsorily acquired by the Government of South Australia to enable construction of the Northern Connector.

Through the Highways Act, the Department for Transport, Energy and Infrastructure (DTEI) has the authority to acquire property that is required for road development purposes. The acquisition process is carried out in accordance with the provisions of the Land Acquisition Act for compulsory acquisition and the means for reaching agreement about the amount of compensation payable. DTEI is also willing to acquire property through negotiated purchase with the owners either during the early planning phases of a project or once an approved scheme has been announced.

Development Act 1993

The South Australian planning system is established under the Development Act and associated *Development Regulations 2008*. The object of the Act is to provide for proper, orderly and efficient planning and development in South Australia. Among other aims, the Act provides for:

- establishment of objectives and principles of planning and development
- a system of strategic planning governing development
- creation of development plans with policies to guide and control development
- appropriate public participation in the planning process and assessment of development proposals
- establishment of various decision-making bodies.

The Act requires the preparation of the Planning Strategy for South Australia (Section 3.1), which is integrated with, and should be read in conjunction with, other specialist plans (e.g. *Strategic Infrastructure Plan for South Australia*; Government of South Australia 2005). The Act requires that development plans should seek to promote the provisions of the Planning Strategy.

Land for the project would be acquired under the Highways Act. This action excludes the application of most of the approval processes prescribed under the Development Act, except State heritage and significant trees.

Roads (Opening and Closing) Act 1991

The Roads (Opening and Closing) Act, in association with the Highways Act, may be required for the opening and closing of local roads affected by or adjacent to the Northern Connector.

Development plans — zones and policy areas

Development plans are prepared under the Development Act to provide land use planning guidance and direction for all areas of South Australia. They have been prepared for each of the three council areas containing the project corridor:

- Playford (City) Development Plan (consolidated 23 December 2010)
- Salisbury (City) Development Plan (consolidated 15 July 2010)

- Port Adelaide Enfield (City) Development Plan (consolidated 23 September 2010).

Tables 14.1–3 summarise the relevant zones (Figure 14.1) that directly affect the project area and surrounds.

Current planning controls in these development plans support existing land uses in and adjacent to the corridor.

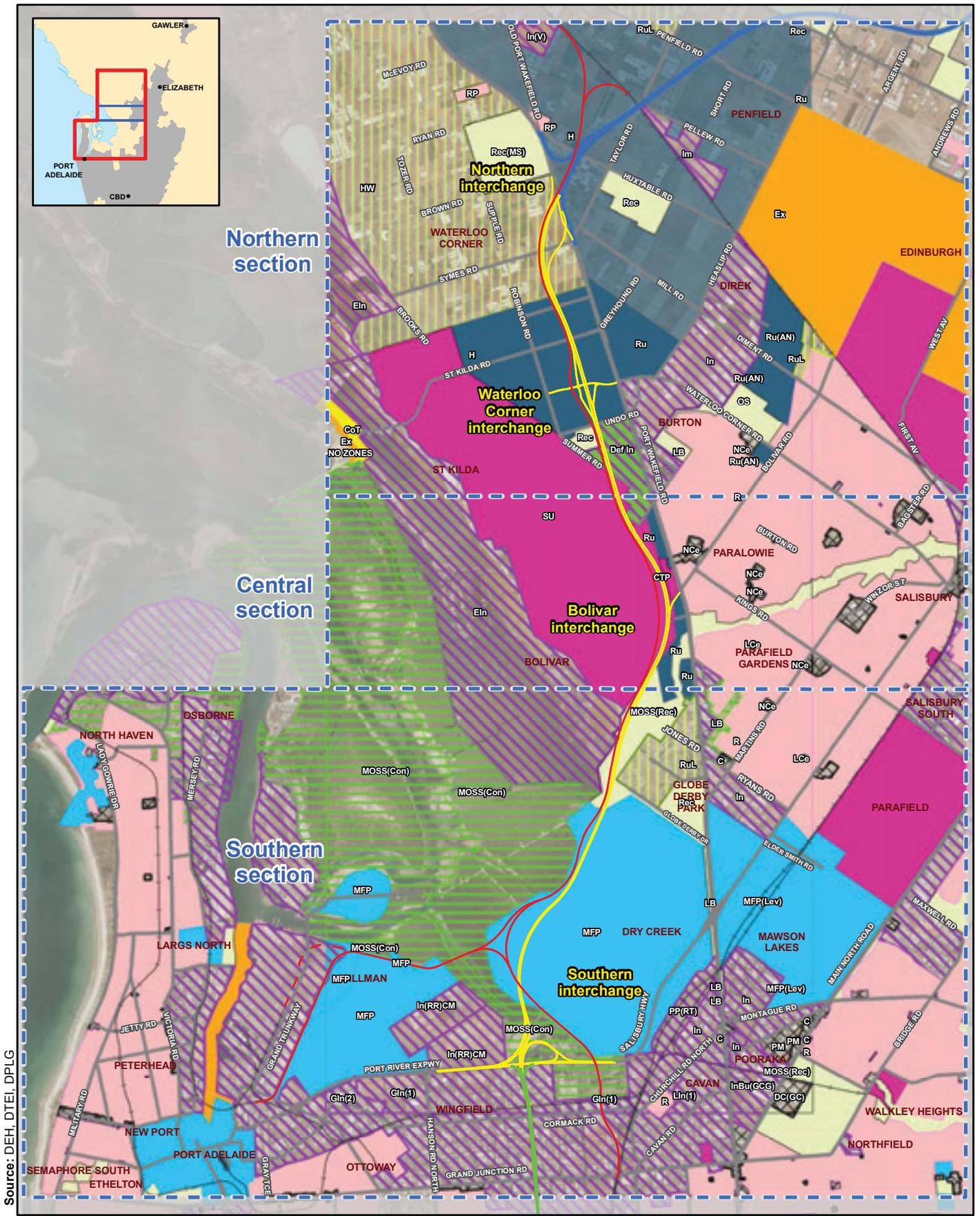
Table 14.1 Playford (City) Development Plan zones

Zone name and objective	Description in project area
Horticulture West Retention of land for horticulture	<ul style="list-style-type: none"> ▪ seeks to protect the significant economic benefits of the Northern Adelaide region for ongoing market garden, greenhouse, horticultural and viticulture activities ▪ important food production area, capitalising on its proximity to the produce markets, major transport routes, labour supply and connection to the Adelaide to Darwin railway network

Table 14.2 Salisbury (City) Development Plan zones

Zone name and objective	Description in project area
Horticulture (H) Retention of land for horticulture	<ul style="list-style-type: none"> ▪ seeks to protect the significant economic benefits of the Northern Adelaide region for ongoing market garden, greenhouse, horticultural and viticulture activities ▪ important food production area, capitalising on its proximity to produce markets, major transport routes, labour supply and connection to the Adelaide to Darwin railway network
Deferred Industry Land preserved for future industrial use	<ul style="list-style-type: none"> ▪ adjacent to Port Wakefield Road ▪ allows for agricultural purposes until required for future industrial expansion
Special Use Land preserved for special public and private activities — recreational, community or institutional use of an open character	<ul style="list-style-type: none"> ▪ covers the land containing Bolivar WWTP and associated buffers
Extractive Industry A zone comprising land intended for the mining and quarrying of minerals	<ul style="list-style-type: none"> ▪ forms part of Cheetham Salt Ltd salt fields, which stretch for almost 80 km along the eastern side of Gulf St Vincent
Caravan and Tourist Park Zone A zone primarily for short-term tourist accommodation and associated facilities	<ul style="list-style-type: none"> ▪ located adjacent to Port Wakefield Road ▪ covers the area occupied by Highway One Caravan and Tourist Park

Zone name and objective	Description in project area
<p>Rural Living</p> <p>A zone primarily accommodating detached dwellings in association with a range of compatible rural activities</p>	<ul style="list-style-type: none"> ▪ located adjacent to Port Wakefield Road ▪ located immediately east of Globe Derby Park trotting track ▪ established to allow persons to live in detached dwellings on allotments that also accommodate stables — providing a direct relationship with adjacent harness racing venue
<p>MOSS (Recreation)</p> <p>A zone in which a predominantly open space character is preserved and enhanced to provide a visual contrast to the urban area</p>	<ul style="list-style-type: none"> ▪ covers the Dry Creek riparian area to the west of Port Wakefield Road ▪ seeks to ensure that the link between wetlands, mangroves and estuarine environments is maintained and enhanced to promote biodiversity and conservation
<p>MOSS (Conservation)</p> <p>Conservation, rehabilitation and improvement of the natural features of land, fauna, flora and marine and estuarine environment as part of the Metropolitan Open Space System</p>	<ul style="list-style-type: none"> ▪ includes St Kilda mangroves ▪ seeks to ensure that links between wetlands, mangroves and estuarine environments are maintained and enhanced to promote biodiversity and conservation
<p>Multi-function Polis</p> <p>A zone originally developed for a comprehensive and staged urban development that would accommodate 30,000–50,000 people</p>	<ul style="list-style-type: none"> ▪ in the Southern section of the project area ▪ established to allow a comprehensive and staged urban development for up to 50,000 people ▪ focus of the original MFP development was shifted to Mawson Lakes ▪ original MFP Zoning in the Gillman area still remains in the Development Plan ▪ land currently used as salt crystallisation pans by Cheetham Salt Ltd ▪ includes wetlands in the project area



Source: DEH, DTEI, DPLG

Figure 14.1 Zoning surrounding the Northern Connector

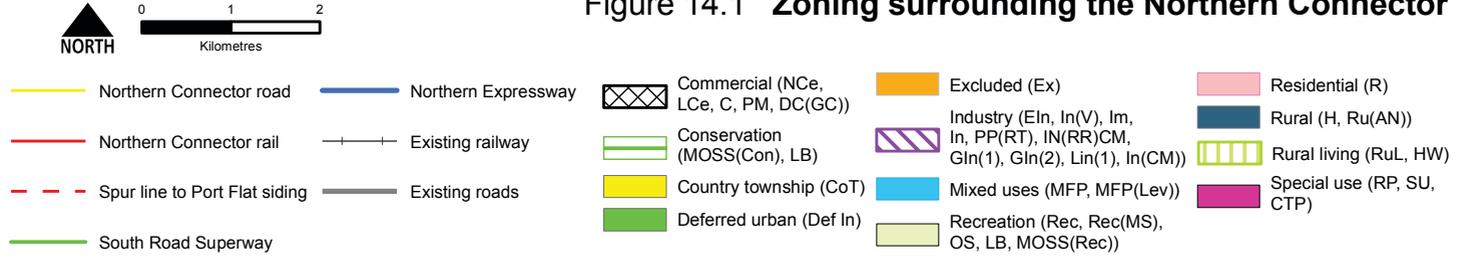


Table 14.3 Port Adelaide Enfield (City) Development Plan zones

Zone name and objective	Description in project area
General Industry (1) Accommodates primarily light and general industries, road transport terminals, warehousing, storage	<ul style="list-style-type: none"> ▪ includes land south-east of the Southern interchange
Industry (Port) Comprises land for long-term growth of port and accommodating activities dependent on a port-side location	<ul style="list-style-type: none"> ▪ includes land to the west of the southern interchange
MOSS (Conservation) Accommodates passive recreation, tourism, education and research activities, in appropriate locations that do not detrimentally impact on natural features of the area or estuarine and marine environment	<ul style="list-style-type: none"> ▪ includes St Kilda mangroves ▪ seeks to ensure that links between wetlands, mangroves and estuarine environments are maintained and enhanced to promote biodiversity and conservation

14.2 Existing conditions

The project area exhibits a number of unique features and characteristics that have either influenced the development of, or would be impacted by, the route of the Northern Connector.

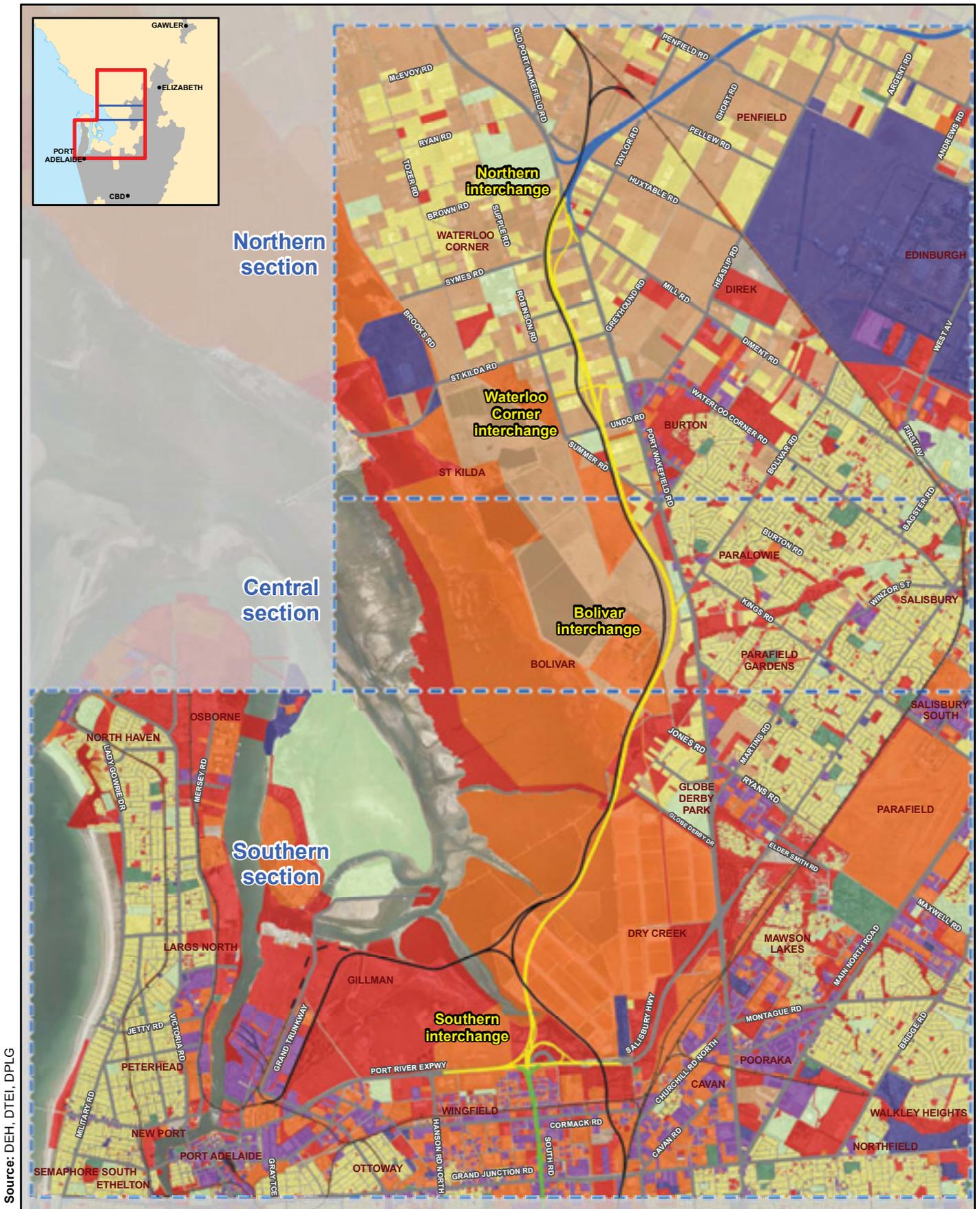
The project area is located in a highly modified area. However, some areas still reflect the original natural system: mangroves, coastal saltmarsh, wetlands and shallow waterbodies. A number of constructed and natural drainage channels cross the flat terrain of the area.

The project area is located in the traditional lands of the Kaurna Aboriginal community. A number of Aboriginal sites, objects and remains have been identified in the area.

Urban settlement in the project area is largely confined to the east of Port Wakefield Road, with the exception of the rural living precinct associated with Globe Derby Park trotting track and the small coastal township of St Kilda (Section 13.2.4).

Specific characteristics vary significantly between the three sections.

Figure 14.2 illustrates existing general land uses surrounding the Northern Connector.



Source: DEH, DTEI, DPLG

Figure 14.2 Landuse surrounding the Northern Connector



- | | | | | |
|-------------------------------|---------------------|-------------|--------------------------|--------------------|
| Northern Connector road | Northern Expressway | Agriculture | Recreation | Public institution |
| Northern Connector rail | Existing railway | Commercial | Industry / mine / quarry | Vacant |
| Spur line to Port Flat siding | Existing roads | Education | Residential | Other |
| South Road Superway | | | | |

14.2.1 Northern section

The Northern section of the project area around Waterloo Corner is largely developed land used for rural living, agricultural, horticultural and commercial purposes, with access through a network of local roads. The horticultural and agricultural communities are known to comprise a number of neighbouring properties that are either family-owned businesses and/or share resources.

The suburb of Waterloo Corner supports a variety of horticultural activities, including market gardens and orchards, with greenhouses dominating the landscape. Dwellings are located on large horticulture and rural living sized allotments, many of which have horse-keeping activities and trotting track facilities. Immediately north of the project area is the Adelaide International Raceway facility.

Immediately to the west of Port Wakefield Road are an existing gun club, go-kart track and food processing facility.

With a resident population of approximately 245 (ABS 2006), St Kilda provides coastal recreational facilities, including boat launching ramps, an adventure playground, and a mangrove boardwalk and interpretive centre.

14.2.2 Central section

The Central section of the project area around the suburb of Bolivar is dominated by Bolivar WWTP and its settlement ponds.

Initially constructed in the late 1960s, Bolivar is the largest WWTP in Adelaide — servicing an area stretching from Gawler to Mitcham. It includes plant facilities, stabilisation lagoons, a recently constructed dissolved air flotation and filtration plant (which filters and disinfects the water for recycling to the horticulture region of Virginia) and associated buffers.

The predicted future growth for northern Adelaide would probably require expansion of the existing facilities.

In addition, there are some commercial uses fronting the western side of Port Wakefield Road, the Highway One Caravan and Tourist Park, Whitehorse Inn and the Caltex service station.

The suburb of Bolivar has a population of 120 (ABS 2006), over 95% of whom are long-term residents of the Highway One Caravan and Tourist Park.

14.2.3 Southern section

The major land use in the Southern section of the project area is salt fields.

Cheetham Salt Ltd is Australia's largest producer and refiner of salt products for food and industrial markets. The salt fields are located on land partly owned by

Ridley Corporation (operating as Cheetham Salt Ltd) and partly leased from the Land Management Corporation. The salt producing and harvesting activities generate salt for Penrice Soda Products, located on Lefevre Peninsula. The salt operations, stretching approximately 80 km along the eastern side of Gulf St Vincent, have been in operation for over a century. A network of above- and below-ground pipes, pumps and electrical systems are located throughout the site.

The southern area of Cheetham Salt Ltd salt fields adjacent to Port Wakefield Road, Salisbury Highway and the Port River Expressway, in the suburb of Dry Creek, forms the final area of salt harvesting.

The project route in the Southern section was selected as the most direct and efficient transport route that minimised the impact on the environment and Cheetham Salt Ltd operations. DTEI understands that Cheetham Salt Ltd is currently investigating future possible uses of its site at Dry Creek.

Globe Derby Park, located to the west of Port Wakefield Road immediately north of the salt crystallisation fields, is a rural–residential area with a population of 313 (ABS 2006) and foundations in the equestrian and associated activities that support the Globe Derby Park Trotting Club and track.

The Southern section of the project area has large areas of natural systems: mangroves, coastal saltmarsh, constructed wetlands, samphire and shallow water bodies.

The constructed linked wetlands (Greenfields Stages 1, 2 and 3 wetlands and Barker Inlet north and south wetlands) skirt the southern boundary of the project area along Salisbury Highway. They perform a critical function in collecting and managing stormwater. They are also highly valued by various community groups, school groups and the local community, and provide habitat for a number of migratory and threatened bird species.

The Southern section also contains the State Heritage listed Dry Creek Explosives Magazine and Earth Mounds adjacent to Salisbury Highway.

To the west of the Wingfield landfill–North Arm Creek is industrial land of the suburbs of Gilman and Dry Creek. The road corridor continues south to the interchange with the Port River Expressway; the rail alignment is to the north of this area, in the Gillman Eco-industrial Precinct highlighted in the Housing and Employment Supply Program (HELSP) report (Department of Planning and Local Government 2010b). The potential development of this precinct is strengthened by the Northern Connector rail alignment which may protect it from stormwater inundations and future sea level rise.

14.2.4 Key land uses and development projects in the region

The HELSP report outlines the location and scale of industrial and residential development throughout metropolitan Adelaide. The Northern and Barossa regions will experience significant growth over the next 10–15 years, emphasising the importance of the Northern Connector investment. These regions are projected to

accommodate a significant proportion of Greater Adelaide's future growth in new dwellings, people and employment opportunities. It contains substantial tracts of broadacre land suitable for urban development.

Northern region development sites over 50 ha

- Andrews Farm (77 ha developed over the next 0–5 years)
- Blakesview/Craigmore (384 ha to be developed over the next 0–15 years)
- Buckland Park (1531 ha to be developed over the next 30 years)
- Golden Grove (63 ha to be developed in the next 0–5 years)
- Highbury (73 ha to be developed in the next 0–10 years)
- Mawson Lakes (51 ha to be developed in the next 0–5 years)
- Munno Para West (418 ha to be developed in the next 0–15 years)
- Northgate (91 ha to be developed in the next 0–10 years)
- Penfield Golf Course 9106 ha to be developed in the next 0–10 years)
- Future potential residential growth areas subject to DPAs or further investigations include Angle Vale (468 ha), Bolivar (700 ha), Dry Creek (869 ha) Globe Derby Park (203 ha), Munno Para Downs (285 ha), Playford North Extension (369) Virginia and North Virginia (148 ha)

Barossa region development sites over 50 ha

- Evaston Gardens and Evaston South (135 ha developed over the next 0–10 years)
- Gawler East (419 ha to be developed over the next 0–15 years)
- Concordia (445 ha subject to DPA timing in 2014–15 to 2018–19)
- Roseworthy (1032 ha subject to DPA to be prepared in 2012)
- Two Wells (1032 ha subject to DPA to be prepared in 2012)

14.3 Potential impacts on existing conditions

Land acquisition, construction and ongoing operations of the Northern Connector would have both positive and negative impacts on existing land uses in the area and the wider region of metropolitan Adelaide (and beyond).

Potential positive impacts of the project include:

- improved access to the north and south of metropolitan Adelaide
- increased accessibility — particularly linking employment and industrial markets to the Port of Adelaide
- improved access to other community and recreational activities

- improved safety, and reduced congestion, traffic delays and noise impacts of existing road and rail freight networks through established urban areas
- improved road and rail freight capacity and speed of movement
- potential opportunities for new urban development in proximity to the Northern Connector
- ‘unlocking’ commercial and industrial development opportunities along the corridor, including the Economic Development Precinct in Gillman and Defence SA in Port Adelaide.

Potential negative impacts of the project include:

- severance of land
- reduced viability of land parcels due to severance or changed access arrangements
- construction impacts — particularly in relation to vehicle movement, air and noise pollution
- impacts on sensitive environmental areas — Barker Inlet wetlands
- potential disruption of business operations of Cheetham Salt Ltd
- a change in the social character and/or amenity for existing residents and businesses
- reduction in social cohesion, particularly for residents located west of the Northern Connector
- loss of land used for agricultural, horticultural, recreational and rural living.

14.3.1 Land use patterns

Northern section

The focus for dealing with potential key land use conflicts within the Northern section is considered to be:

- limiting fragmentation of horticultural land
- minimising any adverse amenity impact and disruption caused to adjacent dwellings in the project area
- maintaining access to residential, commercial, industrial and recreational land such as St Kilda, the northern section of the Cheetham Salt Ltd salt fields and horticultural/agricultural land uses.

Central section

The Bolivar interchange would be located adjacent to the Bolivar WWTP, allowing access to the Northern Connector for the Paralowie and Parafield Gardens residential areas.

The key land use issue for the Central section is to ensure the ongoing viability and expansion potential of the Bolivar WWTP.

Noise attenuation measures may possibly be required adjacent to the Highway One Caravan and Tourist Park, although traffic noise on Port Wakefield Road is expected to reduce significantly.

Southern section

Major land use impacts in this section include:

- Cheetham Salt Ltd salt fields — land severance impacts caused by the project, particularly on operations in the south-western portion of the salt fields that may be isolated by the Northern Connector route
- Southern interchange — design and impacts on existing land uses and Barker Inlet wetlands.

14.3.2 Development potential in and adjacent to Northern Connector corridor

The investment in transport infrastructure would create land use development opportunities linking to, or adjacent to, the corridor, including the creation of industrial and commercial employment nodes, particularly around interchanges and Port Wakefield Road.

Secondary development benefits would include improved access to:

- new developing areas in northern Adelaide
- Virginia horticultural district
- job markets for commuters
- the Barossa Valley and Clare Valley for tourism growth
- the Economic Development Precinct in Gillman and Defence SA in Port Adelaide.

The key land use challenges include:

- capitalising on the transport infrastructure and connectivity created by the Northern Connector
- ensuring that any urban development has minimal or no impact on significant ecosystems in the region
- protecting and enhancing the productive capacity of key agricultural and horticultural areas
- ensuring that the function and expansion capacity of Bolivar WWTP is not adversely compromised by any adjacent development

- giving consideration to the potential for industrial and commercial development and associated employment opportunities for land adjacent to Port Wakefield Road and the interchanges along the Northern Connector corridor
- ensuring that accessibility is maintained for existing land owners
- ensuring that impacts on existing operations of Cheetham Salt Ltd are minimised.

14.4 Management and mitigation

The design planning phase of the project has taken into consideration Australian, South Australian and local government strategic objectives.

Specific management and mitigation measures have been considered for the planning and design phase, the construction phase, and ongoing operation and use of the Northern Connector.

14.4.1 Planning and design

To mitigate adverse impacts, during the concept planning phase of the project:

- alternative routes were considered, and the current preferred route chosen because it meets the overall project objectives while minimising external impacts, including impacts to land use
- location and design of interchanges and impacts on existing local road networks were given due consideration
- ownership of land and the impact of property acquisition were considered; over 60% of the land required for the Northern Connector proposed route is in the ownership of local, state and federal government, and ARTC; less than 40% of the land required is held in private ownership
- community and stakeholder engagement in the concept planning phase helped define the current preferred route
- management and mitigation of potential negative impacts (e.g. noise, visual impact) was considered.

14.4.2 Construction

The construction phase will be managed to minimise adverse impacts on existing communities and on the existing transport network, particularly Port Wakefield Road. Measures to be applied where possible to minimise effects on land use are:

- provide early and clear information to the community about future changes to traffic conditions during construction and about how the community would be affected after construction is completed

- prepare site management plans before construction begins, which incorporate details of how access would be maintained during the construction of interchanges and the overall road and rail alignment
- stage the construction program to retain access where possible so that existing access routes are not severed before construction of interchanges and new access roads
- minimise the number of road closures required for construction at any point in time to enable road users to access alternative routes
- manage construction phasing and timing to minimise potential noise effects on residents and other sensitive receivers
- manage construction to minimise dust effects on residents and crops
- control water runoff
- consider threatened and migratory bird breeding seasons.

14.4.3 Operation

To minimise operational impacts:

- emphasise the ongoing advantages of the road and rail network improvements, particularly in regard to convenience and safety
- establish ongoing monitoring of the road and rail network to identify any operational problems
- ensure clear signage and road use/safety information informs users of the road network status.

15 Traffic and transportation

15.1 Introduction

Existing traffic volume data and crash statistics have been used to describe existing conditions, and as input into modelling to project potential impacts and proposed mitigation measures for the Northern Connector.

15.1.1 Assessment approach

Traffic forecast inputs to the planning and evaluation process were prepared using the Department for Transport, Energy and Infrastructure (DTEI) strategic transport model, Metropolitan Adelaide Strategic Transport Evaluation Model (MASTEM), and the NISAM sub-area model.

Land Use Scenario F (population and employment forecast data) was adopted in the assessment developed by DTEI and the Department of Planning and Local Government, informed the sub-area model and represents a high growth in both population and employment. Estimates of future traffic (and public transport passenger) movements have been forecast as a function of road and public transport network characteristics and land use projections detailed in *The 30-Year Plan for Greater Adelaide* (Department of Planning and Local Government 2010a).

The Northern Connector has been designed to cater for projected future traffic growth at prescribed levels of service (LoS), targeting minimum LoS D to the year 2031. This is the horizon year for land use forecasts and transport networks, as prepared by DTEI.

LoS is a representative measure of the quality of the traffic flows and the ease at which traffic can move in the traffic stream. LoS is measured on a scale from A to F, with LoS A representing free-flowing traffic and LoS F representing significant delays and queuing. The targeted LoS D is representing an acceptable traffic condition with minor delays. It is generally assessed for peak periods, which represents the worst case during the day.

Assessment of traffic impacts on the surrounding road network was based on an analysis of forecast flows for 2021 and 2031. It is considered an overall positive change in traffic movements at key intersections and on arterial and local roads, together with the resulting changes to local accessibility.

15.2 Existing conditions

15.2.1 Road

National and Arterial road network

The arterial roads in the project area (Figure 15.1) are described in Table 15.1.

Table 15.1 Existing arterial road network in the project area

Road	Description
Port Wakefield Road	<ul style="list-style-type: none"> ▪ part of the National Road Network ▪ major north–south corridor ▪ major freight link between Adelaide and Yorke Peninsula, Port Augusta, Western Australia and the Northern Territory
Northern Expressway	<ul style="list-style-type: none"> ▪ part of the National Road Network ▪ major freight route linking Sturt Highway at Gawler to Port Wakefield Road north of Waterloo Corner Road
Waterloo Corner Road	<ul style="list-style-type: none"> ▪ oriented north-west to south-east, providing access to the areas of Salisbury and Parafield
Heaslip Road	<ul style="list-style-type: none"> ▪ freight route, in conjunction with Angle Vale Road, linking Sturt Highway at Gawler to Port Wakefield Road at Waterloo Corner Road ▪ a key connection, with Edinburgh Road, into the Edinburgh Parks industrial area and RAAF base
Kings Road	<ul style="list-style-type: none"> ▪ oriented north-west to south-east, providing access to the Salisbury and Parafield areas ▪ links Port Wakefield Road to Main North Road
Bolivar Road (Kings Road to Port Wakefield Road)	<ul style="list-style-type: none"> ▪ oriented north-east to south-west, providing links into Salisbury centre and surrounding residential areas
Martins Road	<ul style="list-style-type: none"> ▪ oriented north-east to south-west, providing links into Salisbury centre and surrounding residential areas
Salisbury Highway	<ul style="list-style-type: none"> ▪ part of the National Road Network (between Port Wakefield Road and South Road) ▪ oriented north-east to south-west, providing links into Salisbury centre and surrounding residential areas
Port River Expressway	<ul style="list-style-type: none"> ▪ part of the National Road Network ▪ main east–west corridor
South Road	<ul style="list-style-type: none"> ▪ part of the National Road Network ▪ major north–south corridor



Source: DEH, DTEI, DPLG

Figure 15.1 Existing road network within the project area



- Northern Connector road
- Northern Expressway
- Northern Connector rail
- South Road Superway
- - - Spur line to Port Flat siding
- Existing railway
- Local roads
- Arterial roads

The Northern Expressway, linking the Sturt Highway at Gawler to Port Wakefield Road near Taylors Road (just north of Waterloo Corner Road) was opened on 13 September 2010. Since then, traffic has shifted from Heaslip Road and Main North Road to the Northern Expressway.

As part of the Northern Expressway project, and during the Northern Connector planning investigation, Port Wakefield Road was upgraded to increase its capacity.

Existing interchanges in the project area include:

- Port Wakefield Road–Salisbury Highway
- Port Wakefield Road–Northern Expressway (completed in 2010)
- Port River Expressway–South Road–Salisbury Highway.

Local road network

The majority of the local roads to the west of Port Wakefield Road are sealed. The speed limits vary from 50 km/hr in urban areas to 100 km/hr in rural areas.

The local road network (Figure 15.1) is outlined in Table 15.2 and described in the following text.

Table 15.2 Existing local road network in the project area

Road	Description
Northern section	
Anjanto Road	<ul style="list-style-type: none"> ▪ left turn in and left turn out access to Port Wakefield Road only
Brown Road	<ul style="list-style-type: none"> ▪ right turn in and right turn out access to Port Wakefield Road
Coleman Road	<ul style="list-style-type: none"> ▪ north-south local road extending south from Tozer Road, to intersect at a T-junction with St Kilda Road ▪ sealed two-way road
Robinson Road	<ul style="list-style-type: none"> ▪ north-south local road from Anjanto Road in the north to Undo Road in the south ▪ currently the south half is sealed
St Kilda Road	<ul style="list-style-type: none"> ▪ collector road ▪ sole link to the St Kilda recreation reserve ▪ used by significant number of heavy vehicles accessing Bolivar WWTP — approx 16 B-doubles per week, transporting up to 50,000 tonnes of freight per year ▪ right turn in and right turn out access to Port Wakefield Road
Symes Road	<ul style="list-style-type: none"> ▪ left turn in and left turn out access to Port Wakefield Rd only
Undo Road	<ul style="list-style-type: none"> ▪ left turn in and left turn out access to Port Wakefield Rd only
Summer Road	<ul style="list-style-type: none"> ▪ left turn in and left turn out access to Port Wakefield Rd only

Road	Description
Supple Road	<ul style="list-style-type: none"> ▪ continuation of Robinson Road to the north to McEvoy Road in the north
Taylor's Road	<ul style="list-style-type: none"> ▪ east of Port Wakefield Road, north-east to south-west direction ▪ sealed two-way road, allows right in and right out movements at its junction with Port Wakefield Road
Penfield Road	<ul style="list-style-type: none"> ▪ Penfield Road links to Port Wakefield Road via Kings Road ▪ includes an overpass across the Northern Expressway
Central section	
Bolivar Road (north-east of Kings Road)	<ul style="list-style-type: none"> ▪ single carriageway with two-way traffic ▪ narrow, with little or no shoulders ▪ full traffic signal control at junction with Port Wakefield Rd
Hodgson Road	<ul style="list-style-type: none"> ▪ single carriageways with two-way traffic ▪ narrow, with little or no shoulders ▪ intersection at Port Wakefield Road, providing access to Bolivar WWTP junction ▪ right turn in and right turn out access to Port Wakefield Road
Jones Road	<ul style="list-style-type: none"> ▪ single carriageway with two-way traffic ▪ narrow, unsealed with little or no shoulders
Victoria Drive	<ul style="list-style-type: none"> ▪ single carriageway with two-way traffic ▪ narrow, with little or no shoulders ▪ left turn in and left turn out access to Port Wakefield Rd only
Southern section	
Daniel Avenue	<ul style="list-style-type: none"> ▪ single carriageway with two-way traffic ▪ left turn in and left turn out access to Port Wakefield Rd only
Globe Derby Drive	<ul style="list-style-type: none"> ▪ single carriageway with two-way traffic ▪ right turn in and right turn out access to and from Port Wakefield Road via upgraded traffic signals
Martins Road	<ul style="list-style-type: none"> ▪ single carriageway with two-way traffic ▪ traffic signals at the Port Wakefield Road junction ▪ left turn in, left turn out and right turn in access
Whites Road	<ul style="list-style-type: none"> ▪ single carriageway with two-way traffic
Ryans Road (west of Port Wakefield Road)	<ul style="list-style-type: none"> ▪ single carriageway with two-way traffic ▪ left turn in, left turn out and right turn out at Port Wakefield Road
Ryans Road (east of Port Wakefield Road)	<ul style="list-style-type: none"> ▪ single carriageway with two-way traffic ▪ traffic signals at Port Wakefield Road junction, not allowing right turn in from the south

Northern section

Local roads in the Northern section are sealed, with two-way single carriageway, are 5.5–6.2 m wide, and have little or no sealed shoulders.

The common methods of traffic control at junctions are stop sign, give way sign and associated linemarking.

The main existing traffic generators in the Northern section are:

- residential developments:
 - along Supple Road, just north of Ryan Road (approximately 150 dwellings)
 - on the western side of Tozer Road, Waterloo Corner (approximately 30–40 dwellings)
- St Kilda recreational areas
- Bolivar Wastewater Treatment Plant (WWTP)
- agricultural, aquacultural and horticultural practices (greenhouses)
- Speedway City and Adelaide International Raceway
- equestrian facilities along Supple Road and Summer Road.

Central section

Local roads in the Central section are sealed, with two-way single carriageway.

The common methods of traffic control used at junctions are stop sign, give way sign and associated linemarking.

The main traffic generator in the Central section is the Bolivar WWTP.

Southern section

Roads in the Southern section are 6.0–7.9 m wide.

The common methods of traffic control at junctions are stop sign, give way sign and associated linemarking.

The Southern section contains the entire suburb of Globe Derby Park. Traffic generators in this section are the Globe Derby Park trotting track and Globe Derby Park community of approximately 150 residences (and businesses).

A shared service road on the western side of Port Wakefield Road, extends approximately 1,200 m north from Daniel Avenue, parallel to Port Wakefield Road. It is commonly used to walk horses to and from Globe Derby Park trotting track.

A service track located adjacent to the wetlands and Little Para River, joins the western side of Port Wakefield Road just north of Victoria Drive.

Traffic volumes

Arterial roads

Existing traffic volumes along arterial roads in the project area are shown in the form of annual average daily traffic (AADT) in Figure 15.2.

Port Wakefield Road

Existing traffic volumes along Port Wakefield Road range from 14,000 vehicles per day (vpd) (north of Brown Road) to 47,600 vpd (near Globe Derby Drive). Along Salisbury Highway, between Port Wakefield Road and South Road, the existing traffic volume is 54,700 vpd.

Traffic volumes along Port Wakefield Road generally decrease to the north. During the morning peak (7.30–8.30 a.m.) and afternoon peak (4.45–5.45 p.m.) a significant amount of commuter traffic is generated from within the wider Salisbury area.

Local roads

The AADT on the local roads in the project area range from 100 vpd (at Undo Road) to 15,800 vpd (at Bolivar Road, south-west of Kings Road) (Figure 15.2).

Daily traffic variations

During the morning peak, the predominant commuter traffic flow is southbound towards the Adelaide central business district (CBD) and during the afternoon peak predominantly northbound away from the Adelaide CBD.

Generalised characteristics of the daily traffic movements in the project area are:

- weekday traffic volumes generally higher than weekends
- event days at Adelaide International Raceway, Speedway City, Globe Derby Park and St Kilda recreation area generating significant amounts of traffic
- relatively high percentage of commercial and heavy vehicles (3–18%) on weekdays.



Source: DEH, DTEI, DPLG

Figure 15.2 Existing annual average daily traffic volumes



- Northern Connector road
- Northern Connector rail
- South Road Superway
- Northern Expressway
- Existing roads
- Existing railway
- - - Spur line to Port Flat siding
- Annual average traffic volume

Capacity

The capacity of a road can be defined as the number of vehicles that can travel past a point in a given time period at a given speed and headway.

Recent Port Wakefield Road upgrades have significantly increased the capacity of the road, which is now expected to have adequate capacity until the Northern Connector is opened in 2017.

Before the upgrades, sections of Port Wakefield Road south of Waterloo Corner Road were close to capacity during weekday peaks, caused by a mix of local and through traffic.

Level of service

The levels of service of roads in the project area are outlined in Table 15.3.

LoS D represents acceptable performance during peak periods when high density traffic flows are present. The minimum acceptable, LoS D suggests spare capacity to accommodate any future growth in traffic (beyond 2031) without significant delays and congestion.

Table 15.3 Level of service of roads in the project area

Road	Description
Port Wakefield Road	LoS C during normal peak periods after recent upgrades
Salisbury Highway	LoS D
Bolivar Road (Port Wakefield Road to Kings Road)	LoS C
Local roads in the project area	LoS A or B

Safety

Previous road safety investigations, in the Northern Expressway project, in the vicinity of the Northern Connector were based on crash data supplied by DTEI for the period 2001 to 2005 inclusive.

The investigations revealed that the crash rate along Port Wakefield Road is 37 crashes per 100 million vehicle kilometres travelled, typical for National Network urban corridors in Adelaide.

The crashes are concentrated at intersections, with the worst crash history, between 2005 and 2010, at the intersections of Port Wakefield Road and:

- St Kilda Road (8 crashes)
- Waterloo Corner Road (11)

- Bolivar Road (29)
- Ryans Road (6)
- Martins Road (10)
- Globe Derby Drive (14)
- Salisbury Highway interchange (43).

In addition there have been 15 crashes (2005 to 2010) at the interchange of Salisbury Highway–South Road–Port River Expressway.

Port Wakefield Road crash statistics reveal that although crashes are concentrated at intersections, there are more crashes in total in the length between intersections. The 192 crashes between 2005 and 2010, included 2 fatalities, 69 crashes resulting in injuries and 121 crashes causing property damage only. Of these between-intersection crashes, 17% were 'hit fixed object' (including hit parked vehicle).

Freight routes (road)

The project area contains a number of designated strategic freight routes:

- Port Wakefield Road
- Waterloo Corner Road
- Salisbury Highway
- South Road
- Port River Expressway
- the western end of Ryans Road.

Heavy vehicles are defined as vehicles with two or more axles (i.e. not cars). Table 15.4 lists the average number of heavy vehicles and the heavy vehicle proportion of total traffic travelling on key roads in the project area.

Table 15.4 Existing daily heavy vehicle volumes in the project area

Road	Heavy Vehicles	% HV* of AADT
Port Wakefield Road	2,000–5,700	12–14.5%
Waterloo Corner Road	2,600	18%
Bolivar Road (north-east of Kings Road)	467	3%
Bolivar Road (south-west of Kings Road)	591	3%
Kings Road	410	5%
Martins Road	455	6%
Port River Expressway	2,950	12.5%
Salisbury Highway	4,600	10.5%
South Road	3,400	12%

* heavy vehicles

Analysis of the heavy vehicle data from the traffic counts reveals:

- the 5-day average (weekdays only) heavy vehicle counts are generally 10–20% higher than the 7-day average heavy vehicles counts
- heavy vehicle peaks generally do not correspond with commuter morning and afternoon peaks
- heavy vehicle movements are generally more consistent throughout the entire day without large peak heavy vehicle times
- the composition of heavy vehicles travelling on arterial roads includes two-axle trucks/buses, three-axle trucks/buses, four-axle articulated vehicles A-double road trains and B doubles.

15.2.2 Rail

Rail networks

The current Adelaide rail network comprises:

- a broad gauge metropolitan passenger train network operated by TransAdelaide
- a standard gauge rail network for freight and interstate passenger trains operated by Australian Rail Track Corporation (ARTC).

Work has begun on converting the broad gauge network to standard gauge. TransAdelaide rail lines would not be affected by the project.

ARTC owns and operates the existing standard gauge tracks and leases network access to a variety of users including:

- Genesee and Wyoming Australia (GWA) — freight services
- Great Southern Railway — interstate passenger trains

- Asciano Ltd (Pacific National & Patrick Rail Operations) — freight services
- Specialised Container Transport — freight service
- FreightLink — Darwin–Adelaide freight service.

Rail yards

The two rail yards at Dry Creek (Dry Creek North and Dry Creek South) are divided by the overpass of Port Wakefield Road.

The total number of movements through Dry Creek, from 1 January 2008 to 18 September 2008 was 4,384 (two way), excluding localised shunting. The average tonnage for these movements was 2,038 tonnes, with a maximum of approximately 5,900 tonnes.

Dry Creek north

ARTC owns the land and track in Dry Creek North and GWA manages the yard under licence. Dry Creek North is predominantly standard gauge and can be used to stable 1.8 km long trains.

Dry Creek North is used mainly for storing and marshalling rolling stock. Road access to the yard is from the south yard.

Dry Creek south

GWA owns the track and buildings in the Dry Creek South and leases the land from the Minister for Transport. Queensland Rail has a 5-year option to lease Dry Creek South, which is a mix of standard and broad gauge.

The yard is presently used as a stabling marshalling yard and has wagon maintenance and locomotive servicing facilities.

The wagon maintenance facility, known as One Spot, currently operates from a location in the centre of the yard.

Downer EDI operates the Motive Power Centre located at the northern end of the Dry Creek South and on the western side of the freight line. The arrival and departure tracks are from the freight line near the centre of the Dry Creek South.

Access to the yards by road is from Salisbury Highway, via Kidman Road, and via a link road from Port Wakefield Road.

Suburban train stabling location

The new TransAdelaide suburban train stabling yards would be located on the east side of the Dry Creek South adjacent to the rail triangle (discontinued spur in the direction of Cavan).

15.2.3 Public transport network

The public transport network that currently services the project area comprises the AdelaideMetro bus route 900 and the Gawler rail line. Port Wakefield Road is also used by private bus operators servicing interstate and some South Australian regional areas.

Bus route 900 currently travels along Port Wakefield Road between Waterloo Corner Road and Old Port Wakefield Road, from Elizabeth to Virginia to Salisbury (only two services in the morning peak) and from Salisbury to Virginia to Elizabeth (only two services in the afternoon peak).

The Gawler rail line runs parallel to Main North Road and traverses the Adelaide Northern Suburbs, with numerous stations along its length.

15.2.4 Pedestrian and cycle networks

Bicycle movements and access

Cycling facilities exist in the vicinity of the project:

- South Road — the South Road Superway, currently under construction, will have bicycle facilities along its length that connect to Port River Expressway.
- Port River Expressway — has sealed shoulders mid-block and 90 degree cyclist crossings at ramps. The shared path at the south-east corner of the intersection of Port River Expressway and South Road for southbound cyclists, exits onto on-road bicycle lanes at the junction of South Road and Wing Street.
- Port Wakefield Road — sealed shoulders for use by cyclists along Port Wakefield Road connect to short sections of exclusive bicycle lanes at signalised intersections.
- Northern Expressway — the Stuart O’Grady Bikeway (shared path) along the eastern side of the Northern Expressway follows around Port Wakefield Road at its southern end connecting into the local street network at Waterloo Corner.
- Little Para shared path — between Rifle Range Road and Globe Derby Park, crosses Port Wakefield Road via an underpass on the south side of the river and continues west, terminating just before the Northern Connector corridor. It passes the wetlands on just north of Ryans Road and is used primarily by recreational cyclists.

Pedestrian movements and access

- South Road — the South Road Superway, currently under construction, will have footpaths in the corridor that terminate south of Port River Expressway.

There are no formal footpaths along Port Wakefield Road and pedestrians walk in the verge area. Pedestrian crosswalks are provided at most signalised intersections.

- Northern Expressway — the shared Stuart O’Grady Bikeway path along the eastern side of the Northern Expressway follows around Port Wakefield Road at its southern end connecting into the local street network at Waterloo Corner.

No other formed pedestrian footpaths are provided along the arterial roads or local roads in the project area.

The Little Para shared path crosses Port Wakefield Road via an underpass and continues west, terminating just before the Northern Connector corridor.

15.3 Potential impacts

15.3.1 Potential impacts during construction

Road

Potential impacts to the road networks in the project area during the construction phase of the Northern Connector include road closures and construction traffic.

Road closures

The Northern Connector may restrict some traffic movements during construction phase. However, alternative routes/detours will be introduced to minimise impacts on local communities and road users.

Temporary localised diversions and speed restrictions, of varying duration, will be necessary during construction of the interchanges at Waterloo Corner, and Port Wakefield Road, and the on ramp at Bolivar Road. Temporary road closures may be necessary (probably during weekends) while bridge beams are placed.

Construction traffic

The construction traffic — including delivery of construction materials, plant and equipment, and commute of personnel — will travel to the Northern Connector corridor via existing arterial and local roads. Access to the corridor would be from selected locations along Port Wakefield Road. Once secured and established, the Northern Connector corridor will be used as a haul route for construction vehicles.

The additional truck and car traffic will increase traffic volumes on Port Wakefield Road, Salisbury Highway and local roads, and contribute to the already congested conditions along Port Wakefield Road and Salisbury Highway.

The number of trucks and cars required to transport construction equipment, goods and workforce is not considered to be significant. Local roads have capacity to cater for the additional traffic but there could be slight increases where access is

concentrated. Appropriate traffic management measures would need to be deployed to mitigate these impacts (Section 15.4.1).

Rail

The Northern Connector single-track rail line runs in parallel with the Northern Connector road corridor until it branches into two lines: one extending to Port Adelaide via Gilman; the other overpassing Salisbury Highway and linking back to Dry Creek rail yard and to the existing passenger rail line, near Grand Junction Road.

The new rail line would be constructed adjacent to the existing rail lines at the connecting point and slewed in over weekends. Therefore, minimal delays in operations are expected during the construction phase.

At the northern end of the Northern Connector two sets of turnouts would be required. They would be constructed adjacent to the existing freight line and slewed in over a weekend when train traffic is relatively quiet. The area is flat and only minor earth works are required. Again, no train delays are envisaged to connect the new rail line at the northern end.

15.3.2 Potential impacts during operation

Road

Potential impacts to the road network in the project area once operation of the Northern Connector begins would include:

- shifts in traffic
- changes in LoS
- changes in traffic volumes
- changes to access
- improvements to freight efficiency.

Shifts in traffic

Significant volumes of traffic would be expected to shift from east of Port Wakefield Road to the Northern Connector and include:

- longer distance through-trips with higher speed limit (90km/h)
- shorter distance trips, which start or finish in the greater Salisbury area.

Of the longer distance north–south and south–north trips, there would be a significant shift of traffic to the Northern Connector from both Salisbury Highway and Main North Road. This traffic is likely to travel on the Northern Connector for its entire length, with minimal long-distance traffic entering or exiting the Northern Connector at the interchanges along its length.

Shorter distance trips, which start or finish in the greater Salisbury area, are likely to use the interchanges along the Northern Connector, generating additional traffic along Bolivar Road and Kings Road. Traffic travelling on Salisbury Highway is unlikely to shift to the Northern Connector but would continue along Salisbury Highway.

Northbound traffic accessing the Northern Connector from Salisbury Highway and Main North Road is expected to be low.

Changes in level of service

The LoS design criteria (LoS D) applies to each interchange, the main carriageway segments and connections to/from the existing surrounding road network.

Northern Connector

The predicted levels of service on sections of the Northern Connector range from LoS B to LoS D for northbound and southbound traffic.

The desired minimum LoS D would be achieved in all sections along the Northern Connector and with only three lanes on each carriageway north of the Bolivar Interchange.

Changes in traffic volumes — Arterial roads

Port Wakefield Road

The Northern Connector would have significant intentional impacts on traffic volumes using Port Wakefield Road south of the connection to the Northern Expressway. As a consequence of these reduced traffic volumes, access arrangements along Port Wakefield Road would be investigated. North of the Northern Expressway, the changes would be minimal. Brown Road access to Port Wakefield Road will be closed. Ryan Road to the north of Brown Road was opened in the Northern Expressway project.

Existing and 2031 forecast daily traffic volumes along Port Wakefield Road are provided in Table 3.3.

The forecast 2031 traffic volumes along Port Wakefield Road, south of the Northern Expressway, with the Northern Connector in operation, would be 32–40% lower than the existing traffic volumes.

Before construction of the Northern Connector, traffic on Port Wakefield Road would significantly increase south of the Northern Expressway. This increase in traffic has been addressed with upgrades to Port Wakefield Road as part of the Northern Expressway project.

Other arterial roads

Table 15.5 summarises the changes to forecast traffic volumes on other key routes with the Northern Connector in operation.

Table 15.5 Traffic forecasts on other surrounding key roads

Section	Existing 2010 AADT (vpd)	2031 without Northern Connector (vpd)	2031 with Northern Connector (vpd)
Waterloo Corner Road	13,500	11,500	13,850
Heaslip Road	12,300	7,200	9,350
Bolivar Road	15,600	27,000	20,000
Kings Road	9,200	22,200	8,050
Ryans Road	1,300 (2008)	11,100	3,800
Globe Derby Drive	1400	750	750

Traffic volumes on both Waterloo Corner Road and Heaslip Road would decrease by up to 30% in 2031 with the Northern Connector in operation compared to existing traffic volumes. The forecast volume with the Northern Connector is slightly higher than without. On Waterloo Corner Road, this increase is due to residential generated traffic accessing the Northern Connector. The difference along Heaslip Road is marginal. Traffic that would have previously used these roads is expected to transfer on to the Northern Connector.

There would be a negligible change in traffic volume on Kings Road from the existing count (Table 15.6). This represents a reduction given general traffic growth over the 21-year period.

With the closure of Martins Road, between Ryans Road and Port Wakefield Road, traffic from the existing Martins Road would be required to travel on Ryans Road or the future extension of Elder Smith Road, to access Port Wakefield Road.

The existing Globe Derby Drive would be modified to connect into the possible future extension of Elder Smith Road at Port Wakefield Road, with one of the two Globe Derby Park access points being enabled off this link. The link from Port Wakefield Road to the Globe Derby Park interchange would be located on the south side of the existing Globe Derby Drive, east of the existing trotting track; hence the western end of Globe Derby Drive would not incur an increase in traffic due to the Northern Connector.

Local roads

Northern section

To estimate future traffic volumes from within the Northern section, bound by Ryan Road, Port Wakefield Road, Summer Road, St Kilda Road and Brooks Road, the existing 2008 traffic volumes were re-distributed to take into account the road closures and factored down by the percentage of dwellings in the area that would be demolished due to the Northern Connector.

These volumes were given a 3% per annum growth rate to take potential growth into account.

Table 15.6 summarises expected changes in traffic volumes in the Northern section.

Table 15.6 Changes in traffic volumes in the Northern section

Road/section	Existing volume (2008) (vpd)	Existing traffic after re-distribution (vpd)	Forecast 2031 traffic volume ⁽¹⁾ (vpd)
Supple Road			
Brown Road–Symes Road	140	940	1,570
Symes Road–Anjanto Road	180 ⁽²⁾	880	2,800
Robinson Road			
Anjanto Road–St Kilda Road	220	1,940	3,250
St Kilda Road–Northern Connector interchange	210	3,330	5,600
Northern Connector interchange–Undo Road	280 ⁽²⁾	280	470
Brown Road			
Coleman Road–Supple Road	300 ⁽²⁾	300	503
Supple Road–Port Wakefield Road	850	No through road, local traffic only	No through road, local traffic only
Symes Road			
Supple Road–Northern Connector	700 ⁽²⁾	No through road, local traffic only	No through road, local traffic only
Northern Connector–Port Wakefield Road	700	No through road, local traffic only	No through road, local traffic only
Anjanto Road			
Supple Road–Northern Connector	220 ⁽²⁾	No through road, local traffic only	No through road, local traffic only
Northern Connector–Port Wakefield Road	220	No through road, local traffic only	No through road, local traffic only
St Kilda Road			
Coleman Road–Robinson Road	886	900	2000
Robinson Road–Northern Connector	1,400 ⁽²⁾	No through road, local traffic only	No through road, local traffic only
Northern Connector–Port Wakefield Road	1,400	No through road, local traffic only	No through road, local traffic only
Undo Road			
Robinson Road–Northern Connector	100 ⁽²⁾	No through road, local traffic only	No through road, local traffic only
Northern Connector–Port Wakefield Road	100	No through road, local traffic only	No through road, local traffic only
Summer Road			
Robinson Road–Northern Connector	180 ⁽²⁾	No through road, local traffic only	No through road, local traffic only
Northern Connector–Port Wakefield Road	180	No through road, local traffic only	No through road, local traffic only

(1) Factored down by percentage of houses in section being demolished, then factored up by 3% p.a.

(2) Estimated volumes

Assuming the worst case scenario in traffic shifts, an additional 2,500 vpd (approximately) would use Robinson Road, between St Kilda Road and the Waterloo Corner interchange, in addition to the existing 210 vpd. The majority of this additional traffic would originate from St Kilda Road and Symes Road.

There is estimated to be an additional 1,140 vpd travelling along Robinson Road between Anjanto Road and St Kilda Road, in addition to the existing 220 vpd, comprising all Anjanto Road and Symes Road traffic.

It is not expected that Waterloo Corner Road (east of Port Wakefield Road) would be required to carry a significant amount of additional traffic due to the Northern Connector. A small amount of both northbound and southbound traffic is likely to use Waterloo Corner Road to access the Northern Connector. The traffic forecasts show that in 2031 there is expected to be approximately the same amount of traffic as in 2010 along the section of Waterloo Corner Road between Heaslip Road and Port Wakefield Road (approximately 13,850 vpd).

Central section

The 2010 Bolivar Road AADT is estimated to be 15,800 vpd and forecast traffic volume in 2031 is estimated to be approximately 26,582 vpd. This increase is considered negligible for its 21-year time period.

No further changes are expected to be required for the road network in this section to cater for the project changes in traffic movements.

Southern section

There are no local roads near the Southern interchange that are expected to be affected by the Northern Connector.

Intersections

Waterloo Corner Road–Port Wakefield Road intersection

This intersection would have a significantly lower traffic demand in 2031 due to a major shift in traffic from Port Wakefield Road, Heaslip Road and Waterloo Corner Road to the Northern Connector. Traffic volumes on Port Wakefield Road approaches are forecast to be less than half the existing traffic volumes. Waterloo Corner Road volumes are forecast to be approximately 5% lower than the existing traffic volume. The existing T-junction would be upgraded to incorporate an additional approach, providing a four-way intersection with access to the Northern Connector.

Bolivar Road–Kings Road intersection

Bolivar Road–Kings Road intersection would be subject to a minor increase in traffic from existing volumes to the forecast 2031 volumes. The major flow of traffic is still along Bolivar Road, with Kings Road providing the minor traffic flows.

Bolivar Road–Port Wakefield Road intersection

Bolivar Road–Port Wakefield Road intersection would incur a significant decrease in traffic from existing counts. The volumes on Port Wakefield Road approaches are forecast to be less than half of existing movements while Bolivar Road movements would increase slightly. This would become a four-way intersection (instead of a T-junction) with the addition of the local road to the Bolivar Road interchange.

Ryans Road–Port Wakefield Road junction

Ryans Road–Port Wakefield Road junction would be subject to an increase in traffic, mainly due to the closure and diversion of traffic from Martins Road, which would not have direct access to Port Wakefield Road.

Martins Road–Port Wakefield Road junction

Martins Road would be closed at its junction with Port Wakefield Road. Traffic using Martins Road would be required to access Port Wakefield Road via Ryans Road.

Changes to access

The project will impact on the surrounding local road network, specifically in access to neighbourhood precincts and properties, and change traffic movements.

Northern section

Impacts on the local road network in the Northern section will include:

- Brown Road closed at its eastern end at Port Wakefield Road due to its proximity to the Northern Connector ramps to Port Wakefield Road north
- east–west movements along Symes Road, Anjanto Road, St Kilda Road, Undo Road and Summer Road severed between Supple–Robinson roads and Port Wakefield Road (these roads would have no direct access to the Northern Connector itself)
- King Road and Nash Road severed on the eastern side of Port Wakefield Road due to the rail line linking into the existing rail line.

These road closures would necessitate changes to existing access/egress arrangements between properties and the nearby north–south arterial road network, including both the Northern Connector and Port Wakefield Road.

Traffic accessing either Port Wakefield Road or the Northern Connector from Symes Road, Anjanto Road and St Kilda Road will all need to travel south to the on ramp at Bolivar Road. Traffic from Brown Road will need to travel on Supple Road to the north to access Port Wakefield Road, or south to access the Waterloo Corner interchange.

Access to the Adelaide International Raceway will be changed by the Northern Connector and changes to the local road network. Brown Road will be closed at Port Wakefield Road due to the northbound ramp from the Northern Connector to Port Wakefield Road. Access from the north will be from McEvoy via Supple Road.

Access from the south would be possible via the Northern Connector interchange at Waterloo Corner and Supple Road.

Development located between the Northern Connector and Port Wakefield Road will still be accessible via the existing road network. Investigations will be undertaken to determine if access restrictions removed as part of the Port Wakefield Road upgrades could be reinstated at the following locations:

- Anjanto Road
- St Kilda Road
- Undo Road
- Summer Road.

It is estimated that all traffic originating on the western side of the Northern Connector route, which previously accessed Port Wakefield Road via the above roads, would use Supple Road and Robinson Road to access the Waterloo Corner interchange and Port Wakefield Road.

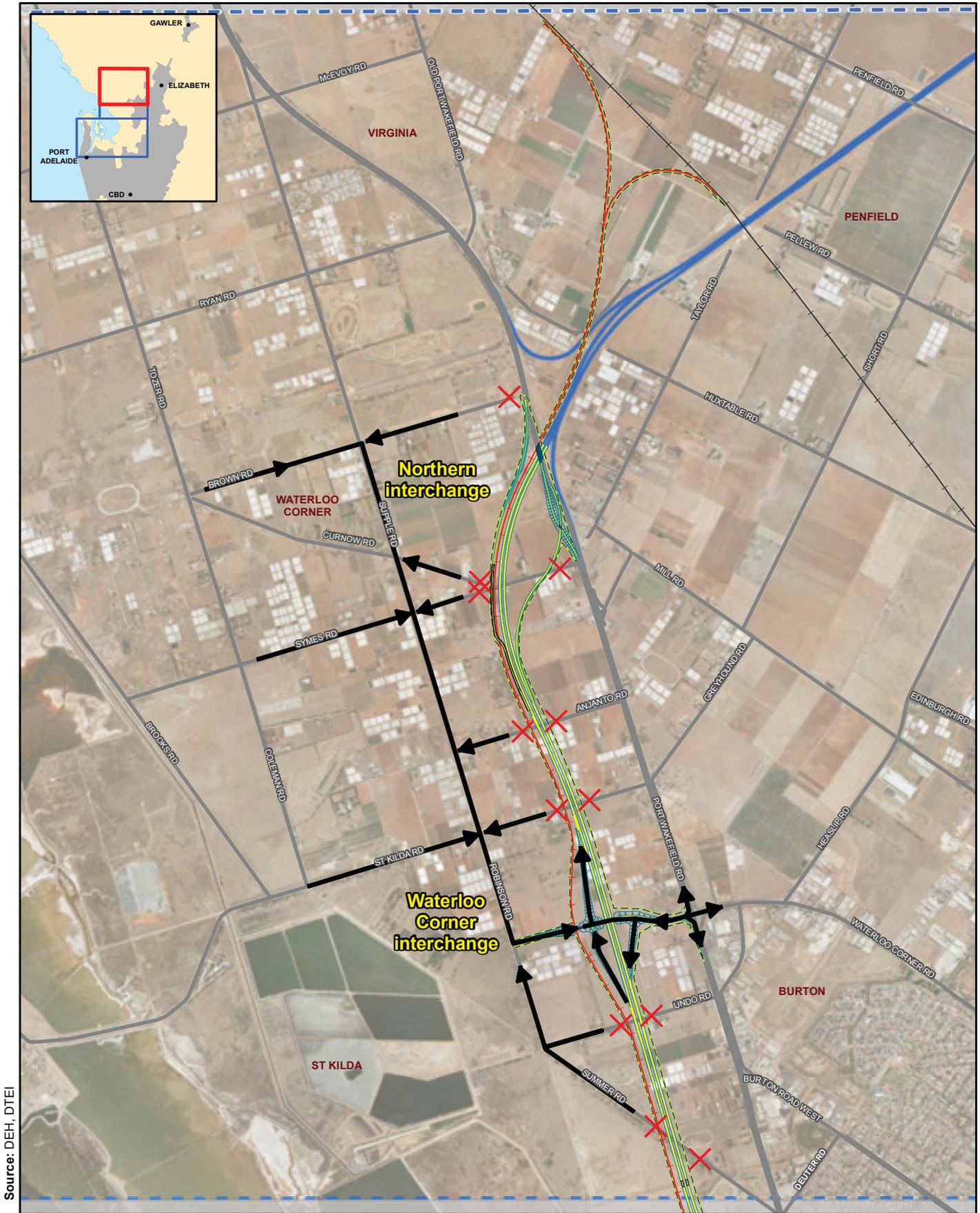
Table 15.7 summarises existing local access arrangements and the required changes to accommodate the Northern Connector route (Figure 15.3). Where appropriate, Table 15.7 also shows the additional travel distance required to access Port Wakefield Road and the route most likely to be taken from either side of the Northern Connector corridor.

Table 15.7 Local traffic access changes

Segment	Existing access	Required changes
North of Ryan Road	Access Port Wakefield Rd by heading north along Supple Rd and accessing via Ryan Rd or McEvoy Rd	Same as existing
Adelaide International Raceway	Direct access from Brown Rd onto Port Wakefield Rd	Travel via Supple Rd – north via McEvoy Rd or south via Waterloo Corner interchange (to Northern Connector or Waterloo Corner Rd–Port Wakefield Rd)
Symes Rd–Brown Rd (Supple Rd to Port Wakefield Rd)	Direct access to Port Wakefield Rd	East of route — no local properties will exist West of route — travel west on Brown Rd or Symes Rd, then south on Supple Rd to access Waterloo Corner interchange to Port Wakefield Rd Extra travel distance: up to 1.0 km
Symes Rd–Ryan Rd including Curnow Road (west of Supple Rd)	Travel to Supple Rd and then directly to Port Wakefield Rd via Symes Rd or Brown Rd	Travel to Supple Rd, south to Waterloo Corner interchange to access Port Wakefield Rd Extra travel distance: <500 m

Segment	Existing access	Required changes
Anjanto Rd–Symes Rd (Supple Rd to Port Wakefield Rd)	Directly onto Symes Rd or Anjanto Rd then directly onto Port Wakefield Rd, or from Robinson Rd and Flight Rd to Symes Rd or Anjanto Rd to access Port Wakefield Rd	East of route — same as existing West of route — travel west on Symes, Anjanto and Flight Rds to access Robinson Rd, then south to Waterloo Corner interchange to access Port Wakefield Rd Extra travel distance: up to 1.0 km
St Kilda Rd–Symes Rd (west of Robinson Rd)	Direct access to Robinson Rd and then onto Anjanto Rd or St Kilda Rd to then access Port Wakefield Rd directly	Travel to Robinson Rd, south on Robinson Rd to Waterloo interchange to access Port Wakefield Rd; properties on Coleman Rd as existing Extra travel distance: < 1 km
St Kilda Rd–Anjanto Rd (between Robinson Rd and Port Wakefield Rd)	Direct access to Anjanto Rd or St Kilda Rd to then access Port Wakefield Rd directly	East of route — same as existing West of route — travel on Robinson Rd south to Waterloo Corner interchange to Port Wakefield Rd Extra travel distance: up to 1.0 km
South of St Kilda Rd (west of Robinson Rd)	Direct access onto Robinson Rd and then St Kilda Rd to access Port Wakefield Rd	Travel on Robinson Rd to Waterloo Corner interchange to access Port Wakefield Rd Extra travel distance: up to 0.8 km shorter
South of St Kilda Rd (between Robinson Rd and Port Wakefield Rd)	Direct access onto St Kilda Rd–Undo Rd–Summer Rd to access Port Wakefield Rd	East of route — same as existing West of route — travel west to Robinson Rd, then to Waterloo Corner interchange to access Port Wakefield Rd; existing property access from Roberts Lane would require two-lane local roads to be constructed either side of Northern Connector, approx 550 m Extra travel distance: up to 2.2 km

On the eastern side of Port Wakefield Road, access to a small section of Nash Road would be via a local road adjacent the Northern Expressway, due to the rail line severing Nash Road in two places. Access to and from King Road (north of the existing rail line), which would also be severed by the Northern Connector rail line, would be via Penfield Road and the Penfield Road interchange (Northern Expressway).



Source: DEH, DTEI

Figure 15.3 Local traffic access changes west of Port Wakefield Rd Northern Section



- Northern Connector road
- Northern Connector rail
- - - Northern Connector boundary
- Northern Expressway
- Embankment
- Existing railway
- Existing roads
- Local traffic movements
- Local road closure

Central section

The change in status of Port Wakefield Road would affect the ease with which local traffic movements can access the north–south arterial road network. Victoria Drive is currently restricted to left in/left out only at its interface with Port Wakefield Road. This arrangement would be altered to allow right in and right out movements to Port Wakefield Road.

Currently, most traffic originating from east of Port Wakefield Road uses Bolivar Road and Kings Road to access Port Wakefield Road to travel south in the morning peak and north in the afternoon peak. This traffic would not have access altered, as all movements at Port Wakefield Road are provided for, with the at-grade intersection, and the Northern Connector Bolivar on ramp would cater for southbound movements.

Access to/from Bolivar WWTP to Port Wakefield Road would be severed. A new local road would be constructed parallel to the Northern Connector between Bolivar WWTP and Waterloo Corner interchange. Traffic would access the Northern Connector at the Waterloo Corner interchange, where all movements would be provided.

Vehicular access to a number of land parcels along Jones Road would be provided via the existing Jones Road.

Southern section

The Southern section of the project area has no impacts to the local road network.

Southbound traffic from this area would continue using Port Wakefield Road. Northbound traffic could access the Northern Connector at the Waterloo Corner interchange but would be likely to stay on Port Wakefield Road if continuing north.

Investigations will be undertaken to determine if access restrictions installed as part of the Port Wakefield Road upgrades could be removed at the following locations:

- Symes Road
- Anjanto Road
- Undo Road
- Summer Road
- Victoria Road
- Daniel Avenue

Improvements to freight efficiency

The Northern Connector would provide a more attractive alternative route (high operating speed and less traffic friction) than Port Wakefield Road. Transfer of

heavy vehicles to the Northern Connector would improve their travel time and reduce transport costs for freight operators.

The Northern Connector would have a measurable effect on the volume of heavy vehicle movements on the surrounding road network. The forecast 2031 volumes of heavy vehicles along Port Wakefield Road, Waterloo Corner Road and Ryans Road are all less than existing volumes. The 2031 heavy vehicle volumes are forecast to increase along the Port River Expressway and South Road. The majority of this heavy vehicle traffic would be from the Northern Connector.

The forecast 2031 volumes of heavy vehicles along both Bolivar Road and Kings Road are expected to increase from the existing volumes. This is mainly due to the growth in heavy vehicles in the greater Salisbury area.

The volume of heavy vehicles along Salisbury Highway in 2031 is forecast to be slightly less than the existing heavy vehicle volume.

The Northern Connector route would become a preferred route for commercial vehicles which exceed legal mass limits and dimensions.

Rail

A 24.7 km National Rail Corridor between Northern Expressway (to the north) and Port Adelaide (to the west) will replace the existing line via Salisbury (29km) for Port oriented freight. The rail corridor will divert rail freight away from well-developed suburban areas of northern Adelaide, east of Port Wakefield Road. Two 2 km passing loops will be constructed at Gillman and north of Waterloo Corner interchange to cater for 2 km long freight trains.

Completion of the project will reduce six at grade level crossings on the Gillman–Wingfield section and five level crossings on the Salisbury line, which will significantly improve the safety and efficiency of the arterial network.

Furthermore, the constructed rail line away from well-developed suburban areas will remove conflicts with local passenger services and improve freight efficiency, safety and noise for local communities and impact on the environment.

Public transport network

At this stage, there are no planned changes to existing public transport services. Accessibility to the Route 900 bus service would be reduced for users located to the west of the Northern Connector route.

Existing public transport services (buses) would be retained along Port Wakefield Road and the adjacent arterial roads. There are currently no proposals to amend these services nor provide bus services along the Northern Connector route.

Regional and interstate bus routes may be re-diverted to the Northern Connector to take advantage of the higher operating speeds and minimise travel times.

Bus routes to service the proposed Buckland Park development may be established along either Port Wakefield Road or the Northern Connector.

There would be no additional changes to passenger rail services along the Gawler rail line as a result of the project. This line will be electrified and the future timetable changed as planned.

Pedestrian and cycle networks

A 3.0 m wide shared-use path would be constructed within the Northern Connector corridor, connected to the Northern Expressway shared path, South Road Superway cyclist facilities and Port River Expressway.

There would be access points through the fence on the eastern side of the Northern Connector corridor to allow pedestrian and cyclist access to the local street networks and Little Para shared path.

Pedestrian and cyclist access to the local street network on the west side of the Northern Connector would be provided at the Waterloo Corner Interchange.

15.4 Management and mitigation

15.4.1 Construction

Road

Construction impacts on local access and traffic flows would mainly be managed by staging the construction process. The Northern Connector is expected to be constructed over a three-year period. In the first stage the three intermediate interchanges would be constructed in parallel following relocation of services. The second stage would include construction of the main carriageways in the Southern and Central sections. Connection of the carriageways to the Northern and Southern interchanges would be the final stage.

Construction traffic impacts would be managed by implementing traffic management plans. Mitigation measures to be implemented to minimise any impacts are to:

- prepare and implement a construction traffic management sub-plan (by construction contractor), which would:
 - identify all public roads to be used by construction traffic
 - manage construction traffic to ensure it used identified roads
 - identify all public roads that would be partially or completely closed during construction and the duration of closure
 - make temporary traffic arrangements
 - install adequate signage alerting road users of any traffic changes
 - manage access to construction sites
 - prepare a response plan for any construction traffic incident
 - monitor, review and amend mechanisms

- ensure that access to properties is maintained during construction and where necessary, provide temporary alternative access.

Rail

The following measures should be taken to ensure the construction phase is completed in a safe and orderly manner:

- The existing staging yard and freight line would be well protected from all construction activities by erection of barriers and warning signs.
- Flag operators would be provided during the slewing in operations when the new line is connected to the existing line.
- Regular communication between the construction contractor and representatives from ARTC would ensure coordinated construction activities and rail operations.

15.4.2 Operation

Road

Shifts in traffic

Any impacts due to the shifts in traffic (Section 15.3.2) would be managed by having adequate signage that is easy to read and follow.

On the eastern side of Port Wakefield Road in the Northern section, access to a small section of Nash Road would be via a local road adjacent to the Northern Expressway due to the rail line severing Nash Road in two places. Access to and from King Road (north of the existing rail line) would be via Penfield Road and the Penfield Road interchange, with access on the south side of the railway line remaining as existing.

On the western side of Port Wakefield Road in the Northern section, the Robinson Road and St Kilda Road intersection would be upgraded, in addition to the Robinson Road and Supple Road upgrades between the Waterloo Corner interchange and Adelaide International Raceway.

Managed Motorways/Intelligent transport system

Applications of intelligent transport system technology would be a feature of the project to enable management of traffic during incidents or other abnormal traffic conditions. Variable and changeable message signs would be erected at strategic locations along the Northern Connector, Northern Expressway, South Road Superway and arterial roads, which could display information for road users on road and traffic conditions and possible diversions. They would be accompanied by surveillance and detection equipment suitably located to measure traffic flows and detect incidents. These systems would be connected to the DTEI traffic management centre. Further details on managed motorways can be found in Section 9.2.1.

Rail

The following measures are proposed along the Northern Connector to enable safe passage of trains and vehicles alike:

- The single maintenance gravel road alongside the tracks will run from existing tracks near the Northern Expressway junction to existing tracks at Dry Creek.
- Rail will overpass the Northern Connector carriageways and Salisbury Highway in the project's Southern section.

16 Aboriginal heritage and Native title

16.1 Overview

The project area is located in the native title claim area of the native title applicants, the Kurna Peoples (SAD6001/00) and adjacent to the native title claim area of the native title applicants, the Ramindjeri (SAD162/10). There is the potential, during construction of the road and rail corridor, for damage, disturbance or interference with Aboriginal sites, objects and remains to occur.

The Commissioner of Highways will seek a section 23 authorisation under the *Aboriginal Heritage Act 1988* from the Minister for Aboriginal Affairs and Reconciliation for the project.

16.2 Legislative requirements

Table 10.1 summarises key legislation relevant to Aboriginal heritage and native title.

Table 10.1 Relevant legislation (Aboriginal Heritage and Native Title)

Legislation	Description	Relevance to project
<i>Native Title Act 1993</i> (Cwlth)	Native title has been described by the High Court as the interests and rights of Indigenous inhabitants in land, whether communal, group or individual, possessed under the traditional laws acknowledged by and traditional customs observed by the Indigenous inhabitants.	The project corridor falls within the area of land over which there is one native title claim, Kurna Peoples Native Title Claim (SAD6001/00).
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) (Cwlth)	The Act protects places of national cultural and environmental significance from damage and interference by establishing a National Heritage List for places outside of Commonwealth land and a Commonwealth Heritage List for places on Commonwealth land. Under the Act, any action that has, will have or is likely to have, a significant impact on a place of national cultural and/or environmental significance must be referred to the Minister for Sustainability, Environment, Water, Population and Communities for approval.	No EPBC listed heritage places in project area

Legislation	Description	Relevance to project
<i>Aboriginal and Torres Strait Islander Heritage Protection Act 1984</i> (Cwlth)	The Act provides a way for the Australian Minister of Aboriginal Affairs to make declarations regarding the protection of an Aboriginal site when the Minister is satisfied that under State or Territory law, there is ineffective protection of the place from the threat of injury or desecration. Declarations made under this Act may involve restricting activities on, and/or access to, an Aboriginal site. This Act is not intended to exclude or limit the operation of a State law that is capable of operating concurrently.	The Commissioner of Highways will seek a section 23 authorisation under the Aboriginal Heritage Act 1988 from the Minister for Aboriginal Affairs and Reconciliation for the project.
<i>Aboriginal Heritage Act 1988</i> (SA)	Under the Act, all Aboriginal sites, objects and remains that are of significance to Aboriginal tradition, archaeology, anthropology and/or history are protected. Under section 23 of the Act, it is an offence to damage, disturb or interfere with an Aboriginal site, objects or remains unless written authorisation from the Minister of Aboriginal Affairs and Reconciliation has been obtained.	The Commissioner of Highways will seek a section 23 authorisation under the Aboriginal Heritage Act 1988 from the Minister for Aboriginal Affairs and Reconciliation for the project.

16.3 Native title

16.3.1 Overview

The Commonwealth *Native Title Act 1993* is part of the Commonwealth’s response to the High Court’s decision in *Mabo v Queensland (No. 2)* and adopts the common law definition of native title, defined as the rights and interests that are possessed under the traditional laws and customs of Aboriginal people in land and waters, and that are recognised by common law. These rights may exist over Crown Land but do not exist over validly granted freehold titles.

The Native Title Act recognises the existence of an indigenous land ownership tradition where connections to country have been maintained and where acts of government have not extinguished this connection.

Native title relates to the rights and interests of Aboriginal people in land and waters, according to their traditional laws and customs, where they have maintained a continuous connection with their land or waters. Native title rights may include the possession, use and occupation of traditional country. It can also be the right for native

title holders to participate in decisions about how others use their traditional land and waters (National Native Title Tribunal 2000).

Native title may exist in areas where it has not been removed (extinguished) by an Act of Government, such as:

- vacant Crown land
- public reserves
- some types of pastoral leases
- land held by government agencies
- land held in trust for Aboriginal communities
- any other public or Crown lands.

Native title is likely to have been extinguished on freehold land and road reserves.

16.3.2 Effects of the project on existing Native title

The project area is located in the native title claim area of one native title applicant, the Kurna Peoples Native Title Claim (SAD6001/00). DTEI has been advised by the Crown Solicitor's Office that native title has not been extinguished in some of the areas of land identified to be affected by the project, and as such DTEI will consult with the Native Title Claim Representatives as required by the Native Title Act.

16.4 Cultural heritage

16.4.1 Existing conditions

The Central Archive, including the Register of Aboriginal Sites and Objects, is maintained by the Aboriginal Affairs and Reconciliation Division (AARD) of the South Australian Department of the Premier and Cabinet.

A search of AARD's records and previous heritage assessments for the project area indicated that there are a number registered and unregistered sites, objects or remains in the vicinity of the project.

16.4.2 Effects of the project on existing cultural heritage

The design of the project has tried to avoid any known sites where possible (Section 16.4.1). A heritage survey of the corridor will likely be undertaken to determine possible locations of other sites, objects and remains. However, in accordance with the Aboriginal Heritage Act, an authorisation will be sought under section 23 of the Act for the project (Section 16.5).

16.5 Management and mitigation

A section 23 authorisation will be sought under the Aboriginal Heritage Act to authorise damage, disturbance and interference with Aboriginal sites, objects and remains (as applicable) in the project corridor.

The Minister for Aboriginal Affairs and Reconciliation, as bound by section 13 of the Aboriginal Heritage Act, will take all reasonable steps to consult with the Aboriginal Heritage Committee, an Aboriginal organisation that, in the opinion of the Minister, has a particular interest in the matter and any traditional owners and other Aboriginal persons who, in the opinion of the Minister, have a particular interest in the matter. It is the Minister's decision whether to authorise or not to authorise under section 23 of the Act, and DTEI will abide by the Minister's decision.

For more information

For more information, to make an enquiry or join the mailing list contact the Northern Connector project team.

Phone: 1300 793 458 (interpreter service available)

Email: dtei.northernconnector@sa.gov.au

Visit the website: www.infrastructure.sa.gov.au and then follow the prompts.

Για περισσότερες πληροφορίες γι' αυτό το πρόγραμμα οδοποιίας τηλεφωνήστε στο **1300 793 458**. Διαθέτουμε και διερμηνείς.

Se desiderate altre informazioni su questo progetto stradale telefonate al **1300 793 458**. Ci sono interpreti a disposizione.

Để có thêm thông tin về công trình đường bộ này xin hãy gọi điện thoại số **1300 793 458**. Sẽ có phiên dịch viên.

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