northern expressway
environmental report
traffic and transport
technical paper

NORTHERN EXPRESSWAY

Australian Government

AUSLINK
Building our National Transport Future

Government of South Australia
Department for Transport, Energy and Infrastructure

TRAFFIC AND TRANSPORT TECHNICAL PAPER

Northern Expressway

Traffic and Transport Technical Paper

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The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) either directly or through its associates, Sinclair Knight Merz Pty Ltd (SKM) and QED Pty Ltd (QED), is to document the effect on traffic and transport of the Northern Expressway in accordance with the scope of services set out in contract 05C091 between KBR and the Department for Transport, Energy & Infrastructure (DTEI) ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

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Revision History

Revision	Date	Comment	Signatures		
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List of abbreviations

DTEI	Department for Transport, Energy and Infrastructure
KBR	Kellogg Brown & Root Pty Ltd
SKM	Sinclair Knight Merz Pty Ltd
QED	QED Pty Ltd
TSD	Transport Services Division (Department for Transport, Energy and Infrastructure)
SMEC	Snowy Mountains Engineering Corporation Pty Ltd
LOS	Level of Service
MASTEM	Metropolitan Adelaide Strategic Transport Economic Model
ITS	Intelligent Transport Systems
VMS	Variable Message Sign
VSLS	Variable Speed Limit Sign
CMS	Changeable Message Sign
CCTV	Closed Circuit Television

Glossary

platoon formation	group of vehicles travelling together
aaSIDRA	computer program that models the operation of signalised intersections
AIMSUN	computer program that models the individual movement of vehicles on a road network.
parclo	form of grade-separated interchange

1 Introduction

1.1 Background to traffic and transport

This Technical Paper details the investigations undertaken for and assessment of the traffic and transport impacts of the proposed Northern Expressway and Port Wakefield Road Upgrade.

1.2 Project description

The proposed Northern Expressway, and the Port Wakefield Road upgrade, will form part of the AusLink National Network, replacing the increasingly congested Main North Road thereby providing road safety and amenity benefits. The Port Wakefield Road component involves the upgrade of the existing National Highway that connects the Northern Expressway and the Port River Expressway.

The proposed Northern Expressway between Gawler to Port Wakefield Road will provide significant State and regional benefits. It is primarily aimed at improving access to Adelaide for freight transport via the Sturt Highway, including freight for export from key areas such as the Barossa Valley wine producing area and the Riverland wine and citrus producing area. Together with the Port River Expressway, it will provide a high standard link between the Sturt Highway at Gawler and the Port of Adelaide, South Australia's main shipping port.

It will maximise the opportunity for freight transport to gain access to producers, transport hubs, freight gateways and markets, achieve better delivery times and increase cost efficiency to gain a competitive edge, while improving safety significantly. It will also improve the transport link to the regions north of Adelaide, such as Gawler and the Barossa, fringe rural communities will be more accessible to business, industry, tourists and commuters.

The Northern Expressway corridor crosses the northern Adelaide plains on the north west edge of the Adelaide metropolitan area. The expressway links with the Gawler Bypass, south of Redbanks Road in the north, to Port Wakefield Road, approximately 500 m north of Taylors Road in the south. Port Wakefield Road would be upgraded between this southern terminal junction with the expressway and the Salisbury Highway/Port River Expressway intersection.

The route passes through mainly rural and horticultural land, bypassing the township of Angle Vale on its eastern side and passing north of the Royal Australian Air Force Base Edinburgh and the land with potential for an intermodal facility at Waterloo Corner.

The proposed Expressway is about 25 km long and upgrades to Port Wakefield Road extend over 12 km.

The Expressway will be constructed to rural freeway standard in a new road corridor, providing dual carriageways, grade separation of access/connecting roads and restricted road access. The horizontal alignment of the new road has been designed for a posted speed limit of 110 km/h. The road would have a wide corridor, typically about 70 m, but may vary at some locations.

Interchanges are proposed at the Gawler Bypass (partial), Curtis Road (partial), Heaslip/Womma roads and at Port Wakefield Road (signalised junction).

The Expressway will have hard shoulders along both sides for emergency vehicles and breakdowns, space for services and drainage, and a 15 m wide median.

The Port Wakefield Road works would involve upgrading of the existing divided road at a number of intersections along the project length, including at Waterloo Corner Road, Bolivar Road, Ryans Road, Martins Road, Globe Derby Drive and the Salisbury Highway, an additional southbound lane from Ryans Road to Salisbury Highway and an additional northbound lane through the Globe Derby junction, as well as changes to service roads, traffic controls and access to properties at other locations. In most locations, Port Wakefield Road will be widened along the outside edge of the road. It is proposed that the posted speed limit on Port Wakefield Road will be typically 90 kph, but may vary at certain times to better manage safe traffic operations.

Landscaping treatment and potential noise management measures will be developed where required following detailed design development.

The proposed route of the Expressway and upgrade of Port Wakefield Road are shown on Figure 1.1.

1.3 Legislative and policy requirements

There are no direct legislative or policy related requirements for the traffic and transport components of the Northern Expressway. However, the design and assessment of the proposed scheme is subject to a number of requirements of two Acts of Legislation; the Highways Act (1926) and the Road Traffic Act (1961).

These two Acts indicate that the design and operation of the roads have to be undertaken using the relevant standards and codes, and to the Australian Road Rules.

DTEI's requires that the design and assessment of traffic impacts be undertaken to the following Australian Standards and Guidelines.

- The Transport SA Code of Technical Requirements for the Legal Use of Traffic Control Devices
- Australian Standard 1742, Manual of Uniform Traffic Control Devices - Various Parts
- Austroads – Urban Road Design, A Guide to the Geometric Design of Major Urban Roads
- Austroads – Rural Road Design, A Guide to the Geometric Design of Rural Roads
- Austroads Traffic Engineering Practice Series – Guide to Traffic Engineering Practice – Part 2 Roadway Capacity, Part 5 Intersections at Grade, Part 6 Roundabouts and Part 7 – Traffic Signals.

500m investigation corridor Study area

Figure 1.1 **Study Area**

2 Existing environment

This section provides a summary of previous investigations undertaken by the Department for Transport, Energy and Infrastructure (DTEI) and a description of the existing environment as a basis for assessing the traffic and transport effects of the Northern Expressway.

2.1 State and regional context

The proposed Northern Expressway and Port Wakefield Road Upgrade will provide significant state and regional benefits. It is primarily aimed at improving access to Adelaide for freight transport via the Sturt Highway, including freight for export from key areas such as the Barossa Valley wine producing area and the Riverland wine and citrus producing area. Together with the Port River Expressway, it will form a high standard link between the Sturt Highway at Gawler and the Port of Adelaide, South Australia's main shipping port.

The Northern Expressway is South Australia's largest and highest priority project under the current AusLink Investment Program and, as such, has the commitment of the South Australian Government.

By establishing the 'primary gateway' to Adelaide (and the Port of Adelaide), linking the national highways from Sydney and Perth/Darwin, and optimising freight efficiency from regional and interstate centres, the project is clearly consistent with AusLink objectives for the National Network. In particular, it is in line with the following objectives identified by the Australian Government:

- improving national, interregional connectivity for people, communities, regions and industry
- improving national, interregional and international logistics
- enhancing national, interregional and international trade
- enhancing health, safety and security
- being consistent with our obligation to current and future generations to sustain the environment
- being consistent with viable, long-term economic and social outcomes
- being linked effectively to the broader transport network.

The new transport link into Adelaide, and the Port of Adelaide at Outer Harbor, is an important strategic objective of the South Australian Government. With the revitalisation of the Port of Adelaide, dramatic changes include improved harbour facilities, new grain handling infrastructure and new defence industry works. The Expressway project is an essential driver to the state's economic development and will help achieve a number of targets in South Australia's Strategic Plan (2007), in particular:

Objective 1 – Growing Prosperity

- Target 1.1 Economic growth
- Target 1.14 Total exports
- Target 1.21 Strategic infrastructure

Objective 5 – Building Communities

- Target 5.11 Infrastructure to support communities in regions.

The *Strategic Infrastructure Plan for South Australia* (2005) identifies 'completion of the link from the Sturt Highway to Outer Harbor' as a priority one project. This reflects the South Australian Government's strong support for the Northern Expressway. The upgrade of Port Wakefield Road Expressway standard is included as part of that link but it is not part of the current project.

The Northern Expressway Project will contribute to state and national economic growth through improved efficiencies for transport, particularly for export, thereby expanding export potential. It will maximise the opportunity for freight transport to gain access to producers, transport hubs, freight gateways and markets; it will achieve better delivery times and increase cost efficiency to gain a competitive edge, while improving safety significantly.

The Northern Expressway and Port Wakefield Road Upgrade will also complement and reinforce the benefits of other strategic infrastructure, such as the Port River Expressway, to support development of the state. It links with two other current major DTEI transport infrastructure projects, which collectively will provide a continuous freight and commuter route from north to south through Adelaide.

Furthermore, the improved transport link to the regions north of Adelaide, such as Gawler and the Barossa, will make fringe rural communities more accessible to business, industry, tourists and commuters.

The outer northern metropolitan area, where 20% of Adelaide's total population live, is one of the largest and fastest growing regions of South Australia, making a significant contribution to the state's economy. It has been identified by the Metropolitan Planning Strategy as Adelaide's main growth area.

Future drivers for economic development are expected to come from the key industries already in the region, manufacturing, defence, information technology, horticulture and viticulture. The Edinburgh Parks development, together with established major industries such as GM Holden, form part of a major arc of industry extending from Salisbury—Elizabeth to Outer Harbor, through Cavan, Wingfield and Port Adelaide.

Overall, it is expected that industrial and agricultural activity will increase by 5% annually over the next 10 years and that all of the major roads will experience a projected growth in traffic of up to 7% over the same period.

The regional significance of the Northern Expressway project is shown on Figure 2.1 illustrating these important transport links and economic drivers.

Main North Road passes through Adelaide's northern suburbs and is a six-lane road in places. However, its efficient operation as a main through route for freight is severely constrained from Gawler to Gepps Cross by considerable local, short distance traffic and by numerous intersections, 22 of which have traffic signals. The road is already congested at times, particularly on the dual two-lane sections, and traffic conditions certainly exceed the operational standards and desired level of transport efficiency for a National Network road link.

It confirmed the preferred long-term route for the National Network road link as being along the Angle Vale Road–Heaslip Road corridor.

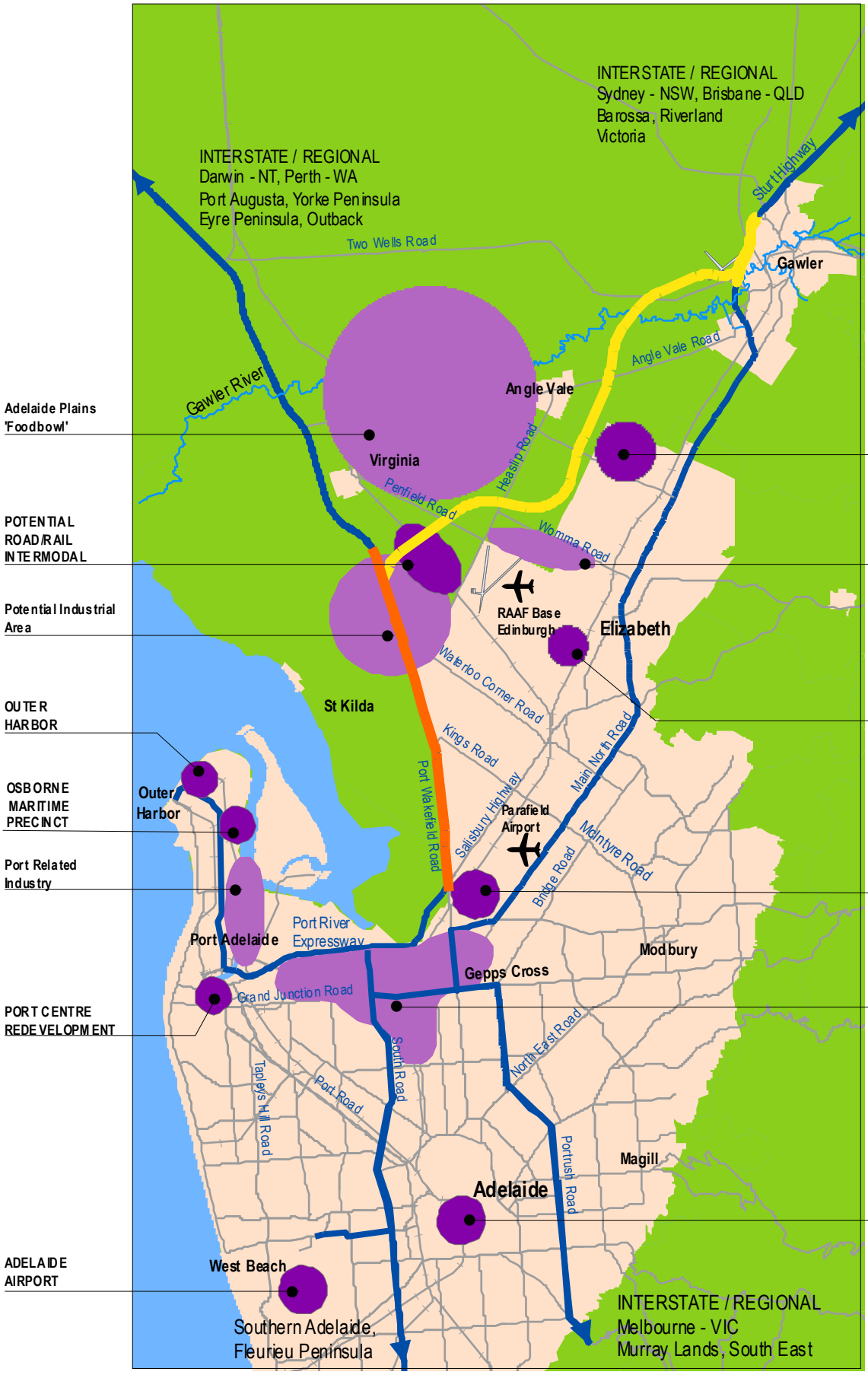


Figure 2.1 **Regional industrial and transport generators**

2.2 Description of other traffic and transport studies

A number of studies and investigations preceded the start of road planning and concept design for the Northern Expressway and Port Wakefield Road Upgrade in October 2006.

These previous studies developed and assessed many routes, broadly located within the band shown on Figure 2.2. The current study has further investigated and developed a short list of options, and finally selected the preferred route.

1998 – SKM report

A strategic planning study by Sinclair Knight Merz Pty Ltd (SKM) in 1998 was undertaken in response to increasing concern about the suitability of the existing National Network route into Adelaide via Main North Road. The study concluded that there was a need to provide additional capacity for traffic movement from the outer northern suburbs.

The study area extended from Two Wells Road in the north, Main North Road in the east, Grand Junction Road/Gepps Cross in the south and Port Wakefield Road in the west. Various routes were identified and broadly investigated:

- existing network, the upgrade of Main North Road
- Salisbury Highway–Main North Road
- Port Wakefield Road–Bolivar Road–Andrews Road
- Port Wakefield Road–Heaslip Road–Angle Vale Road
- Port Wakefield Road–Taylors Road–Angle Vale Road
- Port Wakefield Road–Angle Vale Road.

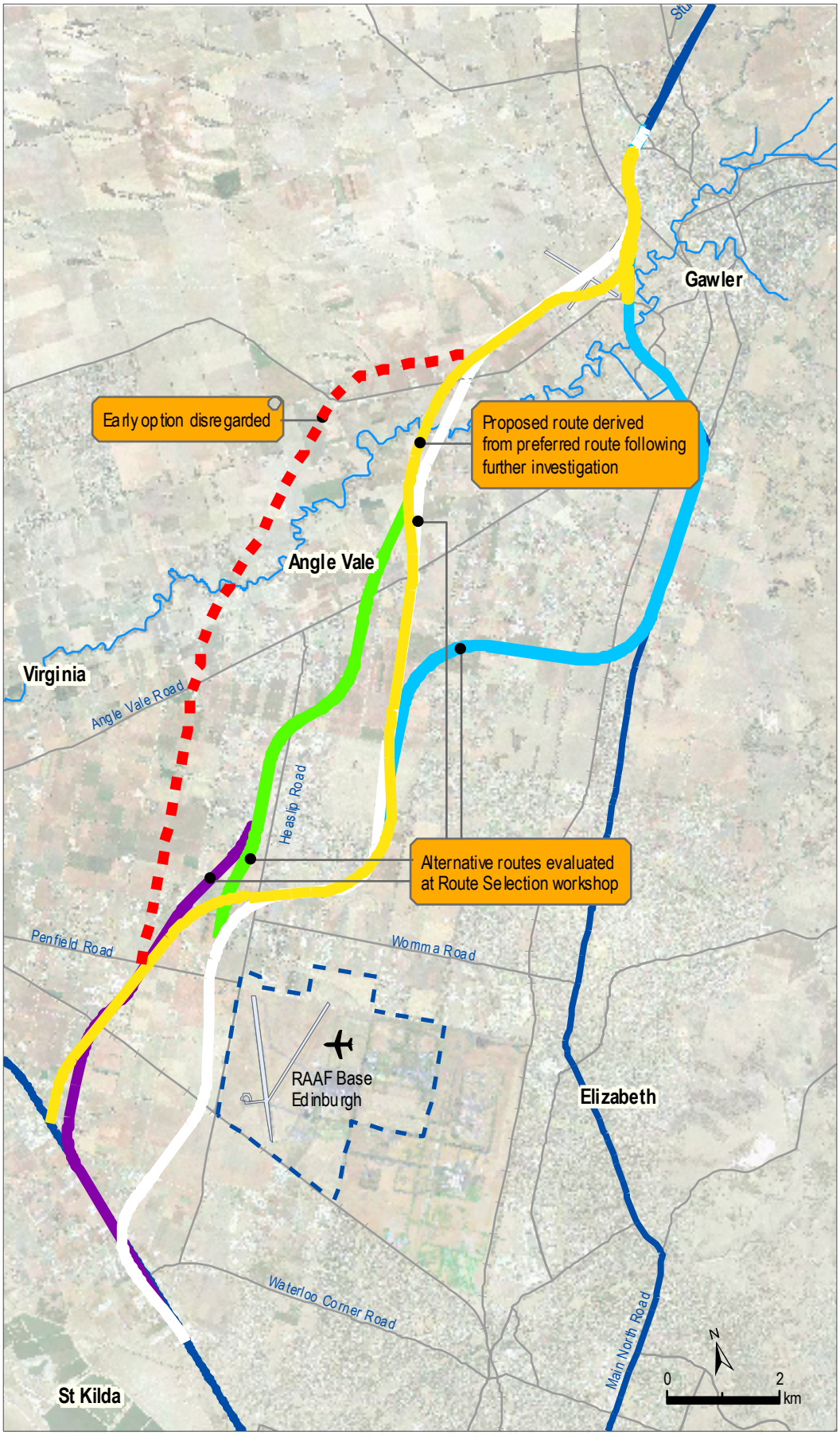
The Port Wakefield Road–Heaslip Road–Angle Vale Road option was considered to be preferable to all other options, and the best option for the National Network in the study area. This was selected because it:

- provided a sound alternative route and greater travel choice in the network
- had the lowest overall cost
- had the lowest overall environmental and social effects.

The preferred route started in the north at the Two Wells Road interchange on the Gawler Bypass, followed Jack Cooper Drive, bypassed Hillier Park, then followed Angle Vale Road, formed a bypass around the south-east side of Angle Vale, then followed mainly the existing alignments of Heaslip Road and Port Wakefield Road to Salisbury Highway.

Initial development of this new route centred on using as much of the existing Angle Vale Road–Heaslip Road corridor as possible.

In 2001, the Transport Strategy and Planning Network Unit of the then Transport SA undertook a strategic review of the SKM proposal for the National Network for northern metropolitan Adelaide.



Proposed Northern Expressway route

Figure 2.2 **Alternative routes considered**

Note: Route paths maybe obscured by other routes

2002 — QED initial consultation

In late 2001, QD Pty Ltd (QED) was commissioned by the then Transport SA to undertake an initial consultation phase with key stakeholders. The aim of this consultation was to identify issues and constraints and to discuss possible options with a range of stakeholders (primarily local members of the Australian Government, South Australian Government, local government and state government agencies).

2003–2004 — TSD

The Transport Services Division of DTEI (TSD) began investigations in early 2003 that included the development of the new route identified in the SKM report. This study was aimed at developing and broadly assessing route alignment options and their effects on the adjacent road structure for the Northern Expressway. It used existing background knowledge and internal expertise, and was the main input and starting point for the current more detailed investigations by the consultant consortium. The study was not intended to provide a preferred concept because insufficient data was available at the time. Its main objective was to provide a range of broad concepts and evaluation criteria which would influence the further development of more refined concepts.

As part of this investigation, TSD commissioned Parsons Brinckerhoff Australia Pty Ltd to develop a discussion paper that could be used to agree on a preferred form and function for the Northern Expressway. The discussion paper provided:

- a context for the development of the new route and how it could be funded by Auslink
- an overview of the outcomes of preliminary consultation with key stakeholders
- a brief description of key issues influencing the role and functionality of the new route.

Five broad concepts and a number of alternatives were developed to an appropriate standard so that a brief assessment could be made of their effects. This assessment and the broad concepts were documented in an interim draft report *Broad Concepts* in July 2004.

Since the *Broad Concepts* report was finalised, further planning investigation work has examined, in particular, the two system connections onto the Gawler Bypass and to Port Wakefield Road.

2005 — TSD

In 2005, TSD began stakeholder consultation with key government and local stakeholders as well as continuing with route and concept planning for the alternative alignments. The consultation process primarily developed two stakeholder reference groups: one for government agencies and one with local councils and other representatives. A number of workshops held with these reference groups identified issues, constraints and possible opportunities.

TSD background environmental studies of the area included noise monitoring and modelling, air quality investigation and modelling, and vegetation and fauna assessments. Other investigations included an initial broad traffic assessment, pavement and geotechnical analyses, and property assessments for the various routes identified to this time.

2005 — SMEC

Snowy Mountains Engineering Corporation Pty Ltd (SMEC) was engaged to review and provide advice on current and previous work being undertaken by TSD (from an informed interstate perspective). This

work included constraints mapping, feasibility assessment and, in particular, the location and design of interchanges as well as route identification.

2005 — Current Study (KBR, SKM, QED Consortium)

In October 2005 following earlier studies by DTEI, the consultant consortium of Kellogg Brown & Root Pty Ltd (KBR), QED and SKM (the consultant consortium) was appointed by the TSD to undertake the planning, environmental assessment, community involvement and concept design of the Northern Expressway.

The overriding objective of this consultancy is to complete the concept design to the stage where it is possible to define the land boundaries necessary for the future highway. Other strategic project objectives have been outlined earlier in Section 2.1.

The four phases of the project are:

- Phase 1 – concept planning, initial route selection and project approval, completed in October 2006
- Phase 2 – concept design, public consultation and environmental assessment, November 2006 to July 2007
- Phase 3 – land acquisition, July 2007 to July 2008
- Phase 4 – construction.

The scope of work being carried out by the consultant consortium encompasses the latter part of Phase 1 and the whole of Phase 2. Phase 2 of the project culminates in approval by the Minister for Transport of the formal environmental assessment, the final concept design of the proposed route and declaration of the defined (proposed) route corridor.

A number of alternative routes in the study area have been investigated during the course of the project to date. These routes have been evaluated, and a preferred route selected in a systematic manner against a range of non-monetised and monetised criteria, including:

- community accessibility
- horticultural production and capital investment
- business operations and development
- visual impact
- noise
- property
- capital and whole of life maintenance costs
- road safety
- travel time and distance costs.

2.3 Road network

2.3.1 Arterial road network

Figure 2.3 shows the road network within the study area. It is characterised by three major north–south roads, Port Wakefield Road, Heaslip–Angle Vale Road and Main North Road (and Gawler Bypass). Main North Road and Port Wakefield Road form part of the AusLink National Network; Main North Road forms part of the Sydney–Adelaide corridor and Port Wakefield Road forms part of the Adelaide–Perth corridor. Heaslip–Angle Vale Road is considered to be a significant freight route and connects the two National Network road links. Main North Road and Heaslip Road form the main connections to the mid-north (e.g. Clare) and to the Riverland areas of South Australia as well as to northern Victoria and New South Wales via the Sturt Highway. Port Wakefield Road forms a fundamental link in South Australia's road network, connecting Adelaide with the Yorke Peninsula, Port Augusta, the Northern Territory and Western Australia.

The remaining arterial roads (generally east–west such as Womma Road, Penfield Road, Angle Vale Road and Two Wells Road) function as links to the Auslink National Network and among surrounding communities.

Within the Gawler township, the arterial road network essentially provides connections to the Gawler Bypass and from Gawler to the major towns to the north and west, including Main North Road, Adelaide Road, Murray Street, Redbanks Road and Ryde Street.

Arterial roads linking with the southern section of Port Wakefield Road include Waterloo Corner Road, Bolivar Road–Kings Road and Salisbury Highway. Waterloo Corner Road forms a direct route towards the Salisbury district centre and via Heaslip Road and Wyatt Road to the Edinburgh Parks industrial area including the RAAF Base Edinburgh. Bolivar–Kings Road links with the Salisbury North area as well as Parafield Airport. Salisbury Highway provides a direct link from Port Wakefield Road to the Salisbury residential area and to the Port River Expressway.

2.3.2 Local road network

The local road network within the study area generally forms a grid pattern of sealed and unsealed roads that link the arterial roads and the surrounding communities of Angle Vale, Virginia, Macdonald Park and Lewiston with Gawler and Munno Para.

South along Port Wakefield Road, the local road network has a number of distributor roads to the east of Port Wakefield Road; to its west the local road network essentially provides access to existing residential and commercial properties.

The Local Government Association's Metropolitan Transport Strategy Contract Report (ARRB Group and Tonkin Consulting in August 2005) identified various local roads as having particular importance within the study area. These roads have been identified based on their particular function and include:

- Primary freight routes — Curtis Road, Taylors Road, West Avenue (Edinburgh Parks) and Wyatt Road
- Secondary freight routes — Womma Road (west of Heaslip Road), St Kilda Road, Heaslip Road (north of Angle Vale Road) and Helps Road

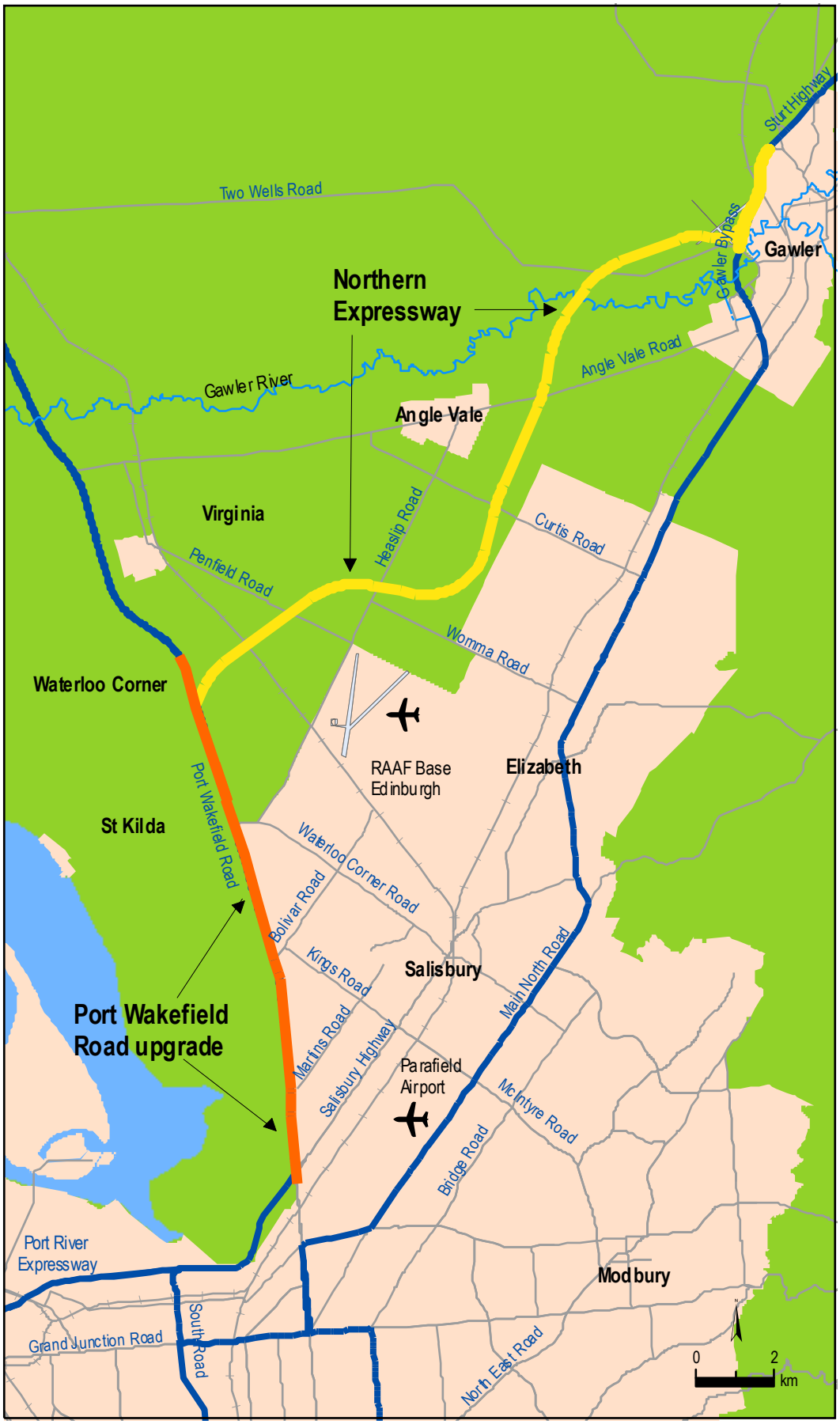


Figure 2.3 **Northern Expressway and surrounding road network**

- Primary social access routes — Bolivar Road, Martins Road, Curtis Road and West Avenue
- Primary tourism route — St Kilda Road.

2.4 Road corridor descriptions

The three main road corridors within the study area are briefly described and characterised in this section.

Gawler Bypass–Main North Road

This road corridor traverses predominantly rural and residential areas from the Gawler Bypass to Munno Para and then residential areas to Salisbury, and residential, commercial and light industrial areas south of Salisbury.

The speed zones vary along the road with 80 km/h in the residential areas increasing to 110 km/h on the Gawler Bypass. Main North Road has 22 sets of traffic signals between the Gawler Bypass and Gepps Cross. The cross-section on Main North Road has four or six lanes on various sections and it generally has a wide median for its full length where the road width provides two lanes in each direction, it is considered to be narrow and has no sealed shoulder.

This road is typically access controlled but there are short sections of the road where individual properties north of Munno Para have direct access.

Angle Vale Road–Heaslip Road

This road corridor traverses predominantly rural and residential areas from the Gawler Bypass to Evanston, Hillier Park, Angle Vale, through the Angle Vale township and then primarily rural areas south of Angle Vale, except for the RAAF Base Edinburgh.

The speed zones vary: 60 km/h in the residential areas of Angle Vale and Evanston increases to a maximum of 90 km/h on both roads. Both roads have a two lane cross-section although widening on Heaslip Road has provided protected turn lanes at the major junctions with Curtis Road, Womma Road and Penfield Road. Abutting properties have direct access on both roads.

Port Wakefield Road

This road corridor traverses predominantly residential, commercial and light industrial areas from Taylors Road to the north to Salisbury Highway to the south.

The speed zone along Port Wakefield Road is 80 km/h just north of Salisbury Highway, to 90 km/h until north of St Kilda Road and then 110 km/h further northwards. Port Wakefield Road is a four-lane divided road with a wide median. There are four sets of traffic signals:

- one at each of the two access ramps with the Salisbury Highway overpass
- with Globe Derby Drive
- at the junctions with Waterloo Corner Road and Bolivar Road (stopping southbound Port Wakefield Road traffic).

Direct access to abutting properties is provided on this road but in some sections access is provided by service roads.

Local roads

Most of the many roads in the study area are sealed although a number of access roads are unsealed such as Frisby Road and Wingate Road (north of Two Wells Road). The speed zones on these roads vary but are typically the default speed limit in urban areas (50 km/h) increasing to 100 km/h in rural areas.

South along Port Wakefield Road, the road network to the east is sealed and to the west mostly sealed except for Summer Road and Undo Road.

The local roads generally have a two lane cross-section of varying width.

2.5 Existing traffic volumes

Existing (2006) traffic data in the form of 'annual average daily traffic' for the arterial and major local roads within the study area are presented in Figure 2.4.

The traffic volumes on Main North Road range from just over 17,300 vehicles per day (vpd) on the Gawler Bypass to 61,800 vpd at Salisbury. Daily volumes on Heaslip–Angle Vale Road vary between 6,000 and 12,000 vpd. The existing traffic volumes along Port Wakefield Road vary from 14,000 vpd north of Taylors Road to 48,000 vpd north of Salisbury Highway. Typically the remaining arterial roads have traffic volumes of less than 5000 vpd.

Traffic volumes on the arterial roads intersecting with Port Wakefield Road are:

- Waterloo Corner Road 14,600 vpd
- Bolivar Road 17,700 vpd.

Analysis of the 11-hour turning and classification counts indicate the following two-way peak hour volumes:

- from 700 vehicles per hour (vph) on Angle Vale Road to 1300 vph on Heaslip Road south of Womma Road with typical peak direction flows at 60–70% of the two-way flow
- on Main North Road starting at 2700 vph at Tiver Road and increasing to 3700 vph at Womma Road, with maximum one-way peak hour flows of up to 2000 vph
- along Port Wakefield Road from 1600 vph at Waterloo Corner Road to 4690 vph at Salisbury Highway.

The commercial vehicle content varies considerably on the main corridors:

- Gawler Bypass south of Redbanks Road — 15% (or 2720) of total average daily volume with heavy commercials (semi-trailers and B-doubles) comprising 51% of this total
- Main North Road south of Gawler Bypass — 6% (or 1670) of total average daily volume with heavy commercials (semi-trailers and B-doubles) comprising 30% of this total
- Angle Vale Road east of Dalkeith Road — 23% (or 1400) of total average daily volume with heavy commercials (semi-trailers and B-doubles) comprising 55% of this total

- Heaslip Road north of Womma Road — 14% (or 1350) of total average daily volume with heavy commercials (semi-trailers and B-doubles) comprising 61% of this total
- Port Wakefield Road north of Waterloo Corner Road — 14% (or 2490) of the total average daily volume
- Port Wakefield Road north of Salisbury Highway — 11% (or 6550) of total average daily volume with heavy commercials (semi-trailers and B-doubles) comprising 45% of this total.

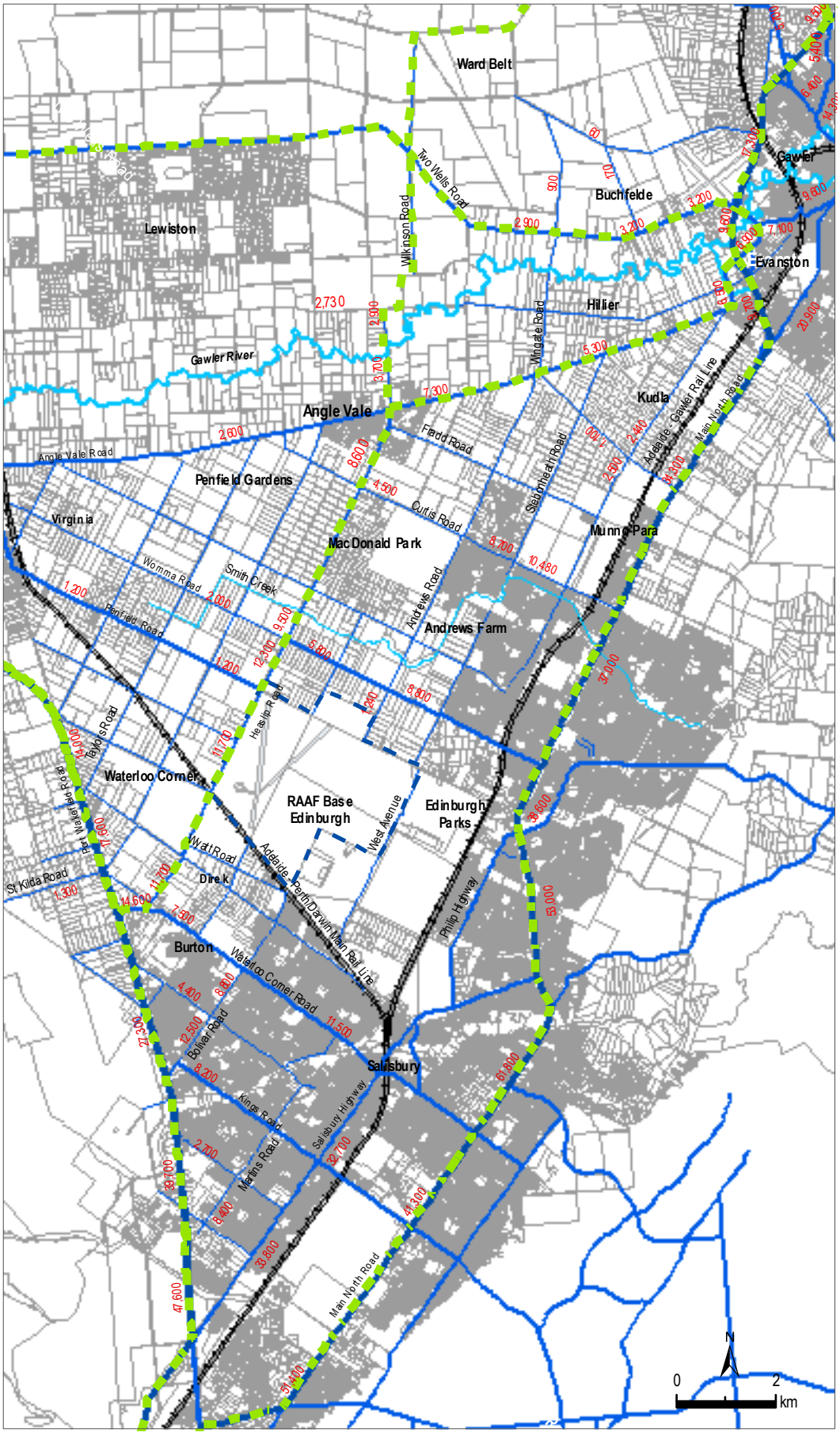
The commercial vehicle proportions show that a significant volume of heavy vehicles are already using the Port Wakefield Road–Heaslip Road–Angle Vale Road route to avoid Main North Road.

Daily traffic volumes on local roads to the north-east of Port Wakefield Road are typically less than 1,500 vpd, except for:

- Curtis Road east of Heaslip Road with daily volumes of 4,500 vpd east of Heaslip Road increasing to 15,000 vpd at Main North Road
- Petherton Road east of Heaslip Road to Andrews Road with daily volumes in the order of 3,000 vpd
- sections of Andrews Road between Curtis Road and Womma Road where traffic volumes are just greater than 1,500 vpd
- Womma Road and Robert Road west of Heaslip Road where daily volumes are 2,000 and 1,500 vpd respectively
- Taylors Road where the daily volumes vary between 1,500 and 1,000 vpd.

Along Port Wakefield Road the following connecting roads have daily traffic volumes of:

- St Kilda Road 1,300 vpd
- Burton Road 2,900 vpd
- Summer Road 160 vpd
- Jobson Road 30 vpd
- Deuter Road 210 vpd
- Hodgson Road 1,900 vpd
- Victoria Drive 2,700 vpd
- Ryans Road (east) 1,500 vpd.
- Daniel Avenue 1,200 vpd
- Martins Road 8,400 vpd
- Globe Derby Drive 750 vpd.



14,500 Daily traffic volume
Over-dimension vehicle route
National Network
Arterial road
Major local road

Figure 2.4 **Existing road network and daily traffic volumes**

2.6 Level of service

The *Austroads Guide to Traffic Engineering Practice (1988) —Roadway Capacity* defines level of service (LOS) as 'a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers'. The guide describes six levels of service ranging from LOS A (best operating conditions) to LOS F (worst conditions— capacity exceeded, forced flow conditions).

This Guide, together with existing traffic data, has been used to determine the LOS for various roads as indicated below:

- Gawler Bypass – LOS B
- Main North Road north of Munno Para – LOS C
- Angle Vale Road – LOS C
- Heaslip Road south of Angle Vale township – LOS C
- Heaslip Road north of Waterloo Corner Road – LOS E
- Port Wakefield Road north of Waterloo Corner Road – LOS A
- Port Wakefield Road north of Salisbury Highway – LOS C.

Travel speeds have been used to determine the LOS on the followings sections of Main North Road during peak times:

- through Munno Para and Elizabeth – LOS D to E
- through Salisbury – LOS E to F

Maximum existing LOS for the following signalised intersections along Main North Road and Port Wakefield Road have been determined with the aaSIDRA software for the peak periods, as follows:

- Main North Road – through Munno Para and Elizabeth LOS D to E
- Main North Road – through Salisbury LOS E to F
- Port Wakefield Road – Waterloo Corner Road junction LOS D
- Port Wakefield Road – Bolivar Road junction LOS C
- Port Wakefield Road – Salisbury Highway junction LOS D.

2.7 Road crashes

Analysis of road crash statistics within the study area has been based on data provided by DTEI for the period 2001 to 2005 inclusive.

Crash statistics for the main arterial and local road sections and intersections are summarised in Tables 2.1, 2.2, 2.3 and 2.4. Table 2.1 provides a comparison of crash rates for the Auslink Adelaide Urban Road network in terms of crashes per 100 million vehicle kilometres travelled per year.

Table 2.1 AusLink Adelaide Urban Network Crash Rate *

Road name	Fatal and serious injury per 10^8 vkt	Minor injury per 10^8 vkt	Total per 10^8 vkt
Grand Junction Road	11	81	92
Main North Road	8	34	42
Salisbury Highway Connector	4	24	28
Port Wakefield Road	6	32	38

* *AusLink Adelaide Urban Corridors Strategy, DOTARS, 2006.*

Table 2.2 Road crash summary — road sections for northern area

Road name	Section	Fatal	Casualty	Property damage	Total
Angle Vale Road	Heaslip Road to Jack Cooper Drive	2	12	38	52
Heaslip Road	Waterloo Corner Road to Womma Road	1	25	34	60
	Womma Road to Curtis Rd	1	24	18	43
	Curtis Road to Angle Vale Road		14	44	58
Womma Road	Heaslip Road to Stebonheath Road		18	18	36
Main North Road	Gawler Bypass to Curtis Road	2	53	101	156
	Curtis Rd to Womma Road	1	77	244	322
	Womma Road to John Rice Ave	3	186	446	635
Jack Cooper Drive	Heaslip Road to Ryde Street		13	21	34
Gawler Bypass	Main North Road to Main North Road		8	28	36

Table 2.3 Road crash summary—local roads for northern area

Road name	Section	Fatal	Casualty	Property damage	Total
Curtis Road	Heaslip Road to Andrews Road		12	14	26
	Andrews Road to Stebonheath Road		8	1	9
Coventry Road	Angle Vale Road to Curtis Road		7	5	12
Stebonheath Road	Angle Vale Road to Curtis Road	1	1	2	4
Dalkeith Road	Angle Vale Road to Main North Road	1	7	8	16
Andrews Road	Angle Vale Road to Curtis Road		2	7	9

Table 2.4 Road crash summary—junctions on Port Wakefield Road

Road name	Intersecting road	Fatal	Casualty	Property damage	Total
Port Wakefield Road	Bolivar Road	0	13	34	47
Port Wakefield Road	Waterloo Corner Road	0	4	17	21
Port Wakefield Road	Martins Road				
Port Wakefield Road	Ryans Road	0	1	2	3

For this same period, a total of 185 crashes were recorded at midblock sections including minor junctions along Port Wakefield Road. Of the 185 crashes:

- there were 5 fatalities
- 75 resulted in some form of injury
- 105 resulted in property damage only.

The major points indicated by an analysis of the crash data (Figures 2.5 and 2.6) are:

- signalised intersections along Main North Road have high numbers of crashes due to the high volume of traffic using this road
- on Heaslip Road the major unsignalised intersections with Angle Vale Road, Curtis Road, Womma Road and Waterloo Corner Road have higher crash volumes and also higher numbers of casualty crashes than the signalised intersections on Main North Road
- along Heaslip Road there appears to be a high proportion of casualty crashes in the midblock section south of RAAF Base Edinburgh to Waterloo Corner Road
- crashes at unsignalised intersections along Port Wakefield Road were predominantly right angle crashes
- the majority of crashes at midblock locations along Port Wakefield Road resulted from vehicles hitting either a fixed object or a parked vehicle; several also resulted from vehicle loss of control and leaving the roadway.

2.8 Public transport

Public transport services in the study area are focused on serving the Adelaide–Gawler rail line and the Elizabeth regional, and Salisbury and Munno Para district centres. Bus feeder services travel along Main North Road, Womma Road and Curtis Road to the Smithfield, Elizabeth and Salisbury rail stations. No Metroticket bus service is provided along Heaslip Road, but a number of school bus services use Heaslip, Angle Vale and Two Wells roads.

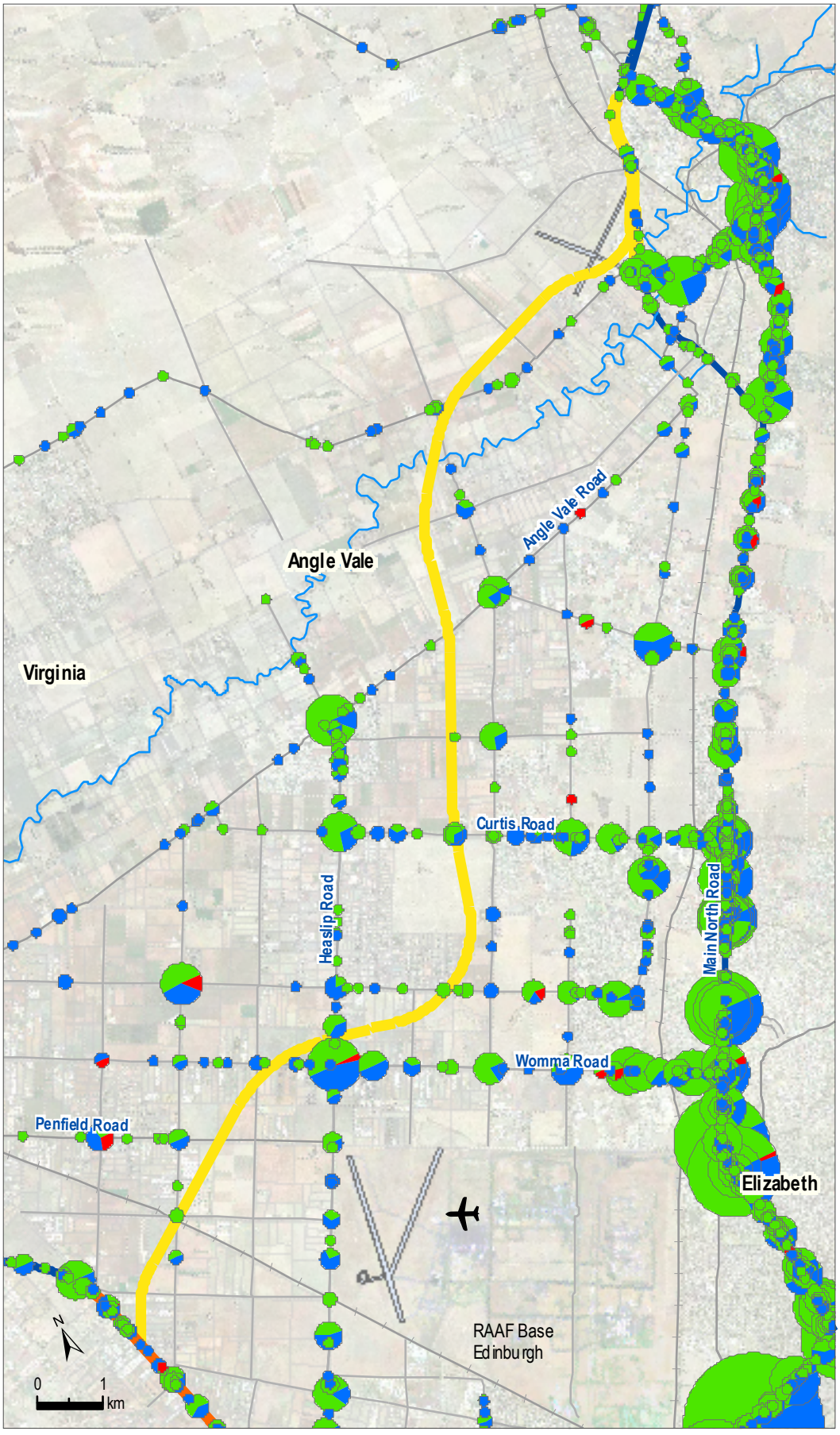
Public transport bus services that operate along Port Wakefield Road include the 224 and 900 service. The 224 service travels from the City of Adelaide to Elizabeth via Port Wakefield Road and Salisbury Highway. It also serves Globe Derby Park with a Saturday night service.

The 900 service travels from Virginia to Salisbury return via Port Wakefield Road north, Port Wakefield Road and Waterloo Corner Road.

Intrastate bus services have a regular, but not scheduled, stop located adjacent to the Caltex Service Station at Bolivar, based on demand from passengers.

2.9 Freight routes

Freight movement in the study area is concentrated on Heaslip–Angle Vale roads as being the main long distance north–south freight route, with Main North Road supplementing this route and providing for shorter distance movements.



Property damage only
Casualty
Fatality

Figure 2.5 **Road crashes Northern area**

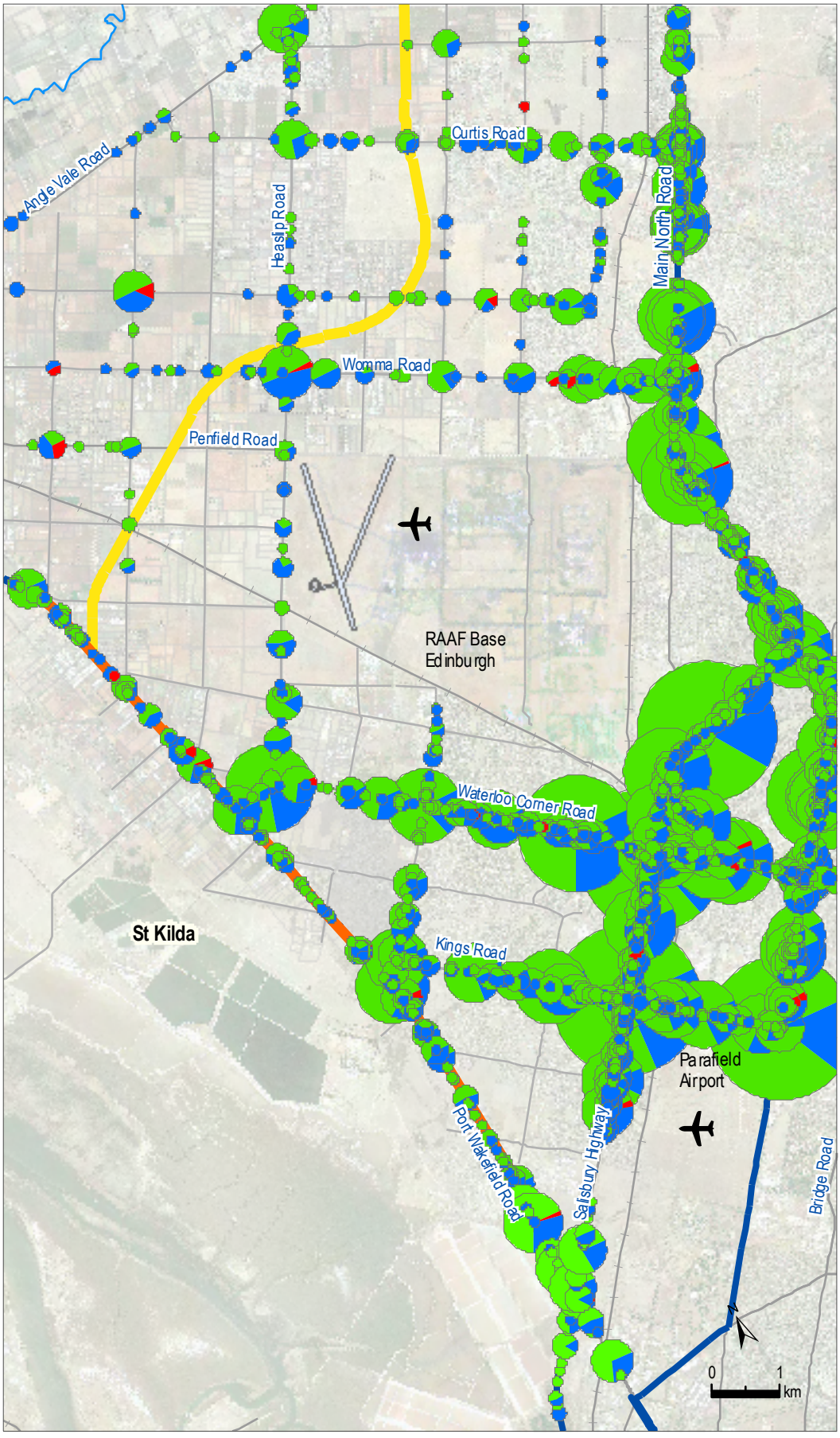


Figure 2.6 **Road crashes**
Port Wakefield Road

Port Wakefield Road (National Network road link) is designated as a key freight route for B-doubles, double road trains and articulated vehicles, forming a key freight route for Adelaide linking with Eyre Peninsula and Yorke Peninsula, Perth, Darwin and parts of New South Wales. Port Wakefield Road is also designated as an over-dimension vehicle route.

Road trains are allowed access only along Port Wakefield Road with B-double trucks gazetted for Heaslip–Angle Vale, Main North, Taylors and Womma roads. However, B-double trucks have been allowed by permit to travel on various local and arterial roads to access individual properties.

The following roads are indicated as being capable of catering for over-dimensional vehicles: Port Wakefield Road, Main North Road–Gawler Bypass, Angle Vale Road (Angle Vale to Gawler section), Two Wells Road to Gawler Road and Wilkinson Road (part of the over-dimensional (load) route, OD3). Refer Figure 2.4.

There are no current service centres along any of the main road corridors within the study area. However commercial vehicles do use service stations along Main North Road, Heaslip Road and Port Wakefield Road. There have been some operational issues, primarily unrestricted parking, at these locations. The City of Salisbury has indicated that there are issues with truck parking adjacent the Caltex Service Station at Bolivar, mainly that unrestricted parking on both sides of Port Wakefield Road restricts sight lines and pedestrian crossing movements.

2.10 Non-motorised transport

There are no defined cycle or pedestrian paths within the study area but cyclists would use the road network to access schools in the region from residential properties located outside of the main residential areas.

There is little pedestrian movement along Port Wakefield Road. However, crossing movement in the vicinity of the Bolivar Road junction is associated with the Highway 1 Caravan Park and Whitehorse Inn hotel. Council has indicated that they have concerns with pedestrian safety in this area, particularly near the Caltex Service Station.

Many of the rural living properties in the study area have horse tracks. On this basis it is expected that some local roads would be used by horses. At Globe Derby Park there is significant equestrian use of the local road network to the west of Port Wakefield Road associated with the trotting track.

3 Future road network

3.1 Base case

The arterial road network within the study area is unlikely to change in the future except for the future upgrading of Port Wakefield Road south of Waterloo Corner Road. If the Northern Expressway was not provided, then Main North Road would require substantial upgrading and widening between Mawson Lakes and Gawler to cater for the future traffic volumes. In addition, Heaslip–Angle Vale Road would also require upgrading and widening (including duplication) to improve safety and cater for the expected traffic volumes.

The proposed duplication of the Sturt Highway from Gawler to Nuriootpa will be completed prior to the opening of the Northern Expressway and the Sturt Highway will also include an upgrade of the Gawler Belt Interchange. It is proposed that some movements not currently allowed for at this interchange will be provided in this scheme. The expected effect of this is a slight reduction in traffic at the Redbanks Interchange for vehicles accessing the Gawler Bypass (that would transfer to the upgraded Gawler Belt interchange).

There would be the need to upgrade a number of east-west arterial roads in the study area to improve safety and access including Womma Road between Heaslip Road and the Adelaide–Gawler/Barossa rail line, Waterloo Corner Road from Port Wakefield Road to Heaslip Road and the access roads from the Gawler Bypass into Gawler.

There are expected to be some minor changes to the local road network with increased development in the region. Possible future improvements could include:

- continued upgrading of Wyatt Road to a divided four lane road to service the rapidly growing Edinburgh Parks development
- upgrading of Taylors Road to service the horticultural area surrounding Virginia
- upgrading of a number of north–south roads that service the Munno Para area
- some requirement to provide additional or upgraded connections to Main North Road and Angle Vale Road from the future residential development of the Evanston Gardens area
- upgrading of Curtis Road and other major local roads such as Stebonheath and Andrews roads as part of the Playford North development. At this time the exact nature of the upgrade for Curtis Road is unknown but could involve duplication. Other works include provision of roundabouts and road widening.

3.2 Base traffic data/modelling

Daily and peak hour traffic forecasts have been produced by DTEI using its new Metropolitan Adelaide Strategic Transport and Economic Model (MASTEM), the 'integrated model'. This model uses employment and demographic data provided by the Department of Primary Industry and Resources, South Australia and takes into consideration the following developments in the region:

- Edinburgh Parks industrial area

- provision of a new battalion at the RAAF Base Edinburgh
- Playford North regeneration project
- other initiatives that match the South Australian Government's strategic programs including the two million population target for 2050.

The study team has reviewed the traffic model and indicated that it provides an adequate basis for deriving traffic demand projections for assessing the impacts of the proposed Northern Expressway and Port Wakefield Road Upgrade. MASTEM is a strategic model that produces traffic forecasts at a relatively broad geographic scale based on journey to work survey areas. These areas are relatively large in outer metropolitan Adelaide, such as for the Northern Expressway Project. Therefore, the strategic model outputs undergo some refinement to obtain design traffic volumes for the project.

Figures 3.1, 3.2 and 3.3 show the percentage change between existing traffic conditions and predicted (2011 and 2026) with and without the Expressway in the form of annual daily traffic for the arterials and major local roads in the study area. Table 3.1 summarises key locations along the main arterial roads in the study area.

Table 3.1 Future daily traffic volumes — 2011

Location	Existing	2011 without Expressway	2011 with Expressway
Gawler Bypass, west of Redbanks Road	17,300	19,300	25,200
Main North Road south of Gawler Bypass	34,300	39,300	28,100
Main North Road at Munno Para	35,850	44,100	35,600
Main North Road at Elizabeth	40,700	62,600	56,100
Main North Road at Salisbury	41,300	46,900	41,900
Angle Vale Road	5,700	7,300	3,500
Heaslip Road (northern end)	8,800	18,700	12,500
Heaslip Road (southern end)	11,600	17,800	12,100
Northern Expressway Gawler Bypass to Curtis Road	N/A	N/A	17,100
Northern Expressway Curtis Road to Womma Road	N/A	N/A	18,300
Northern Expressway Womma Road to Port Wakefield Road	N/A	N/A	18,100
Port Wakefield Road, south of Taylors Road	14,000	20,800	32,700
Port Wakefield Road, south of Waterloo Corner Road	27,300	32,000	38,100
Port Wakefield Road south of Bolivar Road	39,700	48,800	58,800
Port Wakefield Road, south of Martins Road	47,600	58,800	61,100
Salisbury Highway north of Port Wakefield Road	33,800	42,700	35,500
Waterloo Corner Road east of Heaslip Road	7,500	11,800	14,200
Bolivar Road east of Port Wakefield Road	17,700	21,200	17,000
Martins Road east of Port Wakefield Road	8,300	10,600	14,000

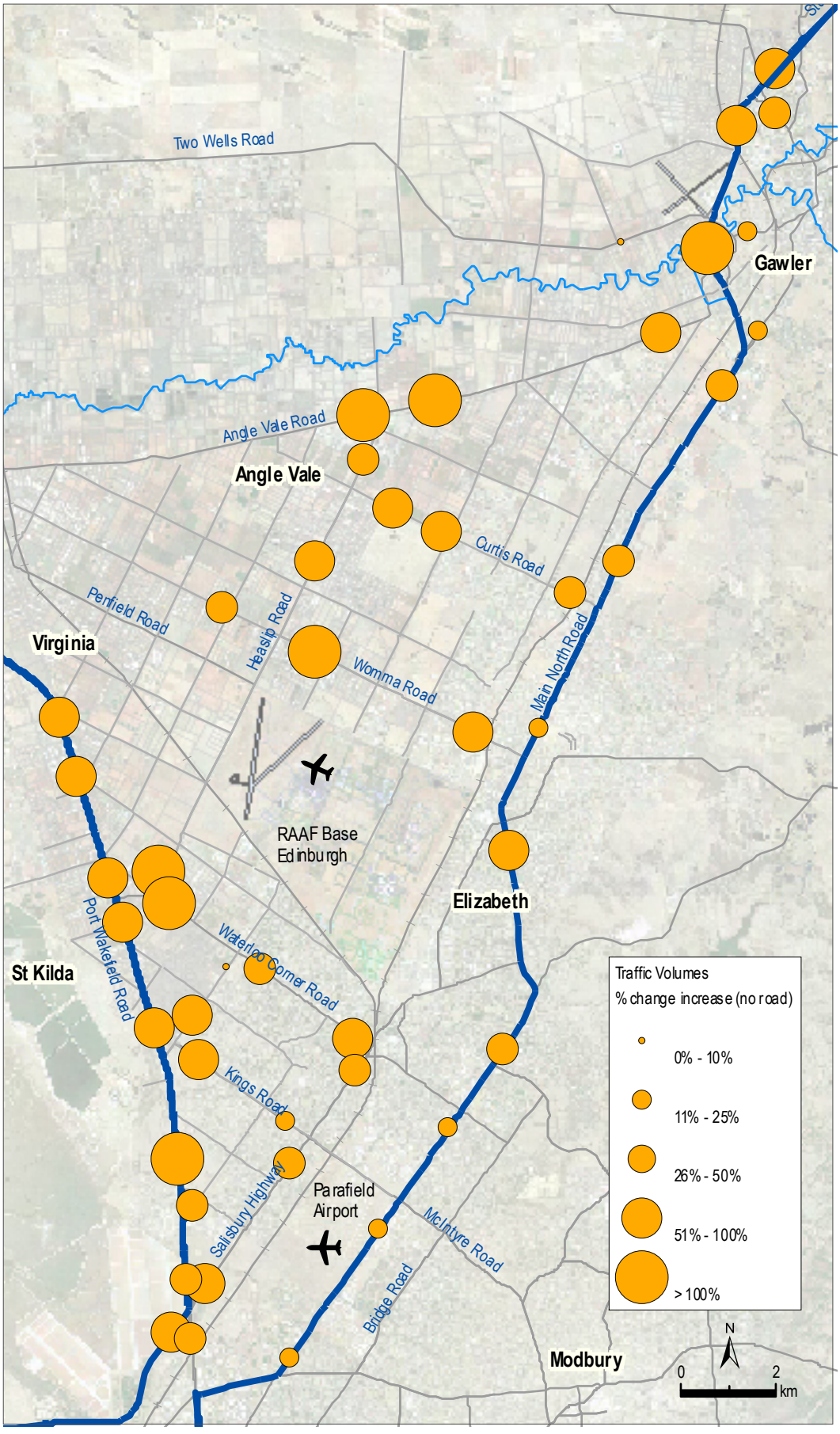


Figure 3.1 **% change between 2011 and 2026 traffic volumes (without expressway)**

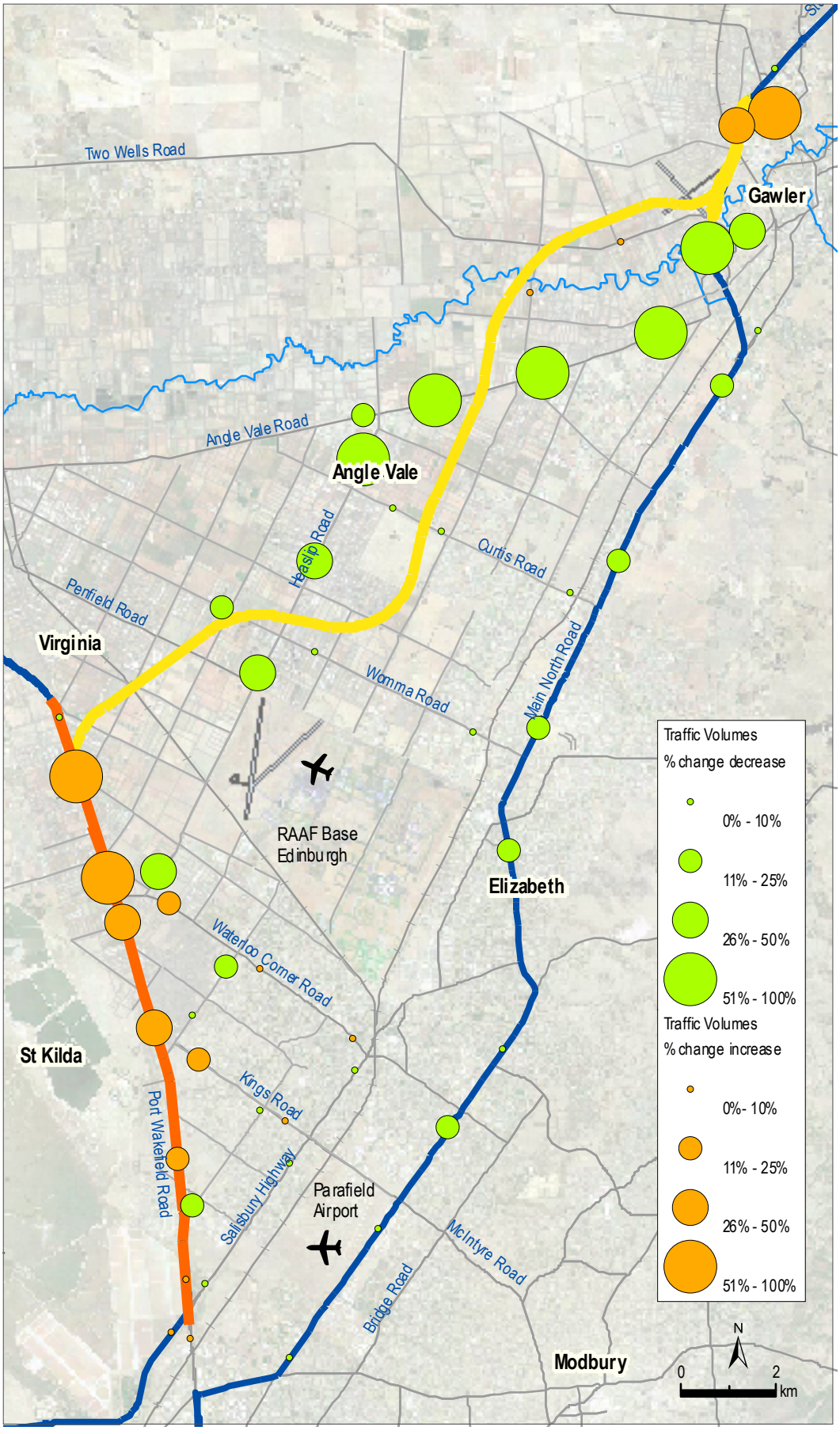


Figure 3.2 **% change in 2011 traffic volumes with expressway compared to without expressway**

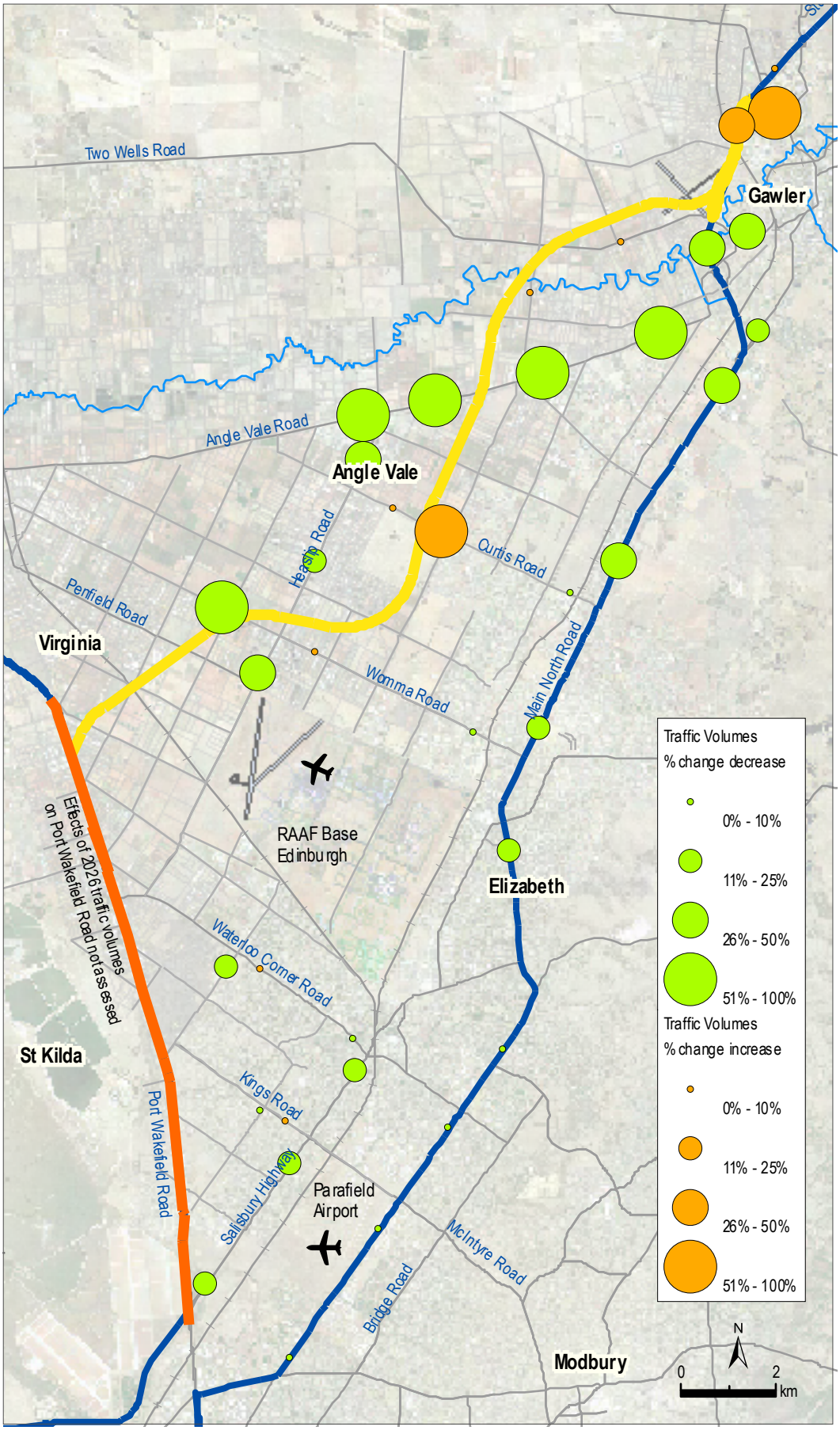


Figure 3.3 **% change in 2026 traffic volumes with expressway compared to without expressway**

Table 3.2 Future daily traffic volumes — 2026 (2016 for Port Wakefield, Waterloo Corner, Bolivar and Martins roads)

Location	Existing	2026 without Expressway	2026 with Expressway
Gawler Bypass, west of Redbanks Road	17,300	27,200	35,800
Main North Road South of Gawler Bypass	34,300	49,150	26,850
Main North Road at Munno Para	35,850	46,650	35,850
Main North Road at Elizabeth	40,700	69,650	61,200
Main North Road at Salisbury	41,300	51,250	48,750
Angle Vale Road	5,700	18,300	5,700
Heaslip Road (northern end)	8,800	30,800	19,200
Heaslip Road (southern end)	11,600	27,550	15,850
Northern Expressway Gawler Bypass to Curtis Road	N/A	N/A	26,900
Northern Expressway Curtis Road to Womma Road	N/A	N/A	31,600
Northern Expressway Womma Road to Port Wakefield Road	N/A	N/A	40,000
Port Wakefield Road, south of Taylors Road	14,000	23,200	38,300[1]
Port Wakefield Road, south of Waterloo Corner Road	27,300	34,900	42,200[1]
Port Wakefield Road south of Bolivar Road	39,700	45,100	49,900[1]
Port Wakefield Road, south of Martins Road	47,600	59,800	63,400[1]
Salisbury Highway north of Port Wakefield Rd	33,800	49,500	38,100
Waterloo Corner Road east of Heaslip Road	7,500	13,200	11,300[1]
Bolivar Road north of Port Wakefield Road	17,700	22,400	16,000[1]
Martins Road north of Port Wakefield Road	8,300	9,500	14,000[1]

Note: 2016 daily draffic.

MASTEM was been used to obtain peak hour turning movement volumes at the intersections along Northern Expressway requiring analysis. These volumes have not been determined for the other major arterial roads that do not connect to the Expressway, as these are not subject to design analysis. Two-way peak hour volumes for the Northern Expressway alignment and Port Wakefield Road:

- range from 700 vph on Angle Vale Road to 1,300 vph on Heaslip Road south of Womma Road with typical peak direction flows at 60–70% of the two-way flow
- for Main North Road, start at 2,700 vph at Tiver Road and increase to 3,700 vph at Womma Road, with maximum one-way peak hour flows of up to 2,000 vph
- along Port Wakefield Road range from 2,400 vph at Waterloo Corner Road to 4,770 vph at Salisbury Highway.

3.3 Effects of base case traffic

The predicted level of service (LOS) for the various roads has been estimated for future traffic volumes on the existing road network using the same methodology as for the existing traffic volumes.

Overall without the Expressway, the LOS is expected to decrease significantly on Heaslip Road and Main North Road as indicated below:

- Main North Road north of Munno Para – LOS D to E
- Angle Vale Road – LOS D to E
- Heaslip Road south of Angle Vale township – LOS D to E
- Heaslip Road north of Waterloo Corner Road – LOS F
- Port Wakefield Road north of Waterloo Corner Road – LOS A
- Port Wakefield Road north of Salisbury Highway – LOS C.

Travel speeds have been used to determine the LOS on the followings sections of Main North Road during peak times:

- through Munno Para and Elizabeth – LOS E to F
- through Salisbury – LOS F.

The maximum LOS for the signalised intersections along Main North Road and Port Wakefield Road are expected to decrease to E and F.

Without the Northern Expressway, the decrease in operating conditions is expected to result in:

- significant delays at the major intersections on Main North Road, Heaslip Road and Port Wakefield Road
- reduced travel times and speeds on the midblock sections of these roads – particularly important for commercial vehicle traffic which is time sensitive
- minor incidents such as a breakdown or crash generating significant queues and delays to traffic
- increased crash rates as traffic levels increase and an increase in crashes at access points caused by vehicles trying to access arterial roads without sufficient gaps in the traffic
- increased use of local roads (rat running) to bypass the poor operating conditions on the major arterial roads – expected primarily on the north–south roads (Andrews and Stebonheath roads) as well as on east–west roads such as Curtis and Petherton roads. This would reduce pedestrian access, increase noise and reduce air quality as well as increase crashes, primarily at intersections.

4 Project description

4.1 General description

The Northern Expressway will begin at the Gawler Bypass, just to the south of the Redbanks Road interchange. It continues in a south-westerly direction passing through parts of Buchfelde, Angle Vale, Andrews Farm, Macdonald Park and Virginia areas before linking with the existing Port Wakefield Road, 650 m north of Taylors Road.

Port Wakefield Road forms the southern section of the proposed Northern Expressway Project making its way further south through to Salisbury Highway and the new Port River Expressway. This road will need to be upgraded as a result of the Northern Expressway between the connection north of Taylors Road and the Salisbury Highway intersection.

Key features of the proposed Northern Expressway and Port Wakefield Road Upgrade project are as follows:

- The project provides for approximately 23 km of uninterrupted traffic flow from the Gawler Bypass through to Port Wakefield Road, just north of Taylors Road.
- The Northern Expressway is to comprise two lanes in each direction separated by a wide median with wide kerb side shoulders for safety and as an emergency breakdown area.
- Grade-separated interchanges along the Northern Expressway are located at the Gawler Bypass, Curtis Road and Heaslip–Womma roads; the Port Wakefield Road junction will have traffic signals.
- Overpasses are located at Two Wells Road and Angle Vale Road.
- A bridge on the Northern Expressway at Taylors Road will allow for crossing of the main Adelaide–Darwin rail line and Taylors Road.
- The upgrading of Port Wakefield Road extends for some 12 km south of Taylors Road with widening of the roadway and additional lanes at selected signalised intersections. Traffic signals will be included and/or updated for major roads intersecting with Port Wakefield Road which include the Waterloo Corner Road, Bolivar Road, Ryans Road and Martins Road.

Figures 4.1 to 4.7 provide a schematic of the proposed project.

4.2 Interchange/intersection options

The location of interchanges along the Northern Expressway alignment has been assessed and initially three interchanges have been proposed at Gawler Bypass, Curtis Road and at Heaslip–Womma roads. Concepts for interchanges have also been developed for both the Angle Vale Road and Two Wells Road overpasses to allow land to be acquired should they be required in the future.

Each of the interchanges, including junction treatments, is described below and reasons for inclusion or exclusion are given as required.

Gawler Bypass – Northern Expressway

Given the need to maintain free flow, grade-separated movements for both the Northern Expressway and the Gawler Bypass, the proposed interchange cannot be conveniently staged. Its layout is shown in Figure 4.8.

The features of this scheme are:

- a high-speed system interchange with the Gawler Bypass
- two new bridges — one on the realigned Gawler Bypass to pass over the Northern Expressway and one to replace an existing bridge on the southbound carriageway over the rail line
- widening of the bridge over the rail line on the northbound carriageway
- the existing on-ramp from Weyland Road is retained and continues as the third lane to the interchange
- the existing off-ramp to Redbanks Road and Mallala Road is retained although it does not meet current design standards and will require upgrading in the future
- the Two Wells Road on/off ramp is retained to the Gawler Bypass. A proposed minor alignment change will provide a service road for access to properties located on the east side of the on-ramp.

There are no alternatives to this arrangement as the critical consideration is to ensure free flow conditions for movement from Gawler Bypass north to the Northern Expressway (and vice versa)

Two Wells Road – Northern Expressway

Only south facing ramps are warranted at this location at some time in the future, refer Figure 4.9. They would facilitate entry to the Gawler township from the west and reduce the demand to access the Expressway at the Redbanks Road interchange with the Gawler Bypass further to the north.

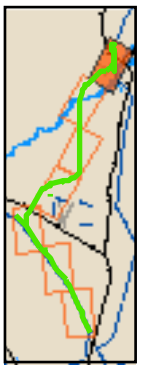
A full diamond interchange is arguably not warranted at Two Wells Road because drivers from the north who choose to enter Gawler are more likely to do so using the existing Main North Road/Gawler Bypass interchange. They may also enter Gawler from the Gawler Bypass using the existing off-ramp to Mallala and Redbanks Road. In addition, minimal demand is expected from the west and these drivers can travel to the Two Wells Road interchange on the Gawler Bypass to access the Northern Expressway.

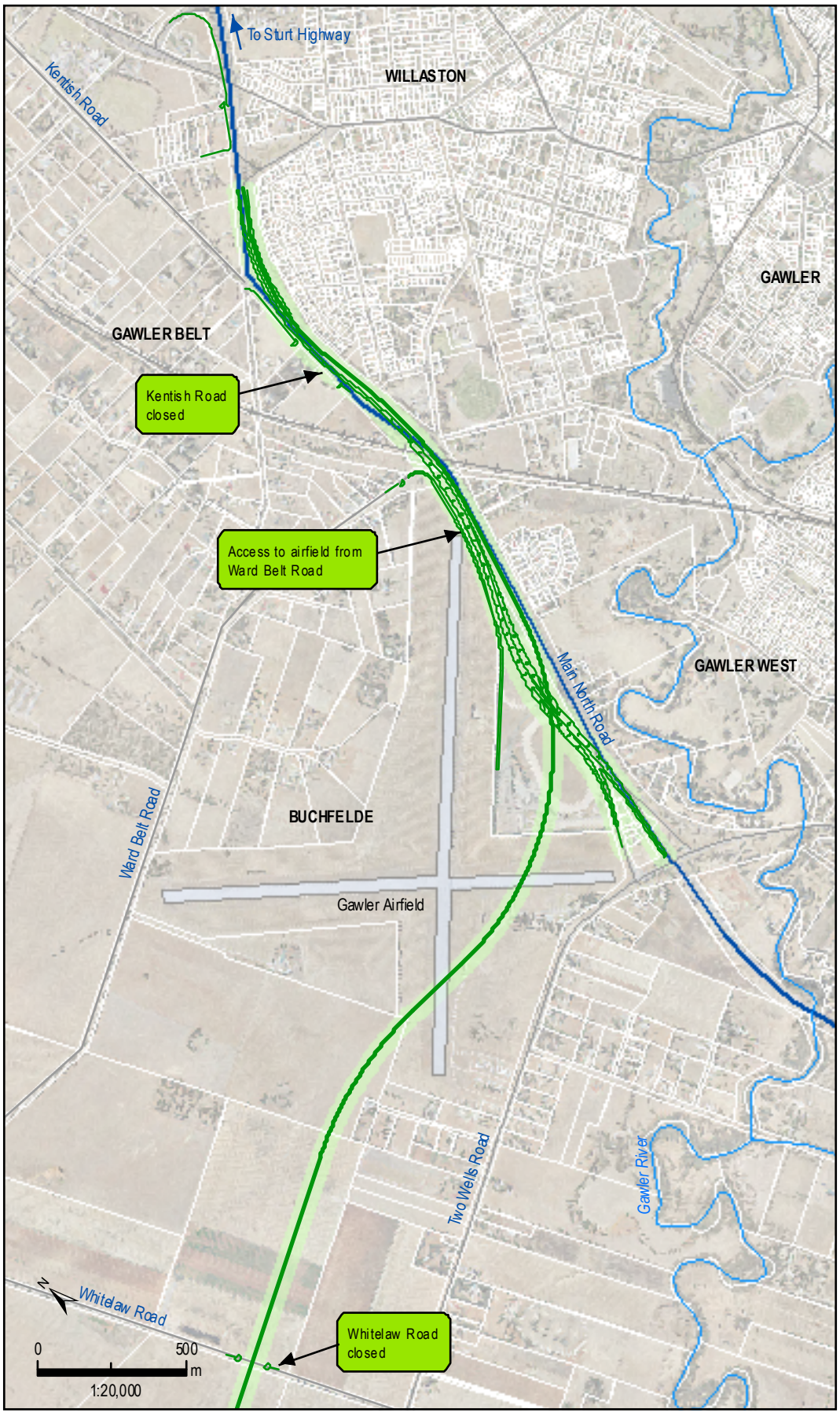
Traffic modelling for this location indicates that in 2011 the volumes on each of the ramps would be in the order of 1,000 vpd but with increased development are expected to increase to 3,000 vpd in 2026. Hence an initial demand is not expected for the ramps and they are not provided in the initial scheme.

The ramp arrangement allows for Wingate Road to be realigned on the eastern side of the Expressway to maintain its connection to Two Wells Road which is deviated as part of this project. Roundabouts are preferred for the ramp connections as they provide a better traffic solution and slow vehicles.

Angle Vale Road – Northern Expressway

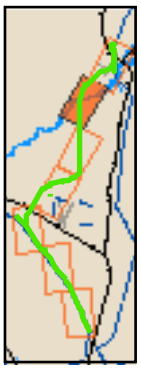
Angle Vale Road provides the main community link between the growing population centre of Angle Vale and the regional centre at Gawler. In addition there are large horticultural business located in the area. Consequently, there is a need to provide an interchange at this location.





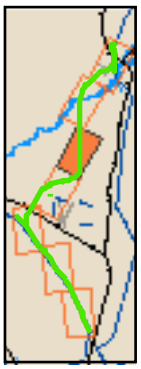
Corridor
Roadway
Road closure

Figure 4.1 **Detailed alignment plan 1 of 7**



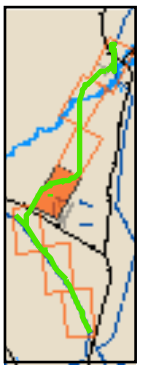
Corridor
Roadway
Road closure
New basin / wetland

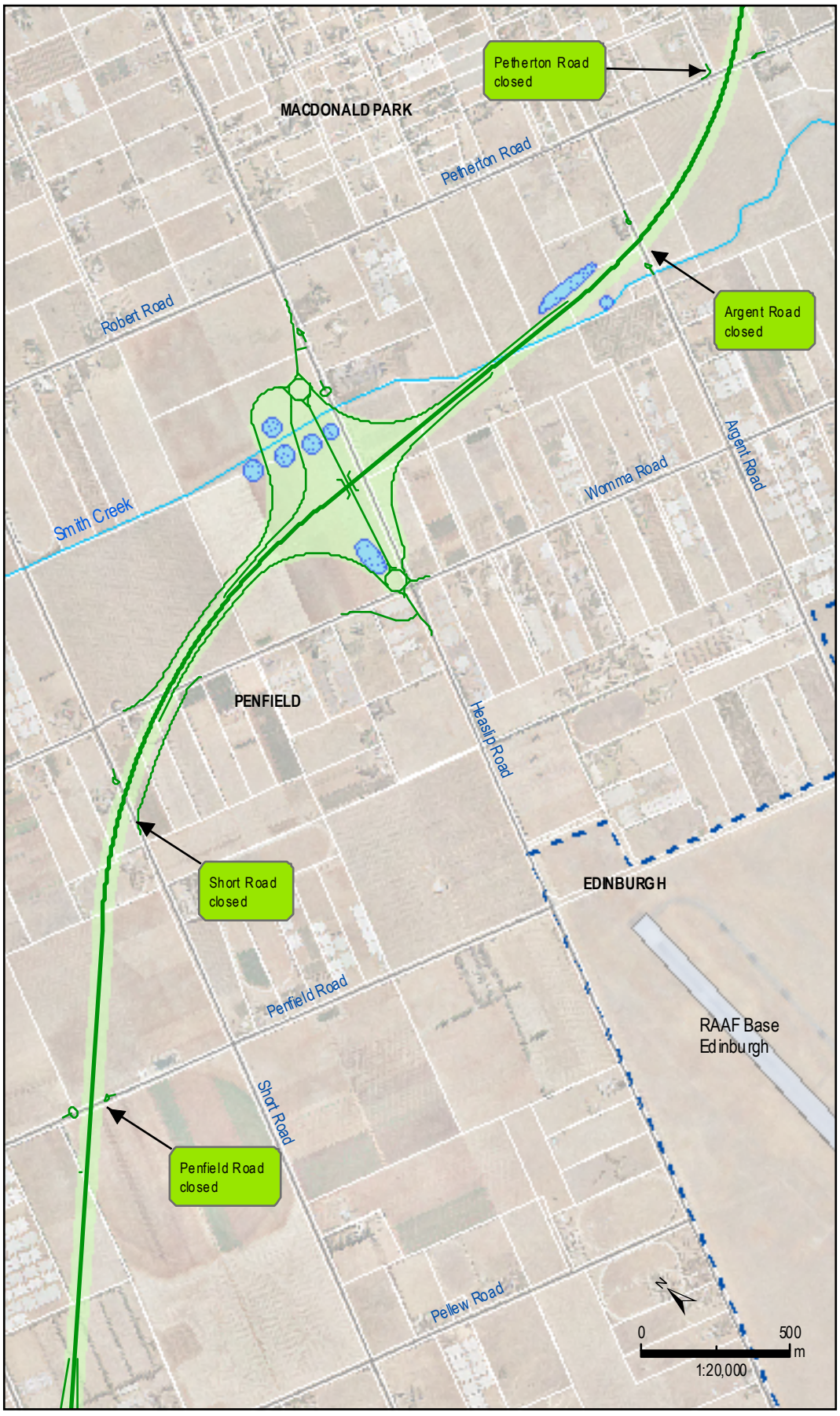
Figure 4.2 **Detailed alignment plan 2 of 7**



Corridor
Roadway
Road closure
New basin / wetland

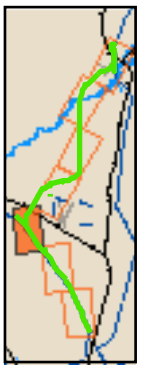
Figure 4.3 **Detailed alignment plan 3 of 7**

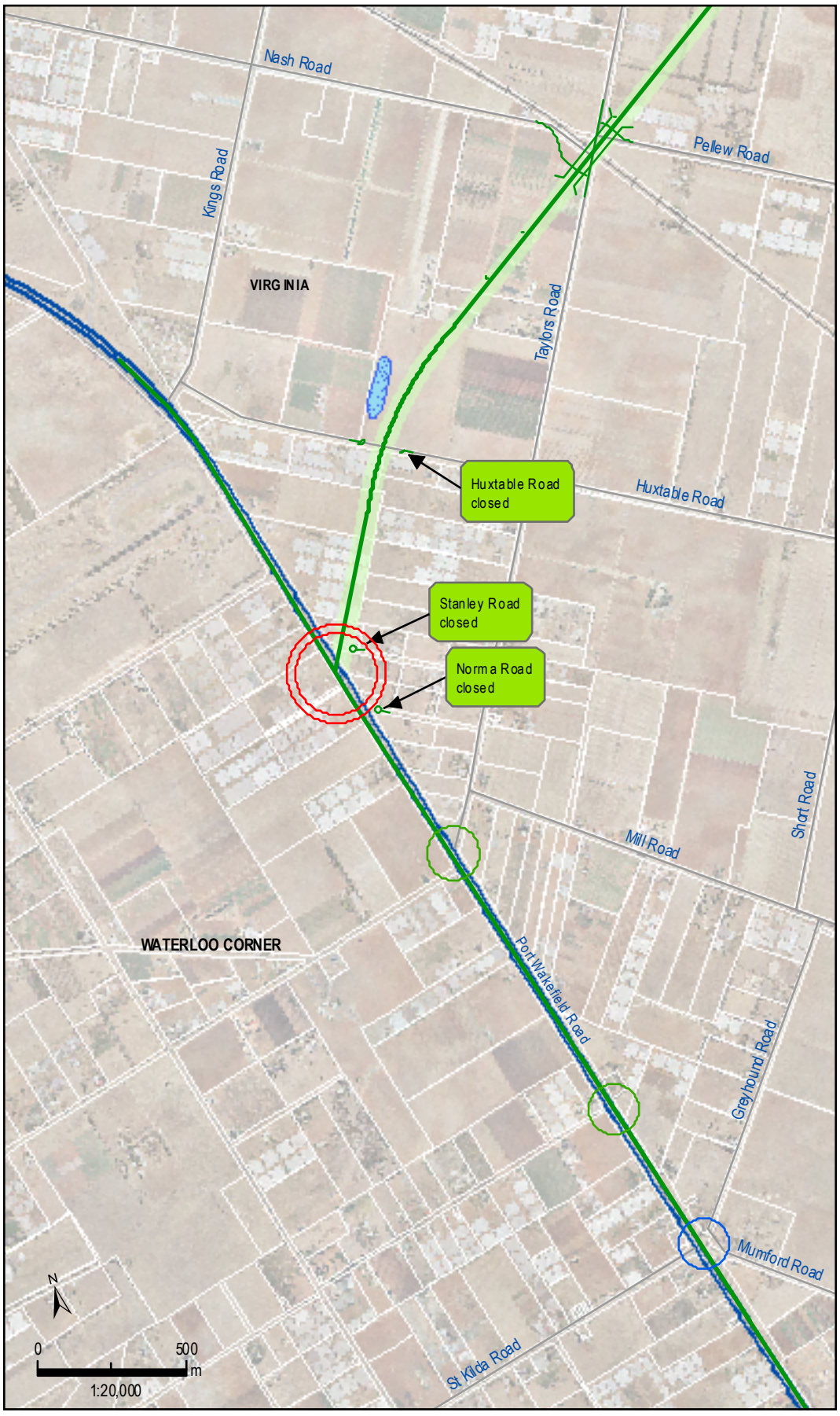




Corridor
Roadway
Road closure
New basin / wetland

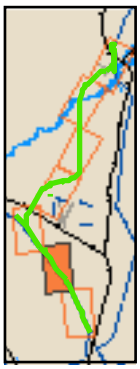
Figure 4.4 **Detailed alignment plan 4 of 7**





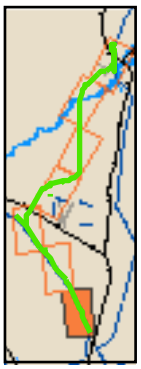
Corridor
Roadway
New basin / wetland
Upgraded traffic signals
New traffic signals
Left turns in and out only (no right turns)
No change in access
Road closure

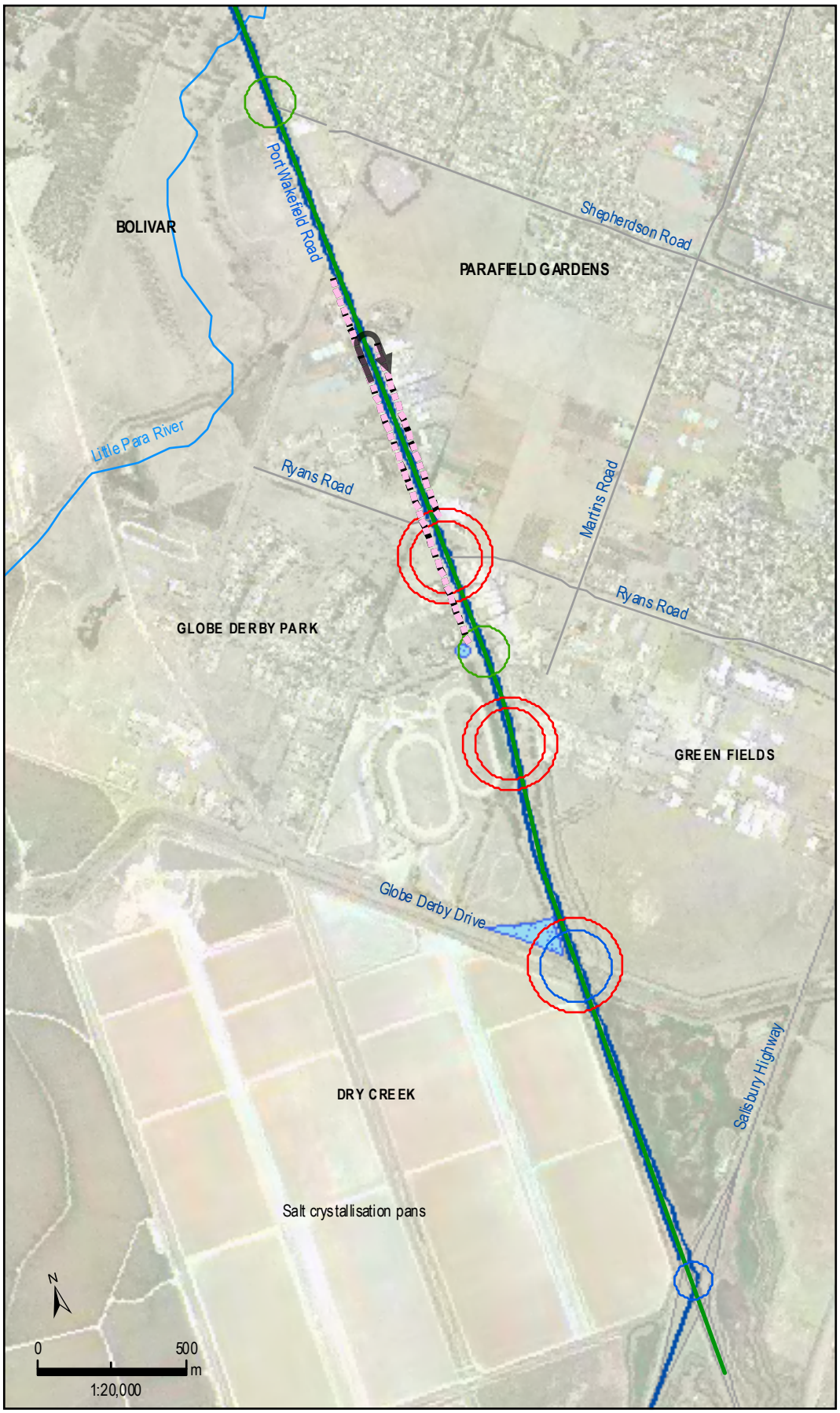
Figure 4.5 **Detailed alignment plan 5 of 7**



Corridor
Roadway
New basin / wetland
Upgraded traffic signals
New traffic signals
Left turns in and out only (no right turns)
No change in access
U Turns permitted

Figure 4.6 **Detailed alignment plan 6 of 7**





Corridor
Roadway
New basin / wetland
Upgraded traffic signals
New traffic signals
Left turns in and out only (no right turns)
No change in access
U Turns permitted
Changed access via modified service road

Figure 4.7 **Detailed alignment plan 7 of 7**

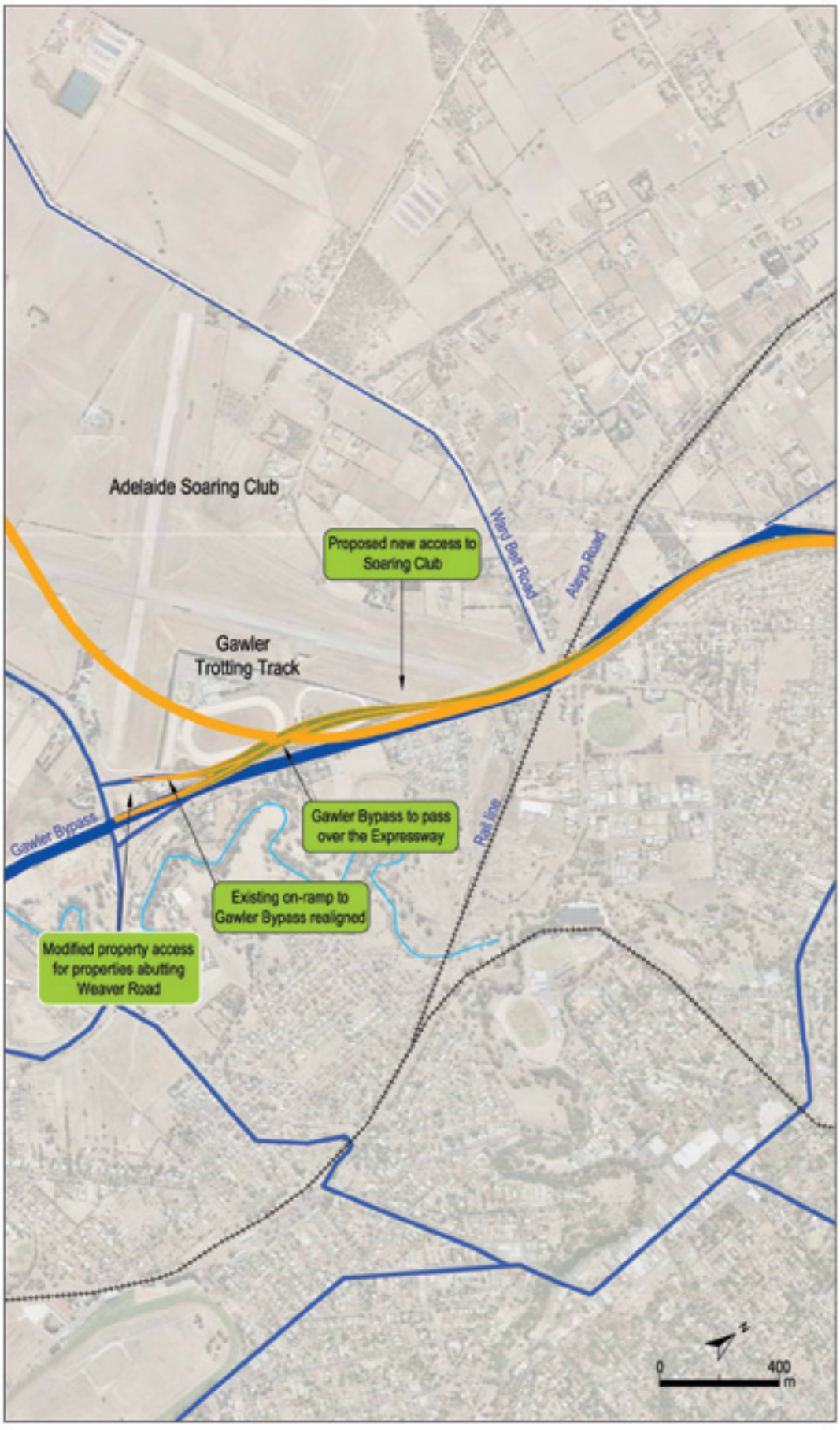


Figure 4.8 **Gawler Bypass proposed interchange**

Options included a full or partial interchange to be constructed now or at some stage in the future. The traffic modelling indicates little demand for the ramps in 2011 (less than 500 vpd for each ramp). However, proposed residential developments surrounding Evanston Gardens and Playford North will increase demands in both directions at this location significantly. In addition ramps at this location will reduce the amount of traffic using local roads such as Stebonheath and Andrews roads to access the Curtis Road interchange.

On this basis a full interchange is required ultimately to cater for future demands and reduce adverse effects on the surrounding local road network. However in the interim at 2011 there is little demand and consequently the ramps are not shown in the current proposal.

The preferred interchange scheme (Figure 4.10) has least effect on abutting residents. Angle Vale Road is deviated as part of the project roundabouts for the ramp connections are preferred as they provide a better traffic solution and slow vehicles.

Initial indications from the community consultation have suggested that as a minimum north facing ramps are required at this interchange which then the Northern Expressway is constructed.

Curtis Road–Northern Expressway

This interchange would allow access from Angle Vale and Munno Para West to the Northern Expressway with south facing ramps. North facing ramps are not required initially as traffic modelling indicates very little demand particularly with provision of a full interchange at Angle Vale Road. They are shown to determine their viability and geometric compliance should they be required at some future time.

Three arrangements have been developed for this interchange with the treatment shown in Figure 4.11 preferred to other interchange types (full diamond or parclo) because property acquisition is minimised and confined to one land owner. Also, north facing ramps can be accommodated in the initial layout without further acquisition.

The features of this scheme include:

- Curtis Road realigned to the south of the existing road reserve to minimise relocation of major services
- the south facing on-ramp as a simple channelised T-junction to connect to Curtis Road, which is adequate for the predicted turning volumes at this location and the one-way nature of the on-ramp
- the south facing off-ramp terminating with a roundabout because of the predominant right-turn movement expected from the ramp to Curtis Road south.

The traffic modelling indicates that to cater for the proposed demands in 2031 a two-lane roundabout will be required. However, initially a single-lane roundabout would be sufficient for the expected turning movements.

Figure 4.9 **Two Wells Road overpass**

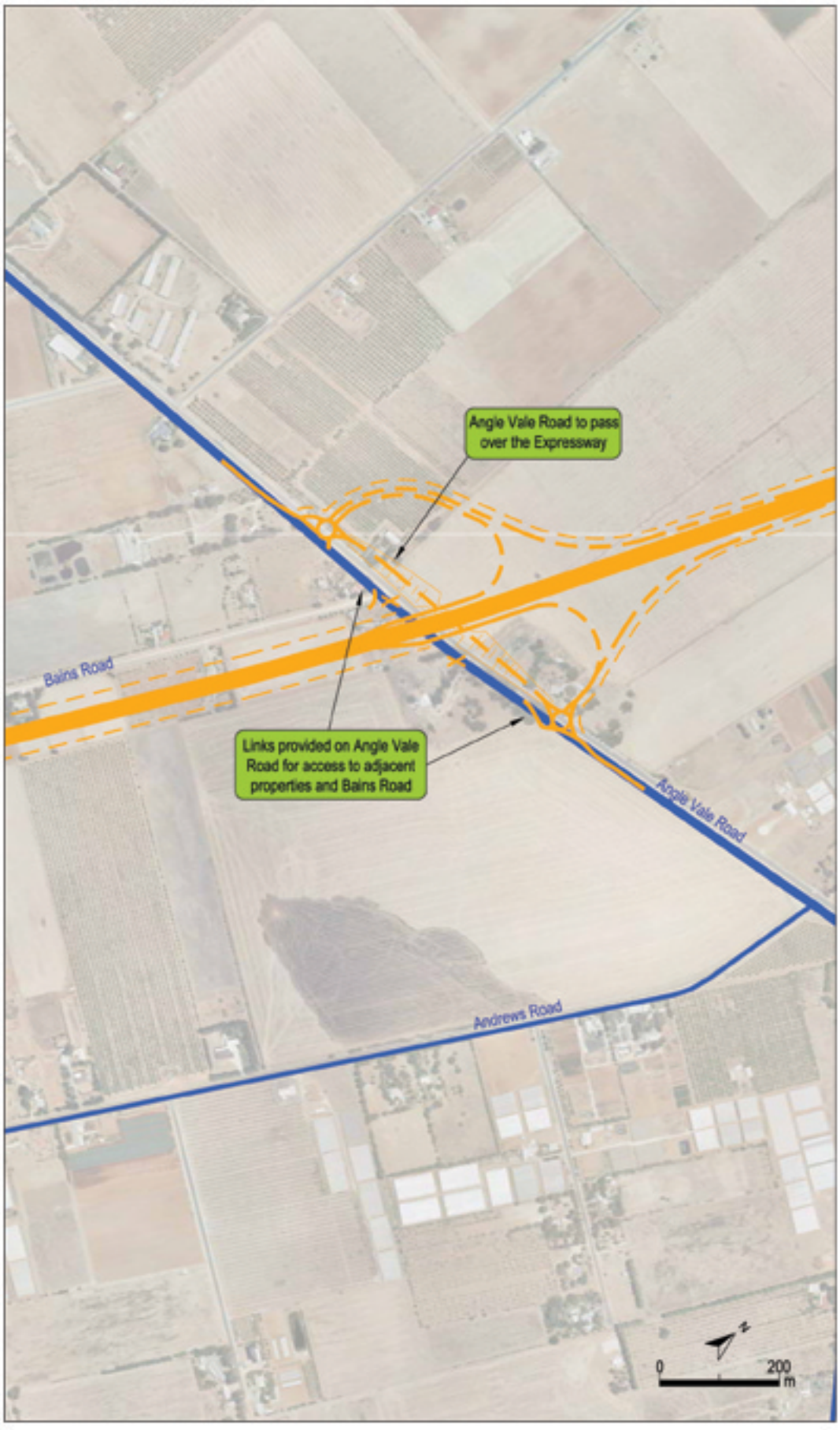


Figure 4.10 **Angle Vale Road interchange half Parclo A-B/diamond option**

Heaslip Road–Womma Road–Northern Expressway

The Northern Expressway route crosses Womma Road and Heaslip Road within approximately 900 m. In deciding which of the two roads would form the direct connections at the interchange, the following factors were taken into account:

- Heaslip Road is designated as an over-dimension vehicle route
- Heaslip Road carries the greater volume of traffic
- both Heaslip and Womma roads provide practical connections to Edinburgh Parks, GM Holden precinct and Salisbury Centre
- Womma Road connects directly to Main North Road, the Elizabeth Regional Centre and provides good accessibility for industry and the community.

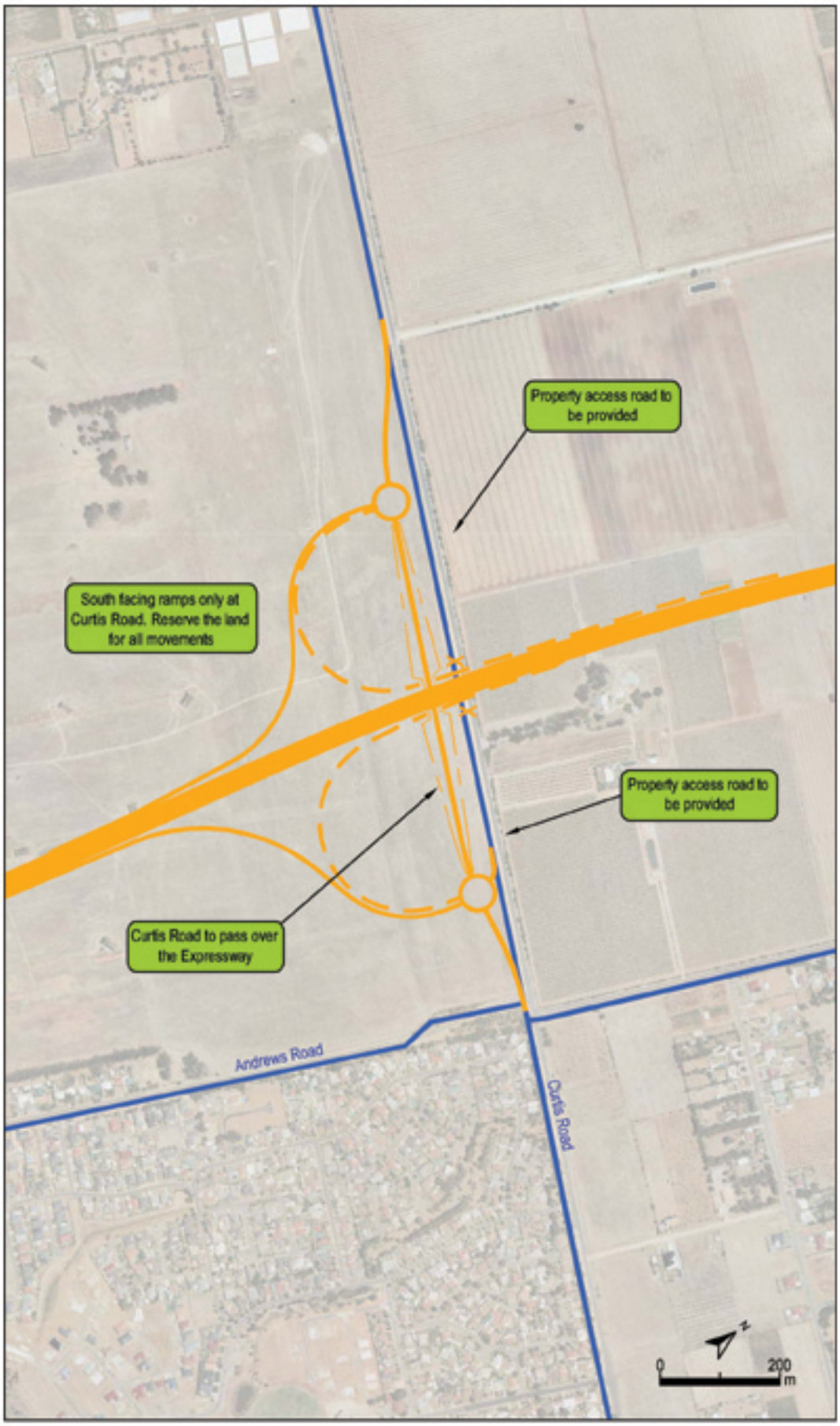
The preferred option is for Heaslip Road to be continuous and for Womma Road to deviate around the Expressway based on the first two factors.

The interchange option (Figure 4.4) is the simplest of all the arrangements considered for an interchange with either Heaslip Road or Womma Road and has a relatively smaller footprint than other schemes.

The features of this scheme include:

- Heaslip Road overpassing the Expressway
- a full diamond interchange with roundabouts controlling the movements between the Expressway ramps and both Heaslip and Womma roads
- Heaslip Road realigned west of its existing alignment (onto undeveloped land) to minimise service relocations
- a scheme satisfying the requirements of the Civil Aviation Safety Authority and the Department of Defence in relation to approach obstacle limitation surfaces and the proposed runway extension
- a scheme allowing for simpler upgrading of the ramps in the future depending on traffic demands.

The traffic modelling indicates that to cater for the proposed demands in 2011 and 2031, two-lane roundabouts will be required at both locations. However, initially a single lane roundabout would be sufficient for the expected turning movements, but may require later signalisation of approaches similar to that provided at the Blythewood roundabout.



Proposed route (Taylors Road option)
Ramp
Possible Ramp
Route boundary
Road closure
Rail line crossing

Figure 4.11 **Curtis Road proposed interchange**

4.3 Port Wakefield Road Upgrade

Figures 4.5, 4.6 and 4.7 show broadly the Port Wakefield Road Upgrade scheme.

From north to south, the Port Wakefield Road Upgrade scheme is characterised by:

- a new signalised junction where the Northern Expressway meets Port Wakefield Road from the north-east, with two lanes provided for all the movements. Also provided will be warning signage to advise motorists of the need to reduce speed to negotiate the reduced radius turn between the Northern Expressway and Port Wakefield Road, and of the traffic signals ahead
- an upgrade of the existing signalised junction with Waterloo Corner Road to provide two right-turn lanes from Waterloo Corner Road onto Port Wakefield Road, northbound through movement on Port Wakefield Road will be stopped to allow for the right turns from Waterloo Corner Road and possible pedestrian movements
- an upgrade of the existing signalised junction with Bolivar Road to provide two right-turn lanes from Bolivar Road, extended to increase queue storage along Bolivar Road to Kings Road, and third southbound through lane on Port Wakefield Road
- installation of a new signalised junction at Ryans Road providing two right-turn lanes on Ryans Road and three through lanes on Port Wakefield Road in both directions, and allowing all movements except right turn into Ryans Road east
- the three southbound through lanes from Ryans Road to the intersection with Salisbury Highway
- installation of a new signalised junction at Martins Road allowing all movements except right turn out from Martins Road
- modification of the Globe Derby Drive junction to provide three through lanes in each direction
- modification of Salisbury Highway–Port Wakefield Road interchange westbound on ramp to increase traffic capacity.

The increase in traffic volumes on Port Wakefield Road will require changes to access for the intersecting local roads. This will require some roads to be closed or restrictions in access to ensure adequate safety for all road users. Further modifications to the road include the provision of deceleration and acceleration lanes where appropriate. The changes to local road access are detailed below.

Taylors Road

Right-turn movements into Taylors Road will be provided for northbound traffic on Port Wakefield Road; however, right-turn out from Taylors Road to Port Wakefield Road will be removed. Left-turn in and left-turn out movements will be retained.

Symes Road, Anjanto Road and Burton Road

Right-turn movements will be banned but left-turn in and out access will be provided.

St Kilda Road and Hodgsons Road

Full movements will be retained at St Kilda Road and Hodgsons Road.

Undo Road

The median opening at Undo Road will be modified to provide a northern U-turn facility only, south of Undo Road. This will include additional deceleration lane length and sealing on the outer shoulder of the northbound carriageway adjacent to the U-turn facility that will connect through to a deceleration lane provided for Undo Road.

Deuter Road–Summer Road–Jobson Road

The median opening at Deuter Road–Summer Road–Jobson Road will be closed with left-in/left-out movements provided only.

A new southern U-turn facility will be provided north of Deuter Road including deceleration lane northbound and outside shoulder widening on the southbound carriageway adjacent to the U-turn facility.

Additionally a new northern U-turn facility will be provided south of Deuter Road, including deceleration lane southbound and outside shoulder widening on the northbound carriageway adjacent to the U-turn facility.

Victoria Drive

Right turn access between Port Wakefield Road and Victoria Drive will be removed. Left in/left out turns will be provided and the area could be accessed via right turn movements at Martins Road to the south or Bolivar Road to the north.

Daniel Avenue

Right turn access between Port Wakefield Road and Daniel Avenue will be removed. Left in/left out will be provided and the Globe Derby Park area from the north can be accessed via Globe Derby Drive.

Service roads (on Port Wakefield Road)

The existing unsealed service road that connects Daniel Avenue to Whites Road on the western side of Port Wakefield Road will be formalised to remove direct access to Port Wakefield Road. This will include access at the southern end via Daniel Avenue, and access at the northern end via a right turn-in only access near Whites Road west. At the northern end of the service road a left turn-out acceleration lane will be provided. The junction with Ryans Road west will also be formalised.

The median opening located at the northern end of the service road on the eastern side of Port Wakefield Road near Whites Road will be retained, but modified to allow right turn in movements from Port Wakefield Road and U-turns (i.e. for vehicles wanting to change from northbound to southbound). The deceleration lane length will be extended, as will a section of sealed shoulder, southbound on the departure from the U-turn facility. The service road will also be modified to one-way operation from north to south, with over-dimension vehicles serving Selecta Homes being able to make right turns onto Port Wakefield Road under police escort.

5 Effects of the project on the existing environment

The Northern Expressway alignment and associated Port Wakefield Road Upgrade will have an effect on regional and local traffic movements within the study area. The Expressway will sever a number of roads and traffic will be redirected onto local roads. This section describes these effects and also provides a brief description of the operation of the road network.

5.1 Road network

5.1.1 Arterial network

Provision of the Northern Expressway is unlikely to affect the connectivity or operations of the arterial road network adversely, but several local roads will be closed. The main effects are to the west of Heaslip Road, where the Expressway severs Penfield Road, which is the current arterial road connecting Virginia with Munno Para/Elizabeth. It is proposed that Womma Road be realigned to form a new connection to Heaslip Road to maintain connectivity to existing communities.

There is expected to be a change in the road hierarchy and function between Penfield Road and Womma Road to the west of Heaslip Road. In particular Womma Road would become the arterial road and Penfield Road would revert to a local road under the care and control of the City of Playford.

The Expressway crosses Angle Vale and Two Wells roads where overpasses will be provided to maintain existing connections.

Traffic modelling has indicated that traffic volumes are expected to increase significantly on Redbanks Road in Gawler (maximum increase of 6,000 vpd in 2011) and Womma Road (maximum increase of 4,000 in 2011) as a result of the Expressway. This could have an effect on the operation of these roads in particular access to abutting properties and safety at junctions. Further investigations are required to determine appropriate treatments if conditions warrant.

Along Port Wakefield Road, the increase in traffic volumes will have an effect on the operation of the existing road layout. Consequently the intersections with the arterial roads at Waterloo Corner, Bolivar, Ryans and Martins roads have been modified (refer Section 4.3) to cater for the predicted increase in traffic volumes.

5.1.2 Local network

The local road network will be effected upon by the Northern Expressway. Some roads will be closed and others will be realigned as they are important connections in the road network. In addition some roads may require upgrading to cater for increases in traffic due to redirected traffic.

An assessment of local road effects has included an assessment of alternative routes if a road is to be closed. Table 5.1 provides a summary of the local roads that are affected by the Expressway. These are shown on the fold-out plan in the Environmental Report and its separate Executive Summary.

The assessment criteria include:

- note existing condition of roads
- identify roads to be closed
- identify which roads are likely to carry higher traffic volumes due to parallel roads being terminated by the proposed Expressway and determine if any upgrading is required due to increased traffic volumes
- identify any requirements to divert or realign existing roads or to create new roads to maintain connectivity within the local network.

Table 5.1 Summary of local roadworks — Northern Expressway

Name of road	Existing condition	Proposed treatment		Description of alternative route (if applicable)
		To be closed (culs-de-sac)	To be upgraded or new roadworks	
Ward Belt Road access to glider field	Unsealed		✓	Minor upgrading to provide access to new glider club hangers and buildings
Kentish Road Service Road	Unsealed		✓	Slight realignment but remains unsealed
Whitelaw Road	Unsealed	✓		Via Ward Belt Road and Wingate Road
Wingate Road	Sealed		✓	Road realigned — access retained
Hillier Road	Sealed	✓		Use Wingate Road, Angle Vale Road and Riverbanks Road
Fradd Road	Sealed	✓		Use Frisby Road or Heaslip Road to access Curtis Road
Frisby Road	Unsealed		✓	
Petherton Road	Sealed	✓		Use Womma Road or Curtis Road for east–west travel
Argent Road	Unsealed	✓		Via Womma Road, Heaslip Road and Petherton Road
Womma Road	Sealed		✓	
Penfield Road	Sealed	✓		Via Pellew Road, Womma Road, Taylors Road or Heaslip Road
Short Road–Penfield to Womma Road	Sealed	✓		Via Taylors Road, Womma Road or Heaslip Road
Nash Road	Unsealed		✓	Upgrade to seal for B-double access onto Port Wakefield Road
Huxtable Road	Unsealed	✓		Via Taylors Road, Pellew Road and Nash Road to Port Wakefield Road
Stanley Road	Unsealed	✓		Via Taylors Road or Huxtable Road to Heaslip Road
Norma Road	Unsealed	✓		Via Taylors Road or Huxtable Road to Heaslip Road
Mill Road	Unsealed	✓		

The traffic volumes affected in most diversions is fewer than 1,000 vpd, hence the effect is not expected to be significant on these rural roads. However, for Petherton Road the existing traffic volume is in the order of 3,000 vpd. Traffic counts indicate the majority of traffic is turning right from Heaslip Road and could use either Womma or Curtis roads to travel east. Both these roads should be able to cater for the diverted traffic with no significant effect.

For Port Wakefield Road, the restrictions in access will result in traffic diversions on both sides of the road. The regularly spaced U-turn facilities should reduce the amount of traffic diverting to other local roads. There will be some diversions but given the majority of the roads have daily traffic volumes of less than 500 vpd the impact is expected to be minor and additional roadworks to cater for these diversions are not expected.

Access and junction changes are proposed for the following locations:

- Taylors Road — no right turn onto Port Wakefield Road, alternative via King Road
- Symes Road — left in and left out only, alternative access to Port Wakefield Road via Brown or St Kilda roads
- Anjanto Road — left in and left out only, alternative access to Port Wakefield Road via Brown or St Kilda roads
- Greyhound Road–Mumford Road — left in and left out only, alternative right-turn access via Heaslip Road
- Undo Road — left in and left out only, alternative access to Port Wakefield Road via Brown or St Kilda roads
- Burton Road — left in and left out only, alternative access via Angle Vale Crescent to Waterloo Corner Road
- Deuter Road–Summer Road–Jobson Road — left in and left out only, separate U-turn facilities to be provided to assist with access
- Victoria Drive — left in and left out only, alternative access to Port Wakefield Road via Martins or Bolivar roads; separate U-turn facilities to assist with access
- Ryans Road (west) — closed to Port Wakefield Road, alternative access via Globe Derby Drive or Daniel Avenue
- Ryans Road (east) — no right turn in, alternative access via Martins Road
- service roads on both sides of Port Wakefield Road between Ryans Road and Whites Road (unmade reserve) to have some restrictions in access
- Martins Road — a new signalised junction provided but no right-turn out, alternative access provided at Ryans Road
- Daniel Avenue — left in and left out only, alternative access via Globe Derby Drive.

5.2 Traffic data

Forecast future traffic data for the Expressway route have been provided by DTEI from their MASTEM strategic transport model of greater Adelaide. The model includes programmed road and public transport improvements on Adelaide's transport network. The model demographic scenario is based on SA Planning's '2 million in 2050' planning case, interpolated to 2011, 2016 and 2026 for this

assessment. The daily traffic volume on the various sections of the Expressway are summarised below for the years 2011 and 2026.

For Port Wakefield Road, traffic volumes for 2011 and 2016 only are presented. Beyond 2016, the link between the Northern Expressway and Salisbury Highway will be the subject of a further planning study. The traffic forecasts are as follows:

- 2011: daily traffic volumes of 17,000 vpd west of the Gawler Bypass increasing to 18,100 vpd south of Curtis Road
- 2026: daily traffic volumes of 26,900 vpd west of the Gawler Bypass and increasing to 25,300 vpd south of Curtis Road, and increasing again to 40,000 vpd south of Womma Road to Port Wakefield Road
- For Port Wakefield Road traffic volumes in 2011 increase to 32,700 vpd south of Taylors Road and to 61,100 vpd north of Salisbury Highway.

The traffic modelling has indicated that the maximum one-way peak hour flows along the Northern Expressway in the year 2011 are expected to range between 1050 vph east of the Gawler Bypass and 1250 vph north of Port Wakefield Road. For 2031, the maximum peak hour volumes would increase to 1410 vph east of the Gawler Bypass and 1600 vph north of Port Wakefield Road.

Traffic composition on the arterial network is expected to change with the construction of the Northern Expressway. It is expected that most of the heavy commercial traffic (semi-trailers and B-doubles) and the majority of the light commercial traffic (rigid trucks) on Heaslip Road will divert to the Northern Expressway. There will also be a lesser diversion of commercial traffic (heavy and light) from Main North Road because some commercial and industrial land uses can better be accessed from Main North Road in the Parafield, Salisbury and Elizabeth areas.

The overall commercial vehicle content (percentage of total traffic) on the Port Wakefield Road Upgrade is not expected to change significantly with the construction of the Northern Expressway as its commercial vehicle content will be similar to the existing Port Wakefield Road. No significant change in the proportion of heavy to light vehicles is expected because the majority of heavy traffic on Heaslip Road already uses Port Wakefield Road south of Waterloo Corner Road.

It is expected that the proportion of commercial vehicles on the Northern Expressway and Port Wakefield Road Upgrade will be in the range of 0—15% of total traffic.

5.3 Traffic operation

The assessment of the traffic operation for the Northern Expressway Project has required an assessment of:

- level of service for the midblock sections and ramps on Northern Expressway and midblock sections of Port Wakefield Road
- intersection assessment of the proposed junction treatments
- microsimulation modelling of the Port Wakefield Road Upgrade
- assessment of road safety for the project.

Each of these is described separately in the following sections.

5.3.1 Level of service

The LOS of the various components of the Northern Expressway has been estimated using the Austroads methodology (described earlier) for rural arterials and the Highway Capacity Manual (Transport Research Board 2000) for the Expressway and on/off ramps. The peak hour volumes used for this assessment were provided by DTEI for the years 2011, 2016, 2021 and 2031 for both the morning and evening peak periods. The year 2026 peak hour volumes were unavailable at the time of this assessment.

Northern Expressway — midblock sections

The midblock sections on the Expressway are expected to operate at LOS A or B conditions in 2011 and reduce to LOS D in 2031.

Northern Expressway — interchanges

The LOS assessment indicates that:

- at the Gawler Bypass interchange the merge and diverge ramps will operate at LOS C conditions for the periods 2011 and 2031
- at the Curtis Road interchange the merge and diverge ramps will operate at LOS B for both the 2011 and 2031 periods
- at the Heaslip–Womma Road interchange the merge ramps will operate at LOS B and LOS C conditions for the periods 2011 and 2031 respectively. The diverge ramps will operate at LOS B for the periods 2021 and 2031, but the northbound ramp will operate at LOS C in 2031 for the afternoon and evening period only.

Port Wakefield Road — midblock sections

The midblock sections on Port Wakefield Road are expected to operate at LOS D/E conditions on the two-lane sections in 2011 and C/D for the section south of Martins Road. It is expected that this would increase to LOS E/F beyond 2016 for the two-lane sections and E for the three-lane section.

Other roads

The Northern Expressway should result in improvements in operating conditions on Heaslip Road/ Angle Vale Road in particular with the level of service likely to improve to LOS B/C in 2011. There should also be an improvement on Main North Road but the expected significant growth in traffic on this road due to ongoing residential development, would see level of service in future years matching current conditions.

5.3.2 Intersection operation

The operation of the intersections has been assessed using the aaSIDRA computer package for both the Expressway ramps and the upgrades for the intersections on Port Wakefield Road. The turning volumes used for this assessment were provided by DTEI for the years 2011, 2016, 2021 and 2031 for both the morning and evening peak periods. The year 2026 volumes were unavailable at the time of this assessment.

The standard defaults for the software have been used except on Port Wakefield Road south of Bolivar Road where it has been assumed there is good coordination of the proposed traffic signals.

The assessment has been undertaken using 2011 and 2031 volumes for the Northern Expressway junctions for the on and off ramps. The results of the assessment indicate that the proposed schemes will operate satisfactorily in both peak periods (morning and evening) with minimal queues and delays in 2011 and in 2031.

For Port Wakefield Road the proposed scheme has been assessed using the 2011 and 2016 traffic volumes in both periods. The results of this assessment indicate that the proposed junction treatments will operate satisfactorily for the 2011 volumes. However in both peak periods the Salisbury Highway–Port Wakefield Road south junction is operating near capacity (i.e. LOS E). In 2016 the junctions from Martins Road to Salisbury Highway are operating close to capacity, with the Salisbury Highway south junction marginally exceeding capacity in the evening peak (LOS = F).

The above analysis and together with the AIMSUN modelling described below indicates that the interim upgrade of Port Wakefield Road should cater for the expected traffic volumes until completion of the further road facility in 2016. However, Port Wakefield Road will be close to the limits of capacity and with minor incidents or accidents traffic operation is expected to break down and have significant queues and delays. To alleviate this, a range of Intelligent Transport Systems (ITS) initiatives are proposed to manage traffic flow and detect incidents, for example:

- incident management systems (CCTV and/or detection loops)
- changeable message signs (CMS)
- variable message signs (VMS)
- variable speed limit signs (VSLS).

These initiatives are currently being assessed in collaboration with DTEI to provide an integrated solution that can be utilised with the Northern Expressway and any additional future road facility
.

5.3.3 Traffic modelling using AIMSUN

DTEI has conducted micro-simulation assessment of the Port Wakefield Road Upgrade using the AIMSUN traffic modelling software, primarily to assess the performance of traffic flow at mid block locations, at intersections along Port Wakefield Road and at merge locations along the Port Wakefield Road. Together with results of the individual modelling of each intersection this has been used to confirm that the proposed scheme will cater for the proposed traffic demands.

Modelled years were 2006 (current year), 2011 (future year) and 2016 (future verification/design year). This modelling work was one input into the concept development and assessment process, along with extensive SIDRA analysis and technical reviews/analysis and development.

Overall, this model was considered to provide appropriate operating conditions for predicted 2011 traffic flows during both peak periods, and was also run with predicted 2016 input traffic flows. In 2016 overall model performance was constrained by the two-lane carriageways for both directions of travel on Salisbury Highway west of Port Wakefield Road. This indicates that this section will require further capacity improvements at the same time as the requirement for the future upgrading of Port Wakefield Road traffic capacity after 2016.

Overall, the AIMSUN modelling results were generally consistent with SIDRA modelling.

The broad conclusion of this work is that the Port Wakefield Road Upgrade should provide acceptable fit for purpose system performance but a number of issues and assumptions will need to be carefully monitored:

- *Actual traffic flows*: The proposed scheme operates close to capacity at a number of locations along this section of Port Wakefield Road with both 2011 and 2016 predicted traffic flows. These are significantly greater than current (2006) flows (by around 22%) but should actual traffic demand be greater than predicted flows, operating conditions will become more congested than this modelling suggests.
- *Other locations*: The scope of the AIMSUN model included the Port Wakefield Road–Montague Road–Churchill Road North intersection. This intersection does not form part of this project, and was included primarily to create a reasonably realistic level of platoon formation on the southern approach to the Port Wakefield Road–Salisbury Highway interchange. Significant traffic capacity was added (above current capacity) to ensure that the operation of this intersection did not affect overall model performance. Even so, this location was very congested during the evening peak period with the southbound queue being held up by right-turning northbound traffic and extending close to the Port Wakefield Road–Salisbury Highway interchange. Clearly if this, and similarly congested, locations were not upgraded to cater for the predicted future traffic flows, it is unlikely that predicted flows along this section of Port Wakefield Road would be realised.

5.3.4 Road safety

The Northern Expressway and Port Wakefield Road Upgrade will provide an alternative route for heavy traffic that currently travels through the urban areas immediately adjacent to Main North Road. In addition it will provide an attractive alternative to Main North Road for commuter traffic from Gawler and Munno Para. Currently there are high crash rates at the signalised intersections on Main North Road and unsignalised intersections on Heaslip and Angle Vale Roads. Heavy vehicle and unsignalised traffic passing through the Angle Vale township provides a high safety risk for students at the Angle Vale Primary School which has frontage on Heaslip Road.

The proposed Expressway is expected to reduce the overall crash rate in the study area as traffic is diverted from Heaslip Road and Main North Road to the Expressway which is of higher standard and has no signalised intersections or at-grade junctions. This reduction could be reduced by up to 15% on Main North Road due to the Northern Expressway and by an approximate average of 50% on Angle Vale and Heaslip roads.

The project upgrades to the majority of existing junctions on Port Wakefield Road are primarily aimed at improving safety at intersections and midblock. The primary treatments to improve safety include:

- reduce direct access
- minimise conflict by reducing right-turn cross movements
- increase acceleration/deceleration lane lengths
- seal shoulders where works are undertaken
- improve sight distances
- improve lighting where works are undertaken
- provide ITS infrastructure for incident and operational management.

The increased traffic volume on Port Wakefield Road is expected to increase the risk of crashes on Port Wakefield Road. However, overall road safety is expected to improve with a reduction in right turning movements onto Port Wakefield Road and the provision of the ITS initiatives.

A preliminary road safety audit has been carried out on the Port Wakefield Road Upgrade proposal and the results are being incorporated in the design process.

5.4 Public transport

Public transport is limited to bus movements along Port Wakefield Road and three bus services could be affected:

- For service 900, three bus stops (both sides of Port Wakefield Road) are located between Waterloo Corner Road and the Northern Expressway south of intersections at Anjanto Road, Symes Road and Taylors Road. The scheme will impact on these bus stops by requiring the stops at Symes Road and Taylors Road to be rationalised into 1 stop because the roadworks proposed at Taylors Road–Northern Expressway create an environment that does not support bus set down and pick up activities. To ensure that the safety of pedestrians is maintained, appropriate pedestrian crossing locations will need to be provided in the detailed design of the project.
- The 224 service to and from Globe Derby Park on Saturday night should be able to be accommodated using Globe Derby Drive or Daniel Avenue.
- The regional bus services to and from northern areas, stop at the Caltex Service Centre at Bolivar will not be affected by the proposed works.

5.5 Freight routes

The Northern Expressway will be a national freight route and it is expected that the existing commercial vehicle composition (12% of the daily traffic volume) on the Gawler Bypass north of the Two Wells Road interchange would be transferred to the Northern Expressway from Angle Vale Road and Main North Road.

As indicated in Section 2.5, Heaslip Road is an over-dimension vehicle route. Minor roads will overpass the Expressway and thus restrict the over-dimension vehicles using this road, particularly those with over-height loads. Thus appropriate connections should be made to Heaslip Road from Port Wakefield Road and the existing road network to cater for these vehicles.

Freight on Port Wakefield Road is not likely to be adversely affected by the road's upgrading or the provision of the Northern Expressway. Traffic volumes along Port Wakefield Road are expected to increase significantly and slower travel times are anticipated during peak times.

Access to local businesses within the area will be restricted as a result of the increased left in and out access points along Port Wakefield Road. The informal parking adjacent to the Caltex Service Station is to be improved (restricted) so that safety is not adversely affected for both parked vehicles and through traffic.

5.6 Cyclists and pedestrians

The Northern Expressway corridor width will allow for the later construction of a shared use path for the full length of the road if required in the future. Discussions with the various stakeholders and community will identify the most appropriate connections to existing and likely future cycle/pedestrian infrastructure.

Existing cyclist facilities on Port Wakefield Road are limited to one marked, short approach cycling lane, southbound at Waterloo Corner Road. The proposed scheme aims to retain this facility, and where possible provide similar facilities at all signalised intersections, as well as, sealing the shoulder of the road in works areas to give cyclists more sealed space.

No dedicated and separate shared bicycle or pedestrian crossing facilities are proposed.

The project proposes to retain the current standard and level of pedestrian facilities, and add pedestrian crossing facilities at the new signalised intersections with Ryans Road or Martins Road and the Northern Expressway as well as improving the crossings at Bolivar Road and Waterloo Corner Road junctions.

At the Port Wakefield Road bridge across Dry Creek, the re-aligned three-lane carriageways should be marked so that the left (kerbside) lane is 3.7 m wide, to improve safety for cyclists.

In the vicinity of the Whitehorse Inn, Caravan Park and Caltex Service Station at Bolivar, it is proposed to improve pedestrian movement by directing pedestrians from the Caravan Park and Whitehorse Inn to Bolivar Road where pedestrian crossing facilities will be installed as part of the upgraded traffic signals. Appropriate fencing in the median of Port Wakefield Road will be used to improve pedestrian safety across this road. It is expected that lighting will also be improved.

Equestrian access and access to equestrian facilities at locations where roads will be closed or modified may be reduced. The service road on Port Wakefield Road near Globe Derby will be sealed as part of the proposal, but equestrian access will be maintained along a wide unsealed shoulder.

5.7 Emergency vehicle access

On the Northern Expressway, emergency vehicle access will be provided in specific locations. This will be determined during detailed design and in consultation with relevant emergency service organisations including the police, ambulance and fire services. Dedicated emergency vehicle links will also be provided to facilitate direction change in the event of an emergency.

On Port Wakefield Road Upgrade, emergency services vehicle access is retained as per the current Port Wakefield Road arrangement. The wide central median can be used for cross carriageway movements in emergencies, and all movements at significant intersections/junctions along Port Wakefield Road are maintained. Where access is restricted for local roads to left turn in and left turn out, U-turn facilities or alternative points of access are provided in the near vicinity. Should emergency services vehicles need to make right turns at locations where they have been restricted, then the wide central median will facilitate this movement.

6 Environmental management

6.1 Principles adopted to minimise effects

In order to minimise any adverse effects of the Northern Expressway on the transport network a series of principles has been adopted including providing:

- a limited number of access points to provide a safe, free flowing roadway
- appropriate access between communities for all users by minimising the number of roads closed
- alternative access routes and arrangements where roads are closed.

Measures include determining alternative routes for roads required to be closed taking into account the additional length, time and traffic volume predicted on the alternative route and the land uses of areas along the alternative routes. Suitable alternative routes for pedestrians, cyclists and equestrian movements where current routes have been modified or removed, particularly in the Macdonald Park area, are to be provided to reduce potential effects on access to individual properties within the areas surrounding the proposed Northern Expressway and upgrade to Port Wakefield Road.

Several junctions are to be converted to left in and out only access, prohibiting right-turn movements. This is expected to improve safety along Port Wakefield Road.

Road closures and restrictions to access will be monitored to determine where traffic is diverting to and possible reasons for these diversions.

6.2 Measures to minimise effects during construction

Construction works for the Northern Expressway will occur off-line in a single-staged process. Measures to minimise the effects of this process include the following:

- fenced, off-line construction with minimal connection to existing road network
- road sealing of alternate routes for road closures and haul routes (reduces dust and reduces maintenance required)
- fill to be carted along the new road corridor and local roads from quarries. Asphaltic concrete or concrete plants to be located on site where practical and materials placed with specialised paving equipment
- for overpass construction, pavement construction and material deliveries, the haul routes will include mainly, but not exclusively:
  - Two Wells Road
  - Wingate Road
  - Angle Vale Road
  - Andrews Road

  - Womma Road
  - Heaslip Road
- where necessary, new or temporary access arrangements will be provided to local residents
- significant traffic management will be required at the Gawler interchange and Port Wakefield Road connections to the existing roads and will be the subject of a special traffic management plan prepared by the contractor.

The proposed construction program for the Port Wakefield Road Upgrade works is between late 2007 and 2009. These works are expected to be undertaken in a number of discrete packages and is still to be determined, however a series of measures are in place to minimise any adverse effects during construction, including:

- works to be staged to reduce operational delays
- most work will be undertaken in normal working hours under traffic management with some areas done at night or in low traffic times
- construction materials sourced locally to reduce transportation requirements
- monitoring of traffic from road closures.

6.3 Measures to minimise effects post-construction

Following construction, measures to minimise any adverse effects of the Northern Expressway and Port Wakefield Road Upgrade are to monitor the operation of these roads and the surrounding road network to determine if the road is operating as predicted and to identify unforseen problems within the network. Particular attention will be paid to the Northern Expressway connection, the signalised intersections, the roads closed due to the project and the alternate routes around the road closures including service roads. All road closures will be monitored to determine where traffic is diverting and possible reasons for these diversions.

7 Conclusion

7.1 Northern Expressway

The existing transport network operates at an acceptable to poor level of service along most arterial roads in the study area. With the predicted increase in traffic volumes the current network will operate with significant delays, particularly along Main North Road and Heaslip Road.

The Northern Expressway will provide an important link to the South Australian freight network and relieve the pressure on the existing road network, particularly along Main North Road and Heaslip Road. Traffic volumes will increase on Port Wakefield Road which will subsequently additional capacity in a form to be determined for it to operate at an acceptable level of service beyond 2016.

By allowing limited access onto the Northern Expressway, it is anticipated that the number of crashes will be reduced significantly.

Some local routes will be severed by the construction of the Expressway, and in these circumstances alternative routes have been determined for these road closures. Access to individual properties may be affected by the proposed Expressway and direct access between the communities in the study area will be maintained wherever possible with alternate routes provided when this is not possible. Based on vehicle travel times anticipated before and after completion of the proposed Expressway, accessibility within the study area is generally maintained and in some instances improved. Pedestrian, cyclist and equestrian access is addressed throughout the study area particularly in the Macdonald Park and Globe Derby areas. Alternate access arrangements will also need to be provided for pedestrians, cyclists and equestrians where road closures are implemented.

The ability to provide satisfactory alternative access arrangements will be key to the success of the local transport network.

Traffic issues during construction will generally be managed by constructing off-line without any traffic in the Expressway corridor, which will wherever possible be used to haul materials to and from the construction site. At locations where local access roads are closed new or temporary access arrangements will be provided.

Post-construction monitoring of the arterial and local road networks will be essential to determine the overall effects of the Northern Expressway.

Generally, the proposed Northern Expressway will significantly improve the standard and continuity of the National Network. It will improve travel times for all vehicle and truck commuters reducing delays within the existing road network. Overall crash rates are expected to decrease with most commercial vehicles being directed away from the local road network to a high standard freeway with a reduced number of intersections.

7.2 Port Wakefield Road Upgrade

Port Wakefield Road is considered to be a significant freight route for South Australia forming an essential link in South Australia's National Network road link. The local road network connects with primary freight routes, secondary freight routes, primary social access routes and primary tourism routes.

Existing traffic volumes along Port Wakefield Road are currently in the range of 15,000 up to 48,000 vpd. The proportion of commercial vehicles is approximately 15%. Traffic volumes along Port Wakefield Road are expected to increase significantly as a result of the proposed Northern Expressway and intersections along Port Wakefield Road will thus require upgrading. This includes the junctions of Port Wakefield Road with Waterloo Corner Road, Bolivar Road, Ryans Road and Martins Road. As a result of the proposed Northern Expressway, the number of access points along Port Wakefield Road will be reduced to improve safety and capacity. However service roads alongside will be provided to maintain access to local roads and abutting properties, reducing the impacts on local road users. Alternate routes for motorists, pedestrians, cyclists and equestrians have been determined for all proposed local road closures.

Beyond 2016, the link between the Northern Expressway and Salisbury Highway will need to be further upgraded. This link will be the subject of a further planning study.

The traffic modelling indicates the proposed improvements will cater for the increased traffic flows at acceptable levels of service and delays. The crash rate is expected to improve primarily due to the changed access conditions with the side roads; however, this is expected to be offset by the increase in traffic volumes from the Northern Expressway.

All traffic will be monitored as a result of local road closures, ensuring the safe and efficient flow of traffic along and surrounding the southern section of the proposed Northern Expressway, both before and after construction.