Buckland Park

Traffic Impact Assessment

1 April 2009

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PREVIOUS ENGINEERING EXCELLENCE AWARD WINNER 2006, 2005, 2004, 2003, 2002, 2001

08-0875-04-2112592A

NCSI Certified Quality System ISO 9001, ISO 14001, AS/NZS4801

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Date: 1 April 2009 .....

Distribution: Walker Corporation .....

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Glossary

DTEI	Department for Transport, Energy and Infrastructure
DC	District Centre
NC	Neighbourhood Centre
NExy	Northern Expressway
PRExy	Port River Expressway
SA	South Australia
RAAF	Royal Australian Air Force
DSTO	Defence Science and Technology Organisation
MASTEM	DTEI strategic transport model
ASD	Adelaide Statistical Division
PTD	Passenger Transport Division
P&R	Park-and-ride
QDMR	Queensland Department of Main Roads
DoS	Degree of Saturation
CBD	Central Business District
LOS	Level of Service
DDA	Disability Discrimination Act

1. Introduction

This report documents a traffic impact assessment undertaken as part of the environmental assessment process for a new urban area at Buckland Park. The proposal's proponent is a joint venture comprising Walker Corporation and DayCorp, and the consultant responsible for this report is Parsons Brinckerhoff Pty Ltd (PB).

This component of the EIS addresses the traffic impacts of the proposal's Master Plan. In particular it examines and assesses:

- a recommended road hierarchy for Buckland Park, having regard to all road users
- a proposed access strategy for Buckland Park
- impacts of traffic on the road network within Buckland Park, how these impact on the defined road hierarchy, and their implications for the internal road network layout and indicative intersection control treatments
- assessment of external road linkages between Buckland Park and Port Wakefield Road
- assessment of the impacts of traffic generated by Buckland Park on the external road network
- assessment of the staged development of a proposed bus route network and associated service structure to meet both intra-Buckland Park and external inter-regional demand for public transport services
- assessment of cycling and pedestrian movements within Buckland Park, particularly to major generators (retail/commercial centres and schools)
- assessment of the relationship between cycling movements within Buckland Park and potential linkages to Port Wakefield Road.

Relevant Government and Local Government agencies were consulted in the preparation of this report. Their views and contributions are reflected in the findings. These agencies comprise:

- The Department for Transport, Energy and Infrastructure (DTEI):
  - Policy and Planning Division
  - Public Transport Division
  - Transport Services Division (Metro).
- City of Playford.

The EIS Guidelines prepared by Planning SA and the Development Assessment Commission in August 2007 for the Buckland Park proposal have been used as the basis for development of the Traffic Impact Assessment.

2. The proposal

The Buckland Park proposal envisages the creation of a new urban area at the north western corner of the Adelaide Metropolitan area, bounded by the Gawler River to the north, and the Port Wakefield Road national highway route to the east.

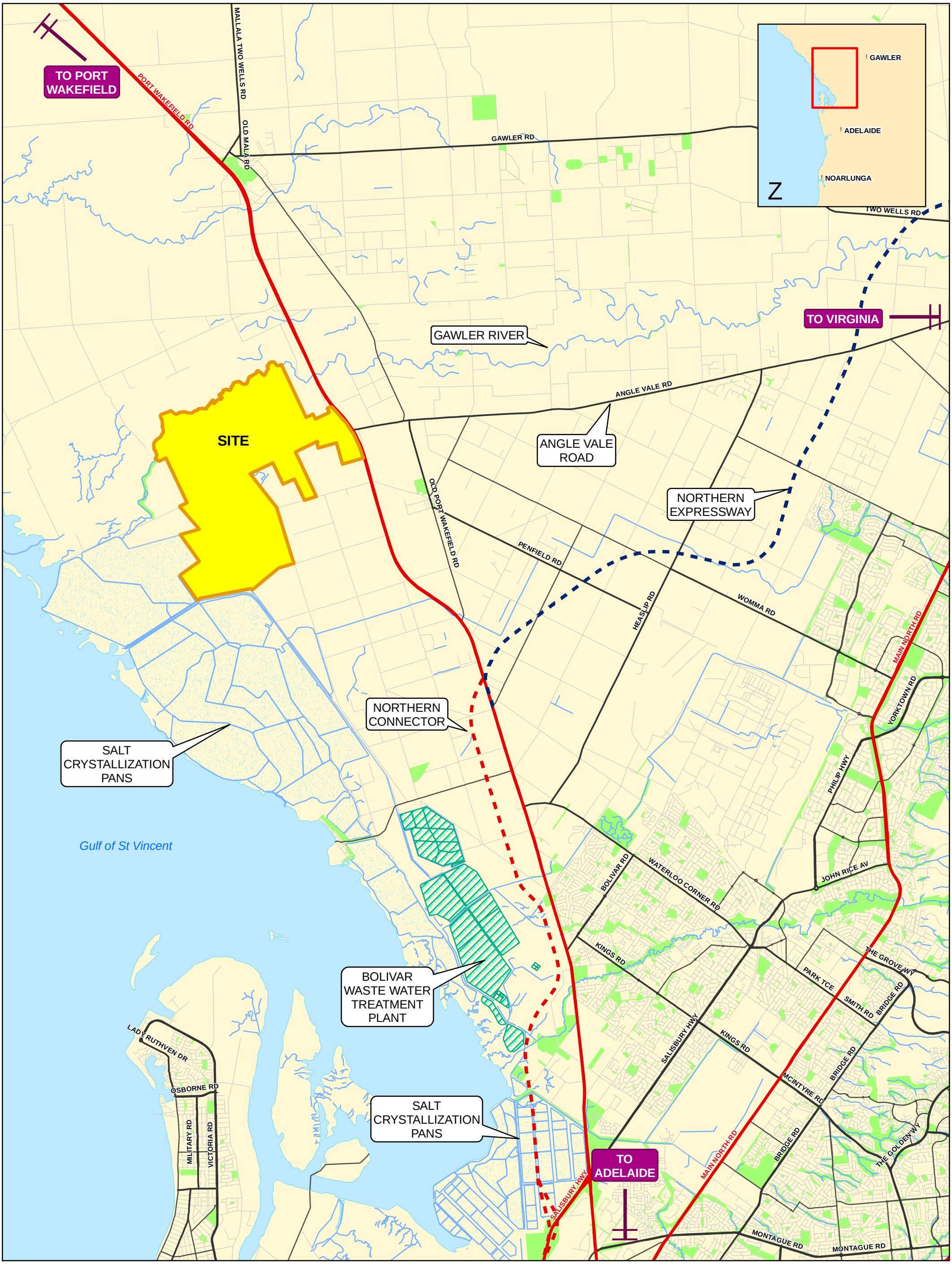
The proposal's Master Plan envisages some 12,000 households in a mixed low and medium density development, with a supporting retail/commercial centre hierarchy: a District Centre (DC) and four Neighbourhood Centres (NC); additional precincts containing manufacturing and other commercial employment also form part of the proposal. Four local primary schools are to be located within the respective NCs, with an integrated primary/secondary school abutting the DC. The proposal is planned to commence in 2010, with full completion by about 2036.

The proposal is founded with a focus on sustainability principles. From a transport perspective, these principles relate particularly to the provision of public transport services at all stages of the development, complemented with an effective walk and cycle structure to link residential precincts with employment and education nodes. Public transport services need to provide connections to each of the DC and NCs, and externally to major commercial centres/transport hubs in the region. It is also important that public transport services be provided around the time the first house is occupied, to reduce car dependence; this may require the proponents to subsidise the provision and operation of local feeder bus services.

Buckland Park is to be served by an efficient internal road network, based around a road hierarchy that achieves two important objectives:

- reflecting the role and function of each road as an integral part of the Master Plan structure; and
- providing a good balance of intra-Buckland Park accessibility and external connectivity, having regard to sustainability principles.

External road linkages between Buckland Park and the Adelaide arterial road network are to be provided to Port Wakefield Road. The South Australian Department for Transport, Energy and Infrastructure (DTEI) have advised that such connections to Port Wakefield Road may be via at-grade intersections, providing that they maintain efficiency and safety for freight and other traffic movements along this national highway corridor.



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Buckland Park Traffic Impact Assessment

Locality plan

Figure 2.1

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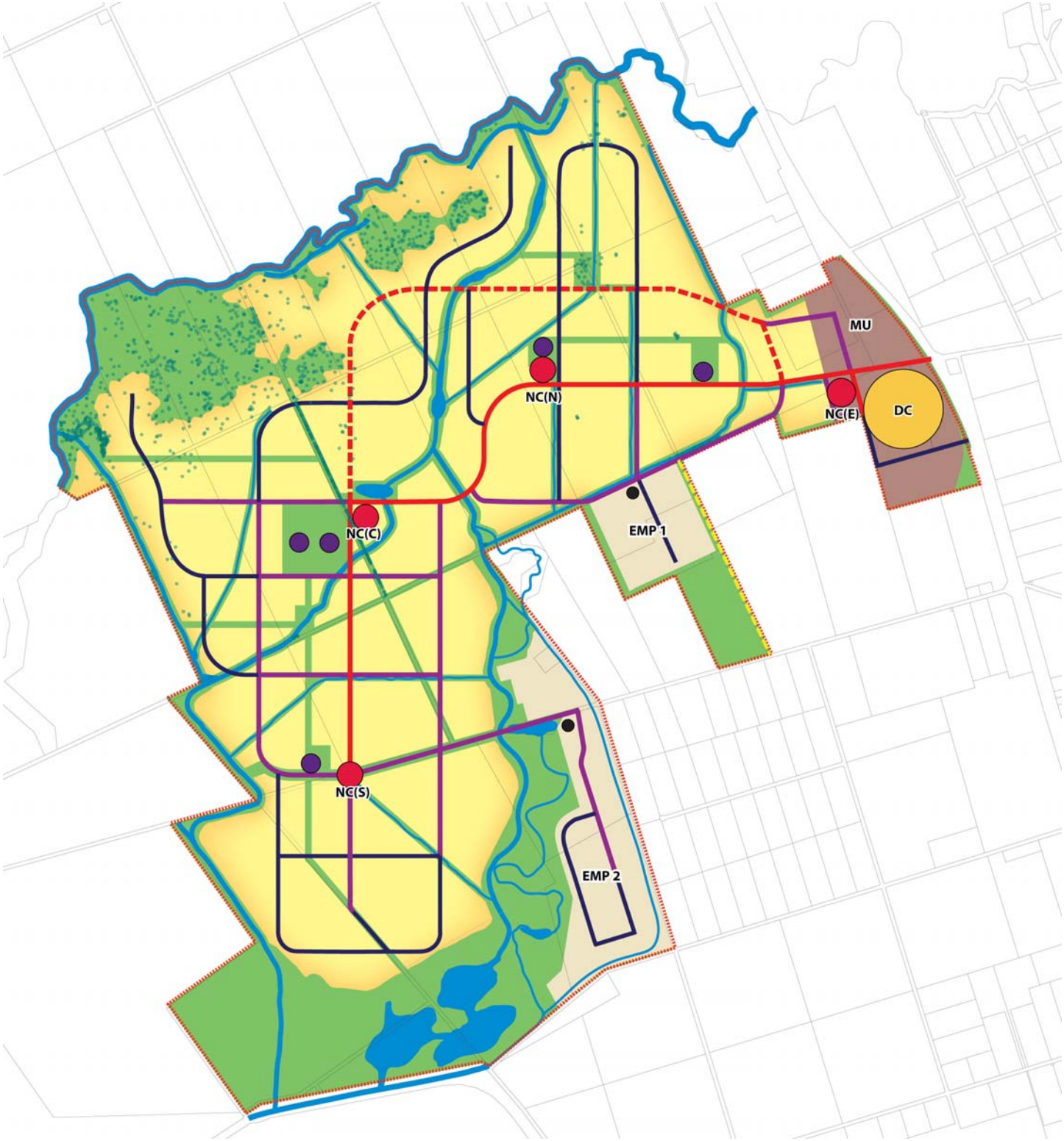


FIGURE 2.2
Master plan

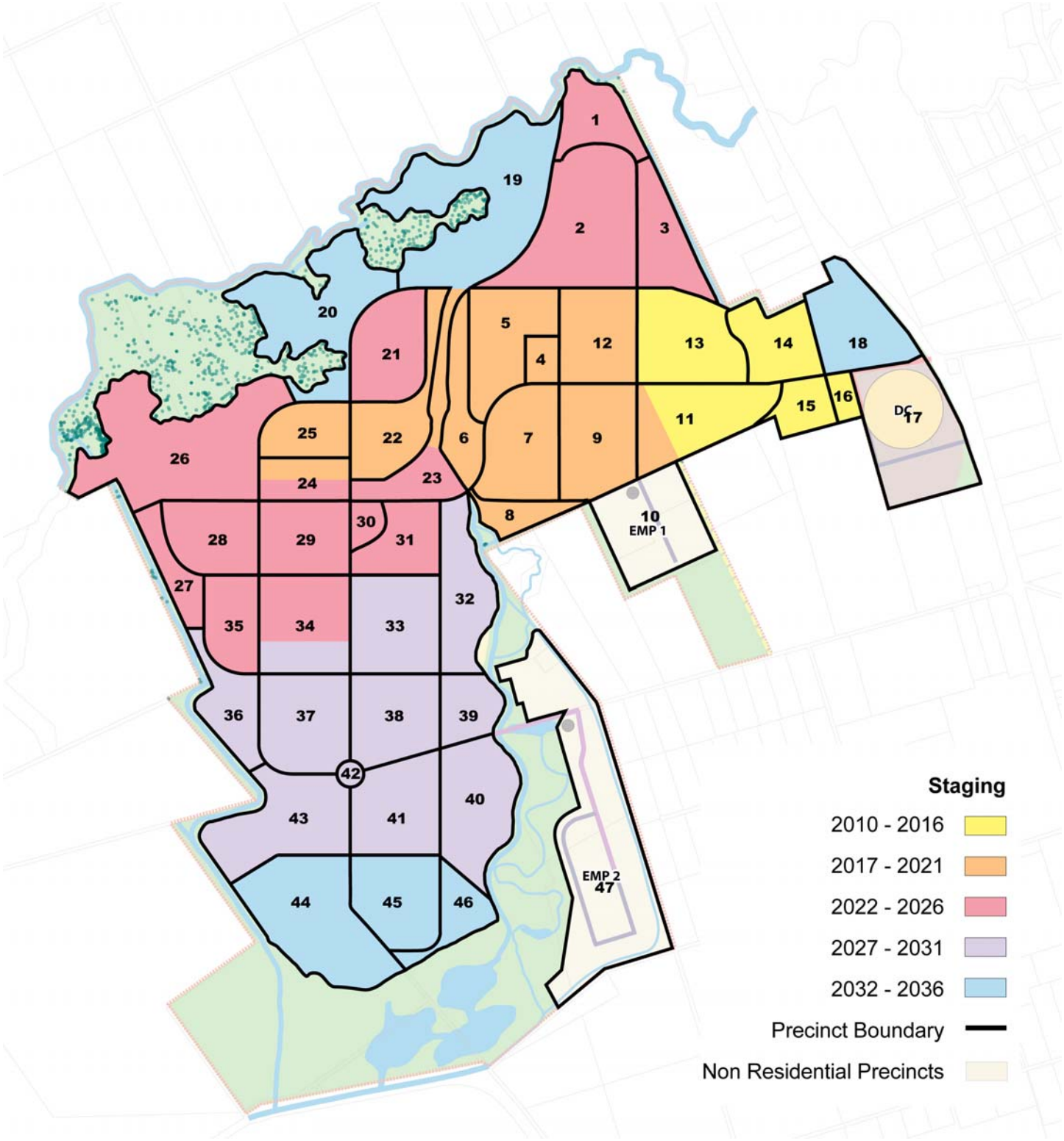


FIGURE 2.3
Staging plan

3. Proposal externalities

There are a number of externalities to the Buckland Park proposal that need to be recognised within a transport (and planning) context. These are summarised in the following sections.

3.1 Northern Expressway

This project, referred to as NExy, is to be implemented by the State Government as a high speed/high capacity freight route linking the Sturt Highway at Gawler to Port Wakefield Road just north of Waterloo Corner Road (near Taylors Road). It forms part of the wider AusLink corridor linking the Sturt Highway with the Port River Expressway (PRExy) to Port Adelaide/Outer Harbor, and also to the south via a proposed upgrade of the South Road corridor. Construction of NExy commenced in 2008, with completion due by 2011.

Traffic movements from Buckland Park will have linkages into the NExy corridor at the Angle Vale Road and Womma Road interchanges, and at the interchange at Port Wakefield Road.

3.2 Northern Connector

The Northern Connector will result in a contiguous expressway standard route for freight traffic linking the Northern Expressway to the Port River Expressway, and thence to the Port of Adelaide and other destinations to the south. The Port Wakefield Road national highway route will link into NExy and the Northern Connector at an interchange on Port Wakefield Road. The Northern Connector project will thus form part of the overall AusLink freight corridor linking both the Sturt Highway and Port Wakefield Road national highways with Adelaide's major port and transport hubs.

A planning study for the Northern Connector has recently commenced. It is understood that the Northern Connector is being planned for completion in about 2016. Traffic from Buckland Park will be able to link into the Northern Connector at the interchange with NExy on Port Wakefield Road.

3.3 Land use scenarios

DTEI and Department of Planning and Local Government (DPLG) have developed four alternative population/employment growth scenarios as inputs to the planning of future transport infrastructure improvements in Adelaide. The fourth of these scenarios, referred to as Scenario D by DTEI, reflects the early achievement of the State Strategic Plan target of two million residents (by about 2030), together with an associated high level employment strategy. Scenario D assumes 12,000 residential allotments at Buckland Park.

PB were requested to adopt Scenario D as the base land use strategy against which the transport impacts of Buckland Park were to be assessed. It is understood that other medium-longer term land development options may also be considered by the Government, but that these are not currently defined, and so have not been included in the travel demand assessment process undertaken as part of this project.

4. Approach to impact assessment

The approach adopted by PB for undertaking the impact assessment of the Buckland Park proposal comprised the main activities as described below.

4.1 Existing conditions

This activity addresses details of the existing road network in the region, current levels of traffic demand on Port Wakefield Road and other major regional arterial routes, and considers public transport services within the broader region. Reference to the Government's commitment to the Northern Expressway, the Northern Connector and other regional road improvements, is also included. This aspect of the assessment also considers current road network usage by local residents/market gardeners within the environs of Buckland Park.

4.2 Road hierarchy

A road hierarchy has been developed in conjunction with the City of Playford as a basis for planning the road network for Buckland Park. This defines a hierarchy of roads, their characteristics and cross section details. It formed the basis for establishing a hierarchy in response to the structure of the master plan for the development.

4.3 Traffic demand forecasting

Forecasts of future traffic generated by Buckland Park have been prepared using the DTEI strategic transport model MASTEM. This model suite was set up by DTEI to model regional traffic and public transport travel patterns as a function of future road and public transport networks, and metropolitan land use growth scenarios determined by Government (official state government high population, high employment growth scenario for the Adelaide Metropolitan Area was used, as directed). MASTEM forecasts car trips, public transport trips, cycle and walk trips for AM and PM peak hours, and for a total weekday.

A traffic zone system, road and public transport networks were created for Buckland Park, based on the Master Plan and its defined road hierarchy. Forecasts of population, jobs (by seven categories) and school enrolments were provided by Connor Holmes as inputs to the forecasting process.

Initial transport assessments were undertaken for 2031. This reflects estimated completion of approximately 80% of the proposed residential precincts within Buckland Park. Interim staging assessments were also undertaken for 2026, 2021 and 2016; 2011 represents the effective commencement of residential occupation of Buckland Park.

Assessment of travel demand using the DTEI strategic transport model provides a consistent basis for assessing the impacts of forecast traffic flows on the internal and external road networks with respect to other traffic planning being undertaken by DTEI.

4.4 Site access requirements

Buckland Park will link directly to the Port Wakefield Road national highway, as noted in Chapter 2. This is a high speed freight route (110 km/h posted speed), and DTEI have confirmed that at-grade connections to the highway represent appropriate forms of intersection control, providing that satisfactory and safe intersection performance is achieved during all stages of the development's progression.

Determination of approved site access arrangements has accordingly focused on the provision of an initial signalised intersection at Port Wakefield Road/Angle Vale Road/ Buckland Park Entry Boulevard, with broad consideration of additional access capacity improvements if/when the initial intersection reaches service capacity. .

4.5 Impact assessment

Transport impact assessments have focused on the following main elements:

- External linkages – at Port Wakefield Road, along Port Wakefield Road, on other external arterial road links, and on local road users within the environs of Buckland Park.
- The internal road network proposed within Buckland Park. This assessment has considered the proposed road hierarchy and its appropriateness, required road capacity requirements and indicative requirements for internal intersection controls.
- The proposed bus service arrangements for meeting internal Buckland Park demand and for providing appropriate linkages to external destinations. The assessment has considered how these arrangements might be most appropriately staged over time in reflection of the roll out of residential neighbourhoods and associated employment opportunities.
- Impacts of the Master Plan and traffic forecasts on pedestrian and cycle movements within Buckland Park.

The assessment process has focused on 2031; this being consistent with the longest strategic transport model forecasting available from DTEI (refer Section 7 of this report). Development of Buckland Park is expected to be 80% occupied at that time. An approximate set of traffic forecasts for ultimate occupation in 2036 has also been derived to quantify ultimate traffic impacts attributable to the proposal on the external road and transport network.

The process also considers, nevertheless, interim impacts as residential neighbourhoods are rolled out over time. Outputs from traffic forecasts in 2016, 2021 and 2026 formed the basis for these interim analyses.

5. Existing conditions

This chapter provides an overview of existing conditions in and around the Buckland Park site. It considers current land use, the existing road network structure, traffic volumes on the main arterials near Buckland Park, and further comments on accessible public transport services. It also comments on current local road usage by residents (in the main market gardeners) adjacent to Buckland Park.

5.1 Locality

The Buckland Park site is located approximately 30 km north of Adelaide. It is west of Port Wakefield Road, with the main entry boulevard to be located at the intersection with Port Wakefield Road and Angle Vale Road. Virginia is just over 1 km to the east of Port Wakefield Road, and about 1.5 km south of Angle Vale Road. Figure 5.1 shows the location of the site with respect to the adjoining road network.

5.2 Land use and zoning

The current pattern of land use in the vicinity of the Buckland Park site and Virginia are depicted in Figure 5.2. This shows that a significant amount of horticulture/agriculture and rural residential living takes place within the region surrounding Virginia, with minimal other commercial and residential uses. Virginia encompasses a school, recreational and commercial/retail facilities, and residential areas.

Jeffries has a composting facility located at the western end of McEvoy Road, approximately 5 km south of the Reedy Road and Port Wakefield Road intersection.

5.3 Roads

5.3.1 Road network

The regional road network in the region of Buckland Park and Virginia comprises a mix of national highway links, arterial roads, and other local roads. They include:

- National Highway: Port Wakefield Road. This is maintained by DTEI on behalf of the Commonwealth. It forms part of the Auslink corridor between Adelaide and Darwin, and between Adelaide and Perth.
- Arterial roads: These include Angle Vale Road, Old Port Wakefield Road, and Heaslip Road. Management and operation of these roads is the responsibility of DTEI.
- Local roads: These are maintained by Playford City Council, and comprise those roads providing local property access within the council area; they also provide connectivity between the national and regional arterial roads, with linkages to major centres in the northern Metropolitan area.

Figure 5.1 shows the road network surrounding Buckland Park, with the major roads described below in Table 5.1. The significant roads within this network are described further below.

Table 5.1 Key elements of the regional road network

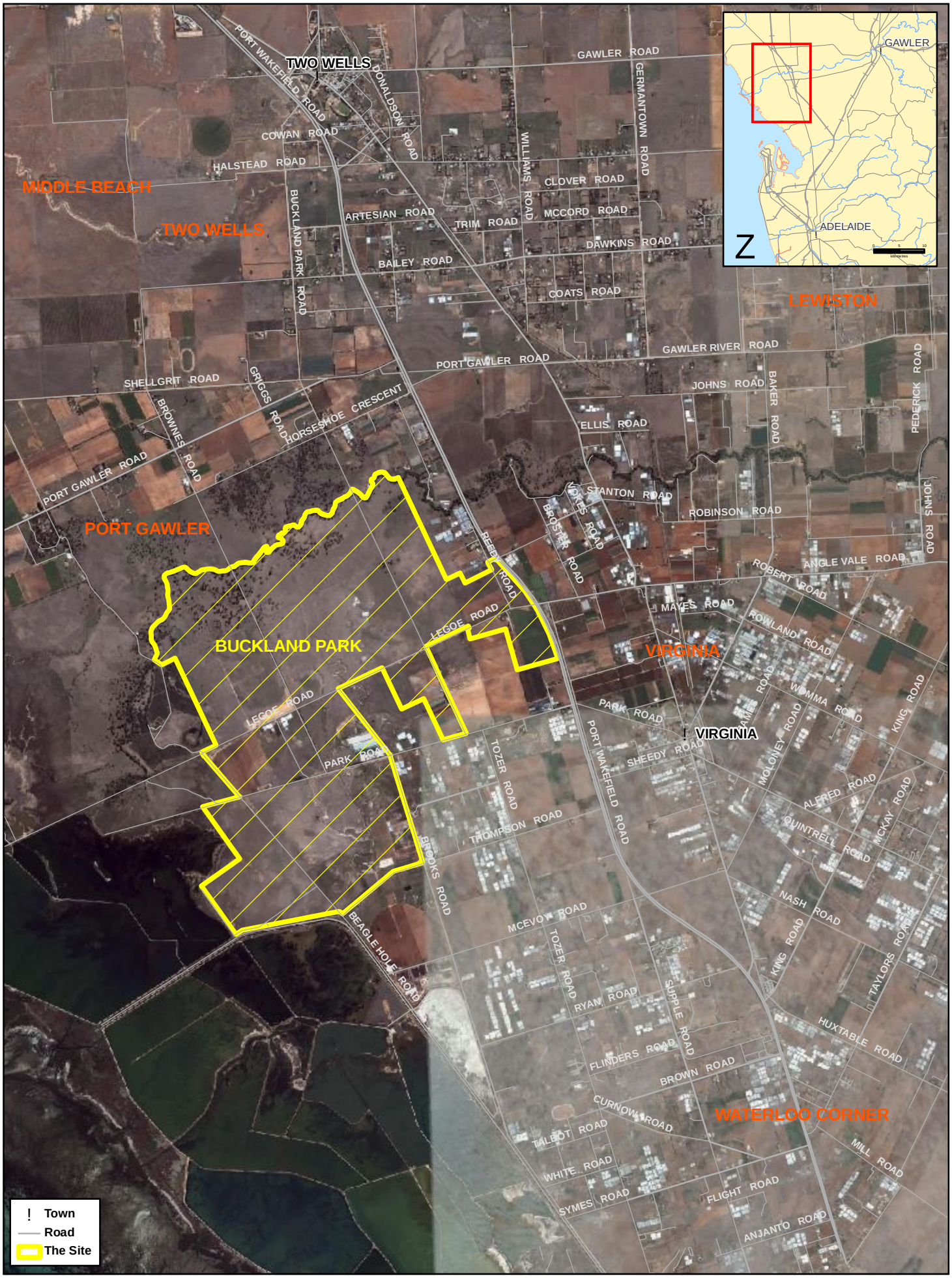
Road name	Classification	Maintenance responsibility	Pavement cross section	Speed limit (km/h)	Control of access
Port Wakefield Road	National highway	DTEI	4 lane divided	110	Controlled
Angle Vale Road	Rural arterial	DTEI	2 lane undivided	100	Not controlled
Old Port Wakefield Road	Rural arterial	DTEI/Council	2 lane undivided	60	Not controlled
Womma Road	Local	DTEI/Council	2 lane undivided	80	Not controlled
Heaslip Road	Rural arterial	DTEI	2 lane undivided	90	Not controlled
Curtis Road	Local	Council	2 lane undivided	..	Not controlled
Park Road	Local	Council	2 lane undivided	60	Not controlled
Penfield Road	Rural arterial	DTEI/Council	2 lane undivided	80	Not controlled
Gawler Road	Local	Council	2 lane undivided	..	Not controlled

Port Wakefield Road is a National Highway linking South Australia with the Northern Territory and Western Australia. It also provides regional access to the northern part of the Adelaide metropolitan area, to the Mid North and Far North regions of SA, Yorke Peninsula and Eyre Peninsula. Annual average daily traffic volumes range between 10,800 and 11,700 vehicles per day in the vicinity of the site.

Angle Vale Road provides a direct access between Port Wakefield and Gawler, and thence links via the Sturt Highway to the Riverland, Victoria, New South Wales and Queensland. Annual average daily traffic volumes are 2,000 vehicles per day.

Old Port Wakefield Road is the main road linking the township of Virginia with Port Wakefield Road approximately 3 km to the south of Virginia; it extends to Angle Vale Road approximately 1.5 km north of Virginia, before continuing north via a staggered T junction at Angle Vale Road to meet Gawler Road at Two Wells. Old Port Wakefield Road is maintained by DTEI between Penfield Road and Angle Vale Road, and is a Playford Council maintained road both south of Penfield Road and north of Angle Vale Road. Old Port Wakefield Road provides access between Virginia and Port Wakefield Road, to the south directly, and to the north via Angle Vale Road.

Womma Road provides access between Gawler Road (at Virginia) to Main North Road at Elizabeth North, and thence to the Elizabeth Regional Centre. Between Main North Road and Heaslip Road, Womma Road is maintained by DTEI, while west of Heaslip Road it is maintained by Playford Council.



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Buckland Park Traffic Impact Assessment

Location map

Figure 5.1

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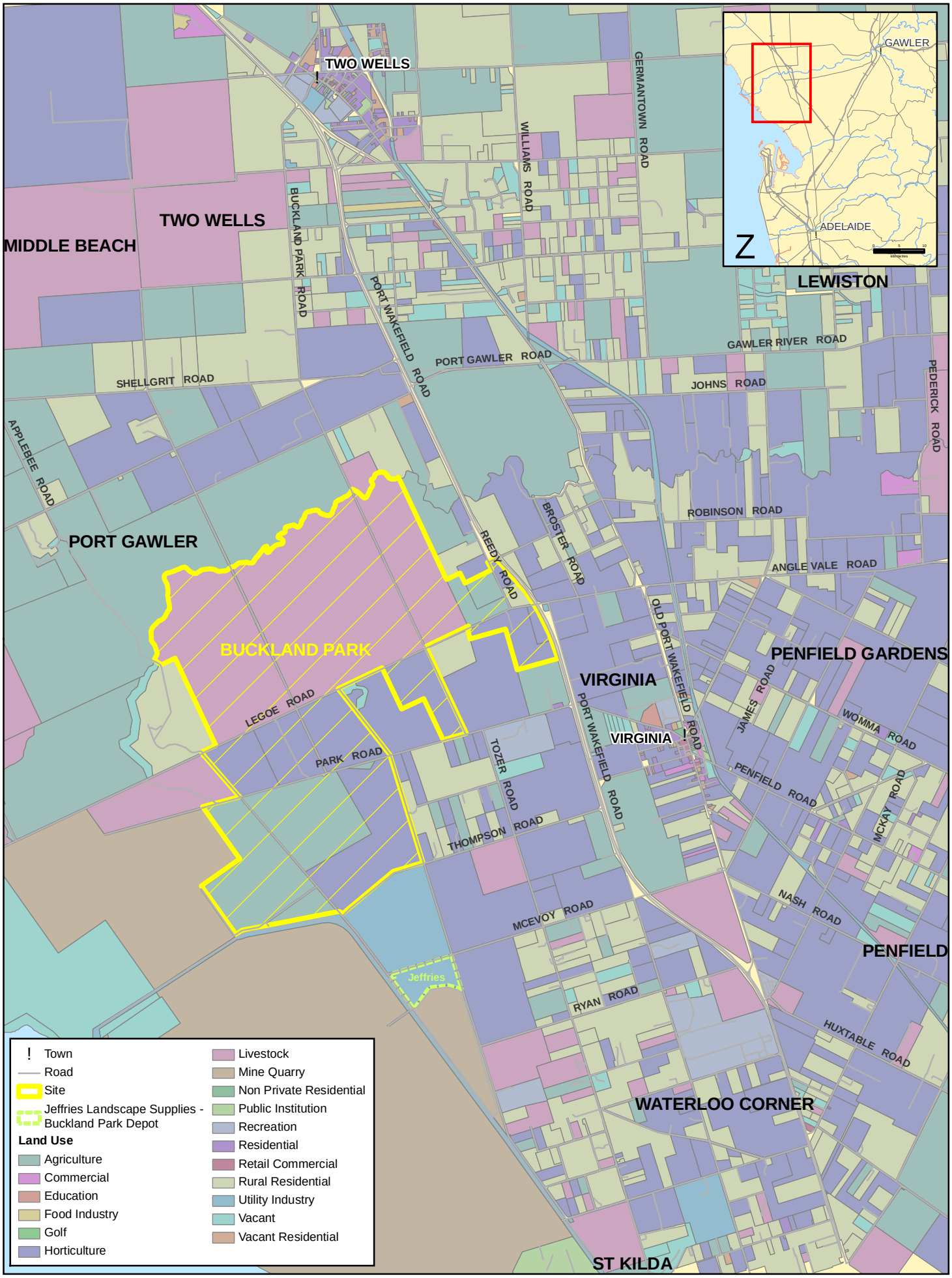

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Buckland Park Traffic Impact Assessment

Land use

Figure 5.2

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Park Road consists of two discretely separate sections:

- West of Port Wakefield Road, it provides local access from Port Wakefield Road to horticultural areas abutting Buckland Park.

- To the east of Port Wakefield Road, it links Supple Road (effectively a service road parallel to Port Wakefield Road) and the centre of Virginia at Old Port Wakefield Road. (Park Road (east) does not connect to Port Wakefield Road.) This road provides access to a school, some houses and the recreation reserve/community centre at Virginia. Park Road is not highly utilised west of the primary school. The intersection of Park Road and Old Port Wakefield Road is in the centre of the Virginia township, and is congested during peak periods particularly around school times.

Penfield Road links the Virginia township with Heaslip Road, which in turn links to Edinburgh Parks, the RAAF Edinburgh Base, and to the Defence Science and Technology Organisation (DSTO).

5.3.2 Intersections

Significant intersections within the environs of the site and Virginia, and which are expected to be impacted by traffic generated by Buckland Park, are described in the following sections.

5.3.2.1 Old Port Wakefield Road and Angle Vale Road

The intersection of Old Port Wakefield Road and Angle Vale Road, just north of Virginia is a left-right staggered T-intersection, with a stagger distance of approximately 150 metres between the northern and southern sections of Old Port Wakefield Road. Deceleration lanes are provided for both left turns and both right turns along Angle Vale Road. Figure 5.3 illustrates the configuration of the intersection.

FIGURE 5.3
Existing staggered T intersection of Old Port Wakefield Road at Angle Vale Road

5.3.2.2 Port Wakefield Road and Angle Vale Road

The existing seagull arrangement at the junction of Port Wakefield Road and Angle Vale Road includes acceleration and deceleration lanes and facilitates all turning movements, as shown in Figure 5.4. The main entry boulevard into Buckland Park is expected to be constructed at this location.

FIGURE 5.4
Existing intersection of Port Wakefield Road and Angle Vale Road

5.3.2.3 McEvoy Road and Port Wakefield Road

McEvoy Road is a local access road, used by B-doubles under permit to Jeffries and their contractors. It is understand that there is to be a planned upgrade of the intersection of Port Wakefield Road and McEvoy Road, as part of an arrangement under which McEvoy Road will be gazetted as a route for B-Doubles.

The existing intersection of McEvoy Road and Port Wakefield Road allows all traffic movements, including right turns in and out across the divided 4 lane carriageway, as shown in Figure 5.5. Details of the intersection upgrade have not yet been made available by DTEI.

5.3.2.4 Port Wakefield Road and Old Port Wakefield Road

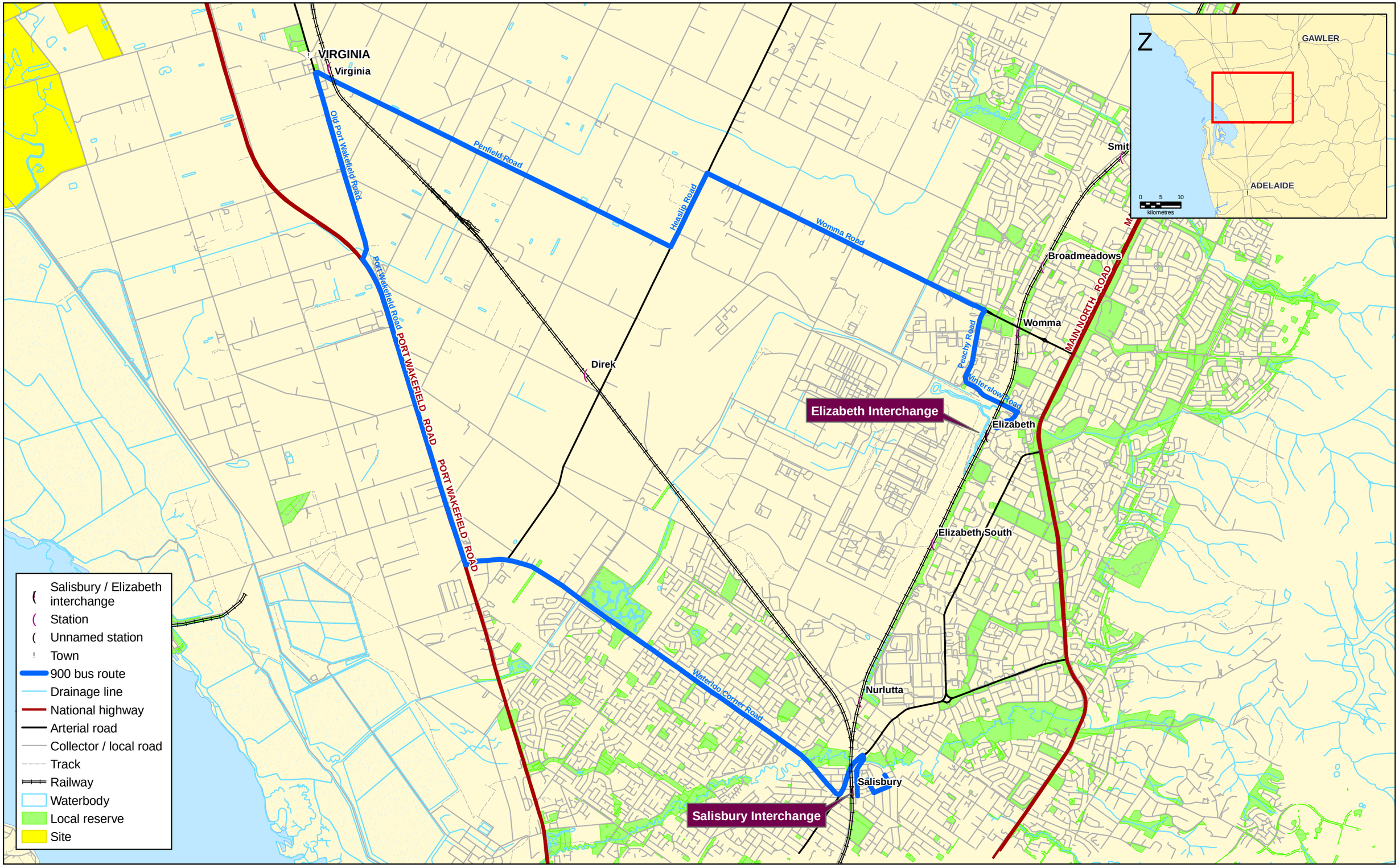
The intersection of Port Wakefield Road and Old Port Wakefield Road consists of a channelised intersection allowing all turning movements, as illustrated in Figure 5.6. This intersection forms the main entry/egress point for traffic movements between Virginia and Adelaide to the south.

FIGURE 5.5
Existing intersection of Port Wakefield Road and McEvoy Road

FIGURE 5.6
Existing intersection of Port Wakefield Road and Old Port Wakefield Road

5.4 Public transport

The route 900 bus service operates between Elizabeth Interchange and Virginia to Salisbury interchange, via Womma Road, Port Wakefield Road, Waterloo Corner Road (and return). This service currently operates during AM and PM peak traffic periods only, and does not operate at night, on weekends or during public holidays.



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Buckland Park Traffic Impact Assessment

Bus route 900

Figure 5.7

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6. Development of a road hierarchy

6.1 Road hierarchy definition

A road hierarchy was developed in conjunction with the City of Playford, as a basis for planning the internal road network for Buckland Park. This defines a hierarchy of roads, their characteristics and cross section details, in response to the Master Plan's structure.

The agreed hierarchy definition is shown in Table 6.1.

Table 6.1 Road Hierarchy Definition

Road Characteristic	Road Class				
	Arterial 2+2 lanes	**Sub-Arterial 2 lanes**	**Distributor**	**Collector**	**Local**
Max. desirable daily traffic volume	>15,000	>10,000	5,000-10,000	<5000	<1000
Design Speed (km/h)	60 (min)	60 (min)	50	50	40-50
Carriageway Width (m)	7.0[2]	8.0[1]	7.0	7.0	7.0[5]
Overall Road Width (m)[8]	22.1[6]	16.0[7]	11.4[3]	9.2[4]	7.0[5]

Source: Consultants

Notes:

1 2 x 4.0 m lanes
2 2 x 3.5 m lanes on each carriageway
3 2 x 3.5 m lanes plus indented parking (assumed 2.2 m each side)
4 2 x 3.5 m lanes plus indented parking (assumed 2.2 m one side only)
5 Playford Land Division Requirements specifies 7 m minimum for local roads; this has been adopted for Buckland Park
6 Comprises 2 x 7 m carriageways plus 4.5 median and 2 x 1.8 m bicycle lanes. (Median allows for 3.3 m turn lane plus a 1.2 m refuge for pedestrians)
7 Provides for 8 m carriageway plus 2 x 1.8 m cycle lanes plus 2 x 2.2 m parking lanes.
8 Kerb to kerb: it does not include provision for footpaths.

In addition, the following geometric and operational road characteristics were also agreed in principle with the City of Playford.

- All roads to be kerbed.
- Local feeder bus services (typically operated using Mitsubishi Rosa capacity buses), and Metro bus services will operate on Collector, Distributor, Sub-Arterial and Arterial roads only.
- Council requires bike lanes on the entry boulevard (designated as an arterial road). The proposed cross section for this standard of road accordingly includes provision for 2 x 1.8m bicycle lanes.
- The cross section for the sub-arterial road is assumed to include provision for 1.8 m cycle lanes (as per the configuration typically adopted by DTEI for arterial roads).
- A standard width of 2.2 m has been assumed for on-road parking lanes.

- Partially indented bus bays will be provided on arterial and sub-arterial roads in the above hierarchy where bus stops are to be provided. This will prevent rear ends of buses protruding into the through traffic carriageway. On distributor and collector roads, it is assumed that bus stops will be located within the indented parking lanes.

6.2 Establishment of a road structure for Buckland Park

The location and arrangement of land uses within the Master Plan formed the basis for establishing a suitable road structure.

The process of designing the Master Plan included the identification of a proposed road network down to the level of collector roads. This network provides connectivity throughout Buckland Park, between residential precincts and education/employment precincts, with external linkages to Port Wakefield Road. The arterial/sub-arterial/distributor network has a grid structure, with a spacing of approximately 1 km; this will enable efficient bus operations through Buckland Park. Intersection treatments are expected to require signals at key locations along the arterial road entry boulevard, with roundabouts at other locations. (Functional design of intersections will be determined during the later detailed design of subsequent stages of the development.)

The following characteristics were considered in hierarchy assessment:

- in general, junctions are created between adjacent (or at worst, second adjacent) road classes. Junctions between Arterial or Sub-Arterial and Collectors or Local Roads are actively avoided

- the road layout and established hierarchy seek to balance the distribution of traffic through the land division (e.g. arterial roads are not directly connected to the Local road network)

- the full range of road users is considered in determining the overall road width requirements for each element of the road hierarchy.

Figure 6.1 illustrates the final Draft Master Plan for Buckland Park.

Figure 6.2 illustrates the hierarchy as defined for Buckland Park.

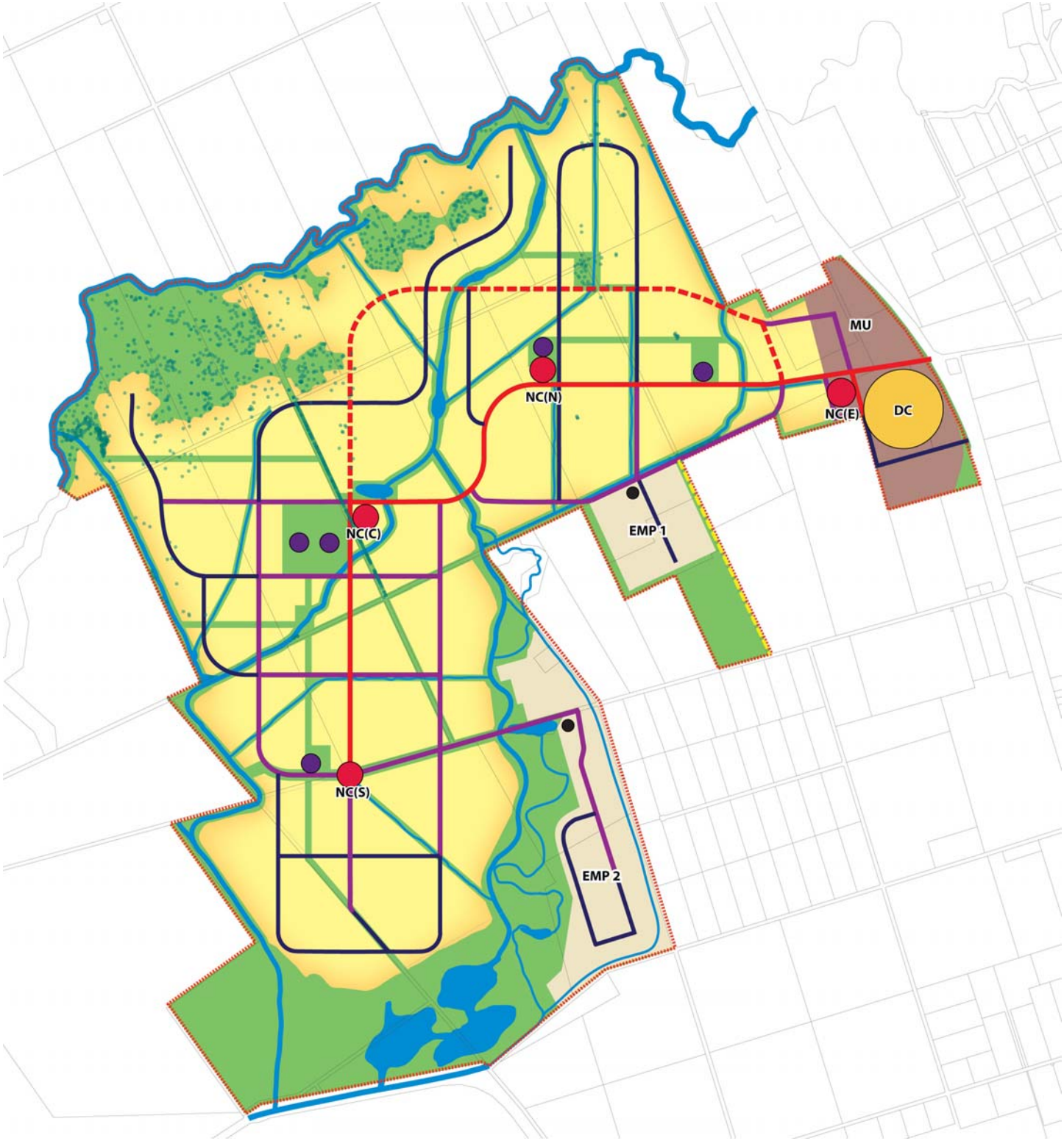


FIGURE 6.1
Master plan

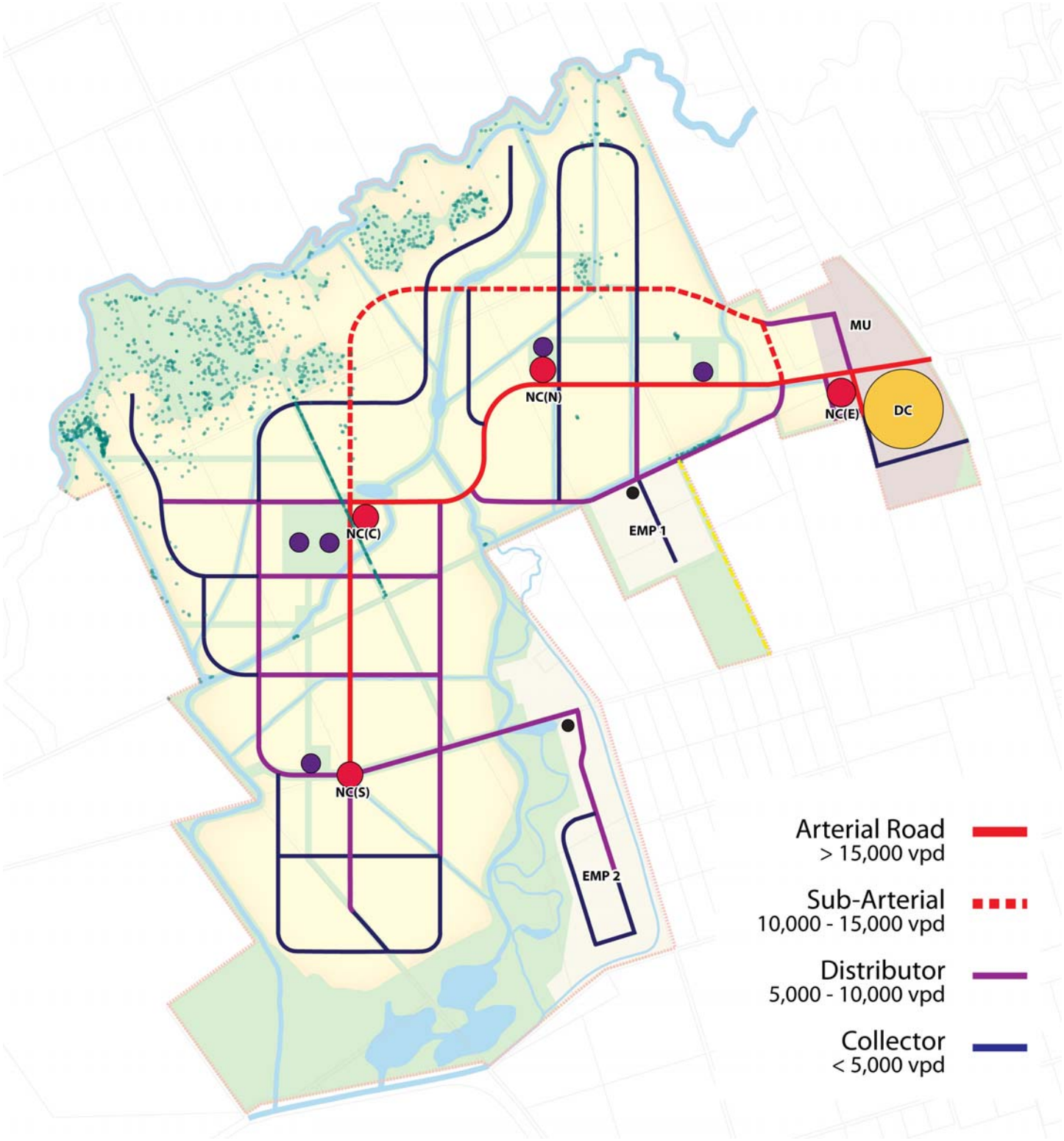


FIGURE 6.2
Proposed road hierarchy

7. Transport demand assessment

7.1 Approach

The scale of the proposal effectively mandated the use of the DTEI strategic transport model (MASTEM) for the travel demand assessment process. This was the only feasible technique by which the intra-Buckland Park travel interactions, as well as the impacts of travel on the external transport network, could be assessed – for motor vehicle and public transport movements. Manual or other simplified techniques would not allow the complex transport interactions to be addressed.

Furthermore, use of MASTEM enabled the external traffic impacts of Buckland Park to be included in the concept planning for the proposed Northern Connector project, currently being conducted by DTEI. This latter issue is very important, as it will enable DTEI to deliver a road solution that can accommodate Buckland Park traffic within the context of the development of the transport corridor linking the Sturt Highway (at Gawler) with the Port Adelaide/Outer Harbor (via the Port River Expressway), and via the upgraded north-south corridor (South Road) to the City and southern suburbs.

Figure 7.1 illustrates the overall modelling and analysis process developed for this project.

Following sections summarise the main elements and assumptions forming part of this approach.

7.2 MASTEM model overview

MASTEM is a full multi-modal strategic model developed by DTEI for assessing the transport demand impacts of road and public transport projects across Adelaide. It forecasts travel demand within the Adelaide Statistical Division (ASD), which extends from Gawler/Buckland Park in the north to Sellicks Hill/Willunga in the south. It includes a sub-model for forecasting motor vehicle movements into/out of the ASD from regional SA and interstate, (referred to as the External Traffic Model).

7.2.1 MASTEM model implementation

The key dimensions of the MASTEM model as currently set up comprise:

- It forecasts travel in five year increments from a 2006 base year to 2031. It is noted, nevertheless, that an indicative set of traffic demands generated by Buckland Park at its proposed ultimate stage of occupation in 2036 has also been prepared, incorporating the 2036 Buckland Park population and employment forecasts into the 2031 MASTEM model. This represents an approximation, but given that the forecasts focus on Buckland Park only, it is considered to represent a reasonable approach to quantifying ultimate traffic impacts attributable to the proposal.

- The model analysis zones are based on Census Journey to Work destination zones. There are 298 internal zones, with a further 22 external zones representing where regional/interstate traffic enters/leaves the ASD.

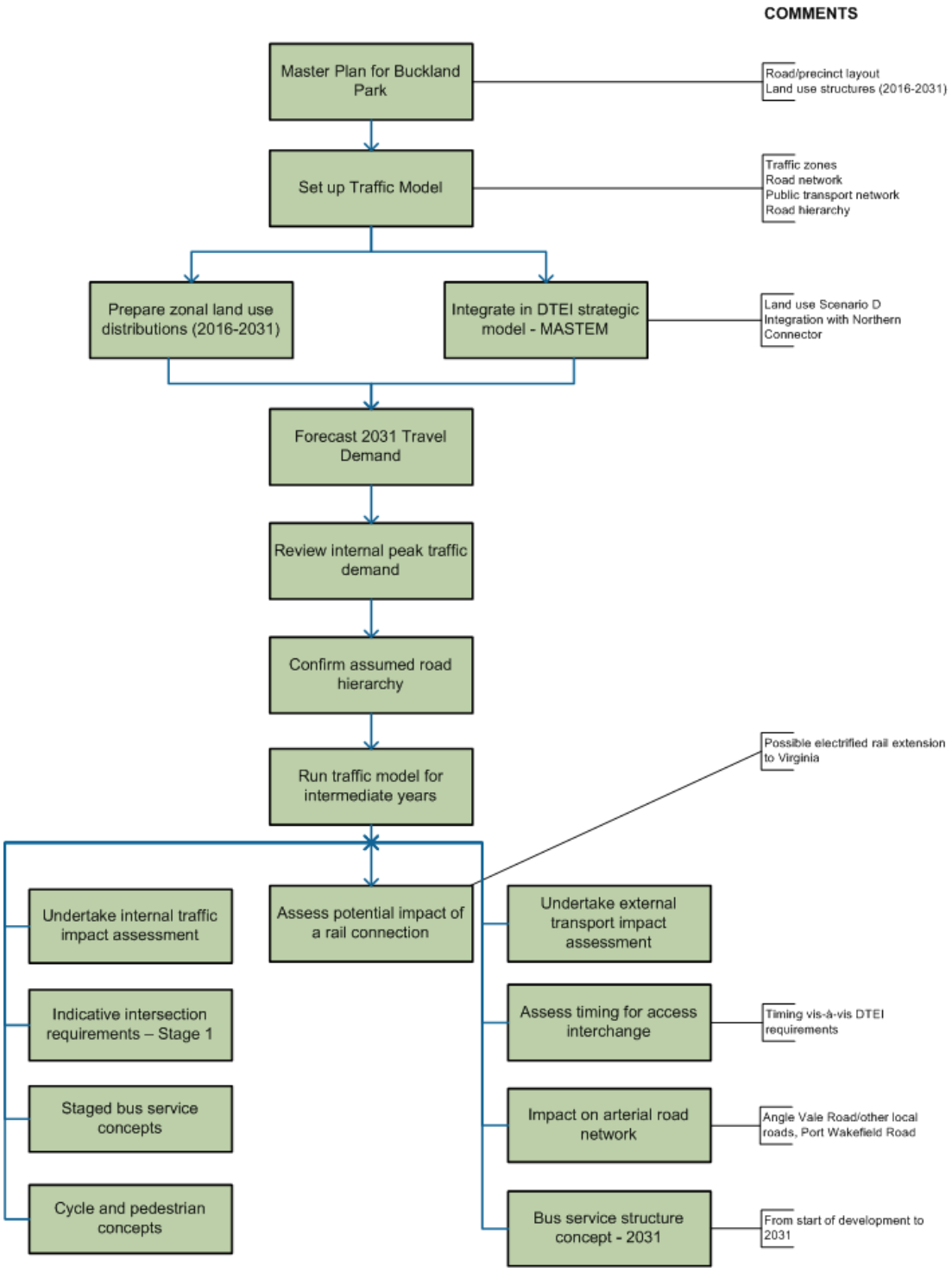


FIGURE 7.1
Travel modelling approach

- DTEI have established four land use scenarios for traffic forecasting. These reflect differing assumptions about future population and employment growth rates, and where future development is planned. For this project, (as well as for the Northern Connector project), DTEI has requested that Scenario D be applied. This reflects a high population/high employment growth scenario.

- The Metropolitan Adelaide road network is represented in MASTEM in terms of a defined hierarchy, with attributes for each section of road reflecting role and function (speed and capacity); intersections are coded in terms of broad approach lane geometry. Future networks include committed, planned and proposed road improvements, including the Northern Connector and upgrades of the South Road corridor.

- The Adelaide public transport system as represented in MASTEM reflects, in detail, routes and services for bus, tram and train operations across the Metropolitan area. Proposed future improvements and upgrading of the network, in response to Government initiatives, are also included in the future networks. These include the proposed rail electrification program, and extension of the tram network along the north west corridor.

- MASTEM currently models:
  - private person travel (car driver, car passenger, public transport, bicycle and walk modes) within the ASD, for seven trip purposes
  - freight vehicle travel within the ASD, in terms of movements by light and heavy trucks
  - external motor vehicle movements for cars, light trucks and heavy trucks.

  Note that the current freight model in MASTEM does not include forecast truck traffic within Buckland Park. This represents a limitation of the current model.

- MASTEM was calibrated for daily travel; estimates of AM and PM peak travel are prepared by the application of a series of peak factors to the respective daily matrices.

- Outputs generated by MASTEM, for each design year, for the land use scenario being considered, and for daily and peak periods include:
  - car and truck volumes on each road network link
  - public transport passenger demand by mode (bus, tram and train) along each section of route/service.

  MASTEM explicitly models bicycle and walk trips as part of the trip generation, distribution and mode choice sub-models. However, cycle and walk trips are not currently assigned to networks or reported.

The following sections describe the representation of the proposed road and public transport networks for Buckland Park.

7.2.2 Traffic zone system

Buckland Park's Master Plan area was subdivided into 47 internal traffic zones, reflecting the structure of residential precincts, neighbourhood centres, the district centre, and other commercial/light industrial zones. This structure provides a good level of detail for modelling travel interactions within Buckland Park, and travel movements to/from other parts of Adelaide.

7.2.3 Road network

The road network developed for Buckland Park represents the intent of the structure embedded in the Master Plan, in a manner consistent with DTEI road network coding principles. Road links were coded as:

- arterial links – along the entry boulevard, comprising 2+2 traffic lanes, with posted speeds of 60 km/h
- sub-arterial links – coded as 2 lane roads, with posted speeds of 60 km/h
- distributor/collector roads – coded as 2 lane roads, with posted speeds of 50 km/h.

Local roads are not included in the modelled network.

An initial road network was developed for 2031, to enable assessment of traffic impacts at this stage of site occupation.

The external road network, i.e. outside of Buckland Park, was provided by DTEI, and included the Northern Expressway and Northern Connector in respective future networks (Northern Expressway from 2011, and the Northern Connector from 2016).

7.2.4 Public transport network

An initial bus route structure was defined for Buckland Park for 2031, with the assistance of the Passenger Transport Division (PTD) of DTEI. The principles adopted in defining this network were to:

- Define a structure for peak services, consistent with the peak hours modelled in MASTEM.

- Establish a set of services that would enable internal passenger travel to destinations within Buckland Park, and to external regional destinations. The services thus were designed to link residential precincts with district (DC) and neighbourhood (NC) centres and with other employment nodes. Characteristics included:
  - route spacing approximately 1 km (target 800 m but influenced by the road grid spacing)
  - stop spacing in the order of 300–350 m
  - routes more direct nearer to the DC and NCs, less direct nearer to the outer route termini
  - peak routes assumed to extend as trunk services beyond Buckland Park to three external destinations: Munno Para, Elizabeth and Salisbury commercial precincts, including connections to the rail network at each location
  - interpeak bus routes (not modelled) were assumed to have a more local focus, feeding to schools, commercial/retail and community facilities

  The overall aim of bus service provision, indicatively commencing early in the development staging of Buckland Park, is to reduce the need for households to purchase a second car, and to provide access to facilities and services in Virginia (and other major northern centres) prior to their establishment within Buckland Park.

The SA Government has committed to the upgrade of the suburban rail network. The second stage of this upgrade could include the Gawler line. Such an upgrade would provide an

opportunity for the conversion of the freight line to Virginia for suburban services connected to the Metropolitan network. It is understood that most freight services would be diverted to a new freight line to be located within the Northern Connector corridor (source: DTEI briefings as part of Northern Connector project). It has not been possible to effectively model a passenger rail extension to Virginia within the current version of MASTEM, which does not have a satisfactory facility to model park-and-ride (P&R) access. (This is important as notionally, P&R would likely form the major access mode to a station at Virginia.) In the absence of this capability, a first principles approach to assessment of rail potential was developed, and this is described in Appendix A. Allowance for the effects of a shift from car driver to rail passenger travel has been included in the assessment process.

7.2.5 Summary model outputs

Key transport system performance measures derived from the MASTEM model runs, and as discussed later in this report, include:

- Mode shares x year.
- Trip capture rates x year (these refer to the level of trips generated by residents of Buckland Park, and whose travel needs are met by facilities within the development rather than travelling outside to external locations). These rates are partially a reflection of the remoteness of Buckland Park from other major commercial facilities, and also a function of the scale of facilities to be provided within Buckland Park.
- Summaries of traffic and public transport passenger volumes – within Buckland Park and externally. These summaries of overall movements are supplemented by select link analyses to quantify the patterns of external movements.
- Assessment of the impacts on a rail extension to Virginia, in the form of reduced car travel levels.

It is noted that the model outputs are a function of the assumed land use distributions within the Buckland Park Master Plan, the calibrated model characteristics in MASTEM, and the transport networks. The relative location of Buckland Park vis-à-vis other major employment, retail and commercial nodes in the wider region will result in relatively higher proportions of trips having destinations satisfied by facilities within Buckland Park than might occur in other areas. This outcome translates into reduced numbers of trips being loaded onto the road network outside of the development.

7.2.6 MASTEM peak model limitation

During early stages of the modelling process, a limitation was detected in MASTEM with respect to the way in which peak factors were calculated (to derive peak trip matrices from the modelled daily matrices). This issue has since been addressed by DTEI, but not in time to undertake the traffic demand assessment for this proposal. A workaround adjustment process was derived (and submitted to DTEI on 18 August 2008), and verbally agreed to by DTEI at a meeting held on 12 September 2008. This process has been applied, to produce the peak forecasts that underpin the traffic analyses documented in this report (Chapter 9).

7.3 Summary traffic forecasting results

This section reports summary trip capture rates and mode shares. More detailed reporting and analysis of traffic impacts is provided in Chapter 9.

7.3.1 Trip capture rates

These rates represent a measure of the proportions of trips generated by residents of Buckland Park that are satisfied by employment and community facilities planned as part of the proposal. Low capture rates would signify that travel demands cannot be met within Buckland Park, with residents having to travel to destinations elsewhere in Adelaide. High rates would signify that the level of employment and services will largely meet the demands of residents.

Table 7.1 reports the estimates of trips generated by each trip purpose for each design year, and the proportion that have destinations within Buckland Park. Note that the table also includes indicative outcomes for 2036, when Buckland Park is assumed to have been fully occupied.

Table 7.1 Forecast trip capture rates by design year (% of trips generated)

Trip purpose	No. of daily trips generated	% captured
2036[1]		
Home-based work	25,288	33%
Home-based education	8,931	66%
Home-based shop	15,487	98%
Home-based recreation	22,345	88%
Home based personal business	18,456	89%
Home-based other	2,229	97%
Non home based work	4,269	81%
Non home based other	26,131	92%
Total	**123,136**	**100%**
2031		
Home-based work	20,722	28%
Home-based education	7,309	68%
Home-based shop	12,799	98%
Home-based recreation	18,500	88%
Home based personal business	15,257	89%
Home-based other	1,839	97%
Non home based work	3,601	79%
Non home based other	20,305	91%
Total	**100,332**	**76%**
2026		
Home-based work	14,269	25%
Home-based education	4,988	67%
Home-based shop	8,587	98%
Home-based recreation	12,500	88%
Home based personal business	10,269	91%

Trip purpose	No. of daily trips generated	% captured
Home-based other	1,243	97%
Non home based work	2,313	88%
Non home based other	14,134	92%
Total	**68,303**	**76%**
2021		
Home-based work	7,356	16%
Home-based education	2,539	60%
Home-based shop	4,428	95%
Home-based recreation	6,416	85%
Home based personal business	5,258	90%
Home-based other	642	94%
Non home based work	1,057	84%
Non home based other	5,150	88%
Total	**32,846**	**70%**
2016		
Home-based work	1,655	3%
Home-based education	581	0%
Home-based shop	1,000	78%
Home-based recreation	1,445	72%
Home based personal business	1,199	77%
Home-based other	145	84%
Non home based work	155	66%
Non home based other	799	79%
Total	**6,979**	**52%**

Source: MASTEM, Master Plan land use forecasts
[1] Indicative forecasts for 2036

Key findings are:

- The growth in employment, retail and other community facilities over time result in an increasing level of trip capture within Buckland Park. This is particularly the case for work trips. The importance of these levels of employment and facilities being provided cannot be understated in terms of self containment of travel requirements. This will lead to improved levels of travel sustainability, and reduced impacts in terms of external travel demands on the regional road network.

- The table shows high levels of trip containment at later stages of development for all non work trip purposes. This outcome is reasonable, and is a direct reflection of the level of development of facilities in Buckland Park, and also a reflection of the trip distribution model functions in MASTEM – residents making non work trips tend to have a more local focus. The increase in the work trip capture rate from 2031 to 2036 reflects a very significant increase in assumed employment over the period.

- The capture rates for work trips reflect the fact that employed persons, wherever they live in Adelaide, typically have very diverse patterns of work destinations, with much longer average trip lengths for travel to work. This is also the case for Buckland Park. Further analysis of travel patterns shows that a very high proportion of work trips have

destinations within the northern Adelaide Metropolitan area, generally to the north of Grand Junction Road.

7.3.2 Trip mode shares

MASTEM forecasts trips for five separate modes: car driver, car passenger, public transport cycle, and walk. The mode shares reflect relative travel times and costs for trip making to various destinations by the respective competing modes, and the availability of destinations for the various trip purposes; thus if the numbers of destinations within Buckland Park are relatively low, (reflected by lower trip capture rates), then there will tend to be an increase in motorised modes at the expense of non-motorised alternatives for longer external trips. These modal outcomes are also very much driven by the calibrated mode choice parameters within the MASTEM model.

Table 7.2 summarises forecast mode shares by design year for trips wholly contained within Buckland Park, and for trips from origins or to destinations outside of Buckland Park.

Main conclusions drawn from the table are:

7.3.2.1 Internal trips

- Car mode shares increase over time within Buckland Park as travel distances between residential precincts and major trip destinations (District Centre, Neighbourhood Centres and other employment nodes) increase over time.
- Public transport (bus) ridership levels remain relatively consistent in the 3.7-4.8% range, increasing over time.
- Walk/cycle shares are initially high (59.8%) but marginally decline over time as distances to destinations in Buckland Park increase (refer to comment above for car shares).

7.3.2.2 External trips

- Car mode shares remain high in the 72-75% range. This is expected, given the length of trip distances and travel times to external destinations.
- Public transport mode shares are shown to marginally decrease over time from 7% in 2016 to 4.3% in 2036. This trend is considered to be a reflection of increasing travel distances (and hence times) to (mainly) external work trip destinations; public transport (bus) becomes relatively less attractive for longer trips, especially where there is a diverse pattern of destinations.
- Walk/cycle shares are low, reflecting long travel distances to external destinations.

Table 7.2 Summary Trip Mode Shares 2016 to 2031: Daily Trips

Mode	Internal Trips[1]		External Trips[2]	
	Number	%	Number	%
2031				
Car Driver	36,983	38.8%	69,388	74.7%
Car Passenger	11,170	11.7%	18,392	19.8%
Public Transport	4,623	4.8%	3,995	4.3%
Cycle/Walk	42,584	44.7%	1,132	1.2%
Total	**96,360**	**100.0%**	**92,907**	**100.0%**
2031				
Car Driver	29,334	38.5%	57,874	74.1%
Car Passenger	8,955	11.8%	15,287	19.6%
Public Transport	3,637	4.8%	3,816	4.9%
Cycle/Walk	34,274	45.0%	1,082	1.4%
Total	**76,200**	**100.0%**	**78,059**	**100.0%**
2026				
Car Driver	19,186	37.0%	40,123	73.4%
Car Passenger	5,865	11.3%	10,916	20.0%
Public Transport	2,405	4.6%	3,098	5.7%
Cycle/Walk	24,428	47.1%	495	0.9%
Total	**51,884**	**100.0%**	**54,632**	**100.0%**
2021				
Car Driver	6,649	28.7%	19,218	73.3%
Car Passenger	2,399	10.4%	5,061	19.3%
Public Transport	853	3.7%	1,653	6.3%
Cycle/Walk	13,227	57.2%	270	1.0%
Total	**23,128**	**100.0%**	**26,202**	**100.0%**
2016				
Car Driver	954	26.1%	5,280	71.9%
Car Passenger	379	10.4%	1,458	19.9%
Public Transport	136	3.7%	520	7.1%
Cycle/Walk	2,182	59.8%	84	1.1%
Total	**3,651**	**100.0%**	**7,342**	**100.0%**

Source: MASTEM forecasts

[1] Trips with both origin and destination within Buckland Park

[2] Trips with an origin or destination within Buckland Park but not both.

8. Assessment of site access requirements

8.1 Site access strategy

A site access strategy has been developed for Buckland Park, as illustrated in Figure 8.1. This strategy has been prepared in reflection of forecast peak traffic movements into/out of Buckland Park up to about 2021. The overarching objective of the strategy is to provide a good level of access to Buckland Park, in a form that is cost effective in the interim, and which provides the basis for further improvement over time in response to growing traffic demand generated by Buckland Park.

The main elements of the strategy comprise:

- The main access into Buckland Park will be via an at-grade signalised intersection at the Port Wakefield Road/Angle Vale Road junction. This intersection will be built at the commencement of the development and will provide access for construction traffic initially, prior to commencement of residential traffic, aiming to maintain efficiency and safety.

  Traffic capacity calculations for the main access intersection at Port Wakefield Road suggest that the proposed at-grade signalised intersection will perform adequately through to 2021 and beyond. Traffic performance will be monitored over time; when performance is found to fall short of acceptable service levels some time after 2021, options for providing safe and efficient Buckland Park access and egress will need to be considered. Options include upgrades to the main entrance boulevard intersection, connections to and construction of a second at-grade intersection possibly provided at Park Road, or grade separated interchange connections to Port Wakefield Road. Such improvements would not likely be expected before 2021, almost 10 years into the construction program.

- A left-in only slip lane is proposed off Port Wakefield Road for northbound traffic to enter the District Centre precinct. (Exit for traffic to destinations outside of Buckland Park would be via the main entry boulevard intersection.) This slip lane will be designed to AustRoads standards, and be located approximately 500 metres south of the main entry boulevard intersection.

- Emergency access to Buckland Park, in the event of unexpected closure of the main entry boulevard or intersection at Port Wakefield Road, would be via Buckland Road. This is an existing road corridor linking Park Road with the site; it is largely unsealed with a gravel pavement surface, and would be maintained as an emergency access road only. To avoid usage of this road by future residents of Buckland Park as an alternative route (to avoid entering/departing via the main boulevard/Port Wakefield Road intersection), it is proposed that Buckland Road be gated. It is expected however, the provision of high quality direct road links onto Port Wakefield Road will deter drivers from using this route.

  A secondary emergency access road is also proposed at the western end of Park Road into the southern end of Buckland Park. This roadway would become active only once the south western section of the proposal is constructed, this being anticipated in 2032-2036.

8.2 DTEI requirements for site access

The Department for Transport, Energy and Infrastructure have advised that the main entry boulevard intersection at Port Wakefield Road/Angle Vale Road can be via an at-grade signalised intersection, providing that the form of the intersection provides a safe operating environment for all road users.

DTEI have advised that posted traffic speeds on the Port Wakefield Road approaches to the intersection would need to be set at 80 km/h, to ensure traffic can safely stop at the signals if required.

8.3 Main entry boulevard access

8.3.1 Estimation of traffic generation

8.3.1.1 Background

The estimation of both the timing and volume of traffic likely to be generated by Buckland Park as it develops over time is the key input to determining the functional requirements for the at-grade intersection to 2021 and beyond.

Considerations in making this determination include:

- The role of Port Wakefield Road as a high speed national highway and freight route. This is a 2 + 2 lane road, with a median width of approximately 18 m.
- The staging of Buckland Park, and the expected growth in traffic demand to the site during construction of site works, construction of residences, followed by occupation of residences.
- The numbers and patterns of traffic movements to/from the site over the course of an average weekday, and how these impact on traffic movements along Port Wakefield Road – from safety and traffic operational performance perspectives.

The following estimates are based on the email from Connor Holmes dated Wednesday 10 September 2008 confirming a maximum development yield of 12,000 dwellings, together with a summary of annually created lots and occupied dwellings between 2010 and 2035, as tabulated below.

Table 8.1 Lot roll out (as issued by Connor Holmes)

Year	Date	Lots created	Lots created cumulative total	Dwellings occupied	Dwellings occupied cumulative value
1	2010	0	0	0	0
2	2011	120	120	0	0
3	2012	160	280	0	0
4	2013	200	480	120	120
5	2014	300	780	160	280
6	2015	400	1,180	200	480
7	2016	480	1,660	300	780

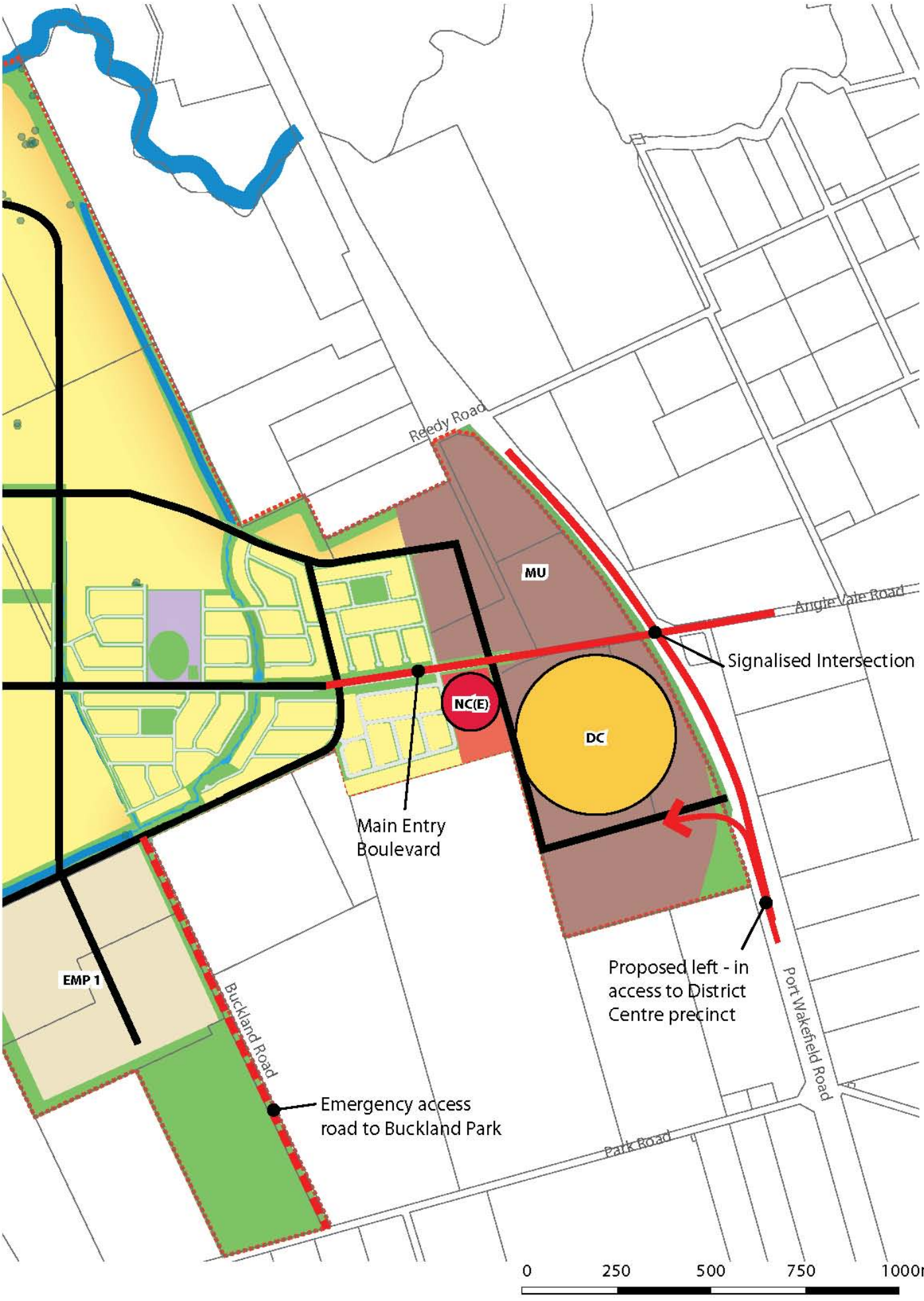


FIGURE 8.1
Proposed access strategy

Year	Date	Lots created	Lots created cumulative total	Dwellings occupied	Dwellings occupied cumulative value
8	2017	600	2,260	400	1,180
9	2018	600	2,860	480	1,660
10	2019	600	3,460	600	2,260
11	2020	640	4,100	600	2,860
12	2021	640	4,740	600	3,460
13	2022	640	5,380	640	4,100
14	2023	640	6,020	640	4,740
15	2024	640	6,660	640	5,380
16	2025	640	7,300	640	6,020
17	2026	640	7,940	640	6,660
18	2027	640	8,580	640	7,300
19	2028	640	9,220	640	7,940
20	2029	640	9,860	640	8,580
21	2030	640	10,500	640	9,220
22	2031	640	11,140	640	9,860
23	2032	640	11,780	640	10,500
24	2033	220	12,000	640	11,140
25	2034	0	12,000	640	11,780
26	2035	0	12,000	220	12,000

8.3.1.2 Construction traffic

Key site construction activities expected over the first 6 years are summarised below; these reflecting realistic estimates sourced from the proponent's previous construction experience.

- Civil works on site:
  - allow ongoing civil works from January 2011 to December 2016
  - approximately 1,660 residential allotments will be prepared over this timeframe, of which 30 will be for display homes.
- Home construction:
  - construction of 1,660 homes to commence in December 2011
  - completion of 1,660 homes in five years – by December 2016.

The process of lot turnoff followed by home construction will continue in an ongoing cycle.

Based on similar large scale residential developments, the following assumptions have been made in determining the expected level of traffic generation during construction:

- Civil Works and Lot Turnoff
  - average number of pieces of machinery on site per day 8
  - average number of workers on site per lot per day[1] 0.12
  - average number of truck/service deliveries per lot per day[2] 0.03
- House Construction
  - average number of tradesman per day per house[3] 2.5
  - average number of building supply deliveries per house per day[3] 1

8.3.1.3 Residential traffic

It has been assumed that in the first six years:

- there are limited employment, commercial, educational and other community facilities within Buckland Park
- demands for trip making will be met in Virginia/Two Wells, further afield in Munno Para, and in Gawler and Elizabeth
- average number of trips per day per household[4] 4

8.3.1.4 Display home traffic

Display home visitor traffic has been discounted due to the very minor number of vehicles during the weekday peak hours; the majority of display home traffic is generally generated on weekends and during the weekday inter-peaks.

8.3.1.5 Traffic generation

Estimates of future daily traffic movements to and from the Buckland Park main entry boulevard/Port Wakefield Road/Angle Vale Road intersection for both 2016 and 2021 AM and PM peak hours are summarised in Table 8.2. Estimates of future traffic demands have been undertake using DTEI's MASTEM model, as described in section 7 above.

Table 8.2 Estimated daily peak hour movements at the Buckland Park main entry boulevard/Port Wakefield Road/Angle Vale Road intersection

Year	Peak	Traffic generation (trips per day)											
		Port Wakefield Rd (north)			Angle Vale Road (east)			Port Wakefield Rd (south)			Buckland Park entrance (west)		
		L	T	R	L	T	R	L	T	R	L	T	R
2016	AM	33	402	30	50	34	18	26	292	15	20	81	215
	PM	32	378	30	50	122	30	149	445	15	20	88	52
2021	AM	38	439	45	55	161	22	99	308	18	30	360	665
	PM	35	415	45	55	469	32	541	493	18	30	321	181

Source: Consultant analysis

[1] *As per advice from Walker (= 1 worker per 8.5 lots), with staggered arrivals/departures*
[2] *As per advice from Walker (= 1 delivery per 34 lots), with staggered arrivals/departures*
[3] *As per advice from Walker, staggered arrivals/departures*
[4] *Equals four round trips per day (i.e. 8 trip ends per day)*

8.3.2 Main entry boulevard intersection layout

The main entry boulevard access point at Port Wakefield Road will be a signalised intersection, with four approaches. The signalised intersection layout proposed is expected to be able to cater for forecast traffic demands up to and beyond 2021.

The proposed intersection layout is designed to fully utilise existing Port Wakefield Road pavement, with upgrade of the Angle Vale Road approach as needed to tie in with the upgraded intersection. The proposed functional layout will maintain the existing two through lanes in each direction on Port Wakefield Road, and provide a short left turn continuous lane into Buckland Park; short right turn lanes will also be provided on Port Wakefield Road for access to Buckland Park and Angle Vale Road.

The western approach from within Buckland Park will require a single left turn slip lane to Port Wakefield Road (north), a single through lane to Angle Vale Road and two right turn lanes to Port Wakefield Road (south). The Angle Vale Road approach will require a short left turn slip lane and a short right turn lane in addition to a single through lane.

Figure 8.2 shows a schematic layout of the initial requirements of the signalised intersection at Port Wakefield Road catering for 2021 traffic forecasts.

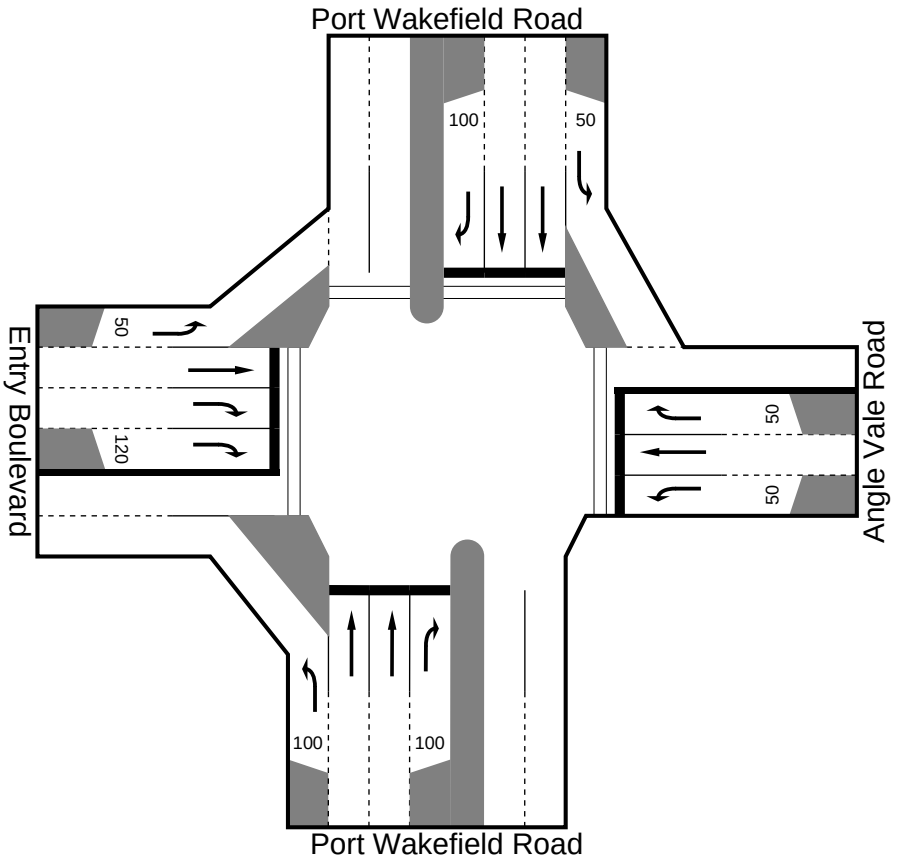


FIGURE 8.2
Schematic layout of main entry boulevard signalised intersection

9. Impact assessment

The impact assessment presented in this chapter relates to 2031, which represents the latest year for which traffic forecasts are available. The purpose of reporting impact assessments for 2031 was to provide an overview of the indicative ultimate impact of traffic generated by Buckland Park, and thence to provide a basis for the ongoing planning and design of the entry boulevard road and associated intersections.

The exception to this approach relates to the functional planning and design of the entry boulevard with Port Wakefield Road and Angle Vale Road. This has been undertaken to provide a design concept (section 8.3.2) for traffic generated during the first 10 years of the project.

9.1 Road network

9.1.1 Introduction

This section presents the results of an assessment of the impacts of traffic generated by the Buckland Park proposal on the internal and external road networks. The assessment is based on the outcomes of the traffic modelling process using the DTEI MASTEM travel model. It focuses on:

9.1.1.1 Internal network

The assessment of the internal road network, and how it is staged over time, is presented in section 9.1.2. This considers the following main issues, based on an analysis of forecast traffic growth from 2016 (base modelling year) through to 2031 (and indicatively to 2036):

- The required road hierarchy appropriate for Buckland Park, having regard to the ultimate form of the Master Plan, the role and functions that each road perform, how traffic demand is expected to grow over time, and the need to provide for the staged development of efficient bus operations.
- The adequacy of the proposed network to accommodate the forecast growth in traffic demands, with reference to internal road capacity, and the capacity and operation of the proposed main entry boulevard at-grade signalised intersection at Port Wakefield Road.
- Performance of the network with respect to road spacing, network accessibility.
- Indicative form of internal road junctions. Specific assessment of the two major intersections along the entry boulevard has been undertaken for 2031/2036, as it is important that the performance of these intersections does not impact on the operation of the main entry boulevard signalised intersection at Port Wakefield Road. These intersections need to be designed and constructed as part of the Master Plan's Stage 1.

9.1.1.2 External network

The assessment of the external road network is presented in section 9.1.3. It focuses on traffic impacts from the 2031 forecasts, and also presents broad traffic implications for 2036. The main issues addressed comprise:

- impacts on the arterial road network – Port Wakefield Road and Angle Vale Road

- impacts on the local road network (insofar as detail in the DTEI road network permits)
- impacts of traffic on Virginia
- broad impacts on local road users.

9.1.2 Network structure

9.1.2.1 Capacity of the road network to accommodate growth in traffic demand

The internal road network within Buckland Park, and the external linkage via the intersection at Port Wakefield Road, will be progressively developed and extended over time to accommodate growth in traffic demand as residential precincts roll out. Decisions on staging will form a key part of the ongoing planning and design process.

Key issues of relevance to this traffic impact report are seen to comprise:

- The capacity of the intersection at Port Wakefield Road to accommodate the forecast growth in traffic demand generated by Buckland Park. As noted in section 8.1, it is proposed that all access into/out of Buckland Park take place via this at-grade signalised intersection. It is important to confirm that the proposed intersection has the capacity to accommodate future traffic demand.

- Form and capacity of the first two intersections along the entry boulevard west of the entry boulevard/Port Wakefield Road intersection. These intersections will need to be planned and designed as part of Stage 1, and it is therefore important to assess what form they should take, and that they have the capacity to accommodate forecast 2036 traffic.

- The capacity of the proposed road network (as reflected in the hierarchy) to accommodate the growth in internal traffic demand as additional stages of residential development take place within Buckland Park.

9.1.2.2 Main entry boulevard/Port Wakefield Road/Angle Vale Road intersection capacity

The proposed main entry boulevard intersection at Port Wakefield Road is a signalised intersection, as described in section 8.3. The performance of this proposed intersection has been assessed using SIDRA Intersection software, based on 2021 traffic forecasts, for AM and PM peak hour periods. Analysis undertaken confirms that the form of intersection proposed will meet forecast traffic demands to 2021 and beyond. Following paragraphs summarise key outcomes of the analysis. Summary performance measures from the SIDRA analyses are presented in Appendix B.

Summary results from the SIDRA analysis for the main entry boulevard/Port Wakefield Road/Angle Vale Road intersection are contained in Appendix B.1. This shows the proposed intersection configuration, 2021 approach volumes, delays, queue lengths and degrees of saturation. The main findings from the analysis are:

- Port Wakefield Road (north) approach:
  - In the AM peak, the estimated queue length is 67 m, and in the PM peak 81 m.
  - Degree of Saturation is 0.81 and 0.68 in the AM and PM peaks respectively.

- Angle Vale Road (east) approach:
  - In the AM peak, the DoS is estimated to be 0.66 in 2021, and 0.86 in the PM peak.

- The estimated queue length east along Angle Vale Road is 48 m in the AM peak and 171 m in the PM peak. In the PM peak, the queue length extends past the Supple Road junction with Angle Vale Road.

- Port Wakefield Road (south) approach:
  - In the AM peak, the estimated queue length is 48 m, and in the PM peak 107 m. The PM peak queue would not extend back into Port Wakefield Road, as there is a proposed free left turn into Buckland Park.
  - Degree of Saturation is 0.59 and 0.85 in the AM and PM peaks respectively.

- On the Buckland Park (west) approach:
  - In the AM and PM peaks, the Degrees of Saturation (DoS) on this approach are estimated to reach 0.91 and 0.88 in the 2021 respectively.
  - The approach flow has major movements to both Angle Vale Road and Port Wakefield Road (south).
  - Queue lengths reach a maximum 111 m in the AM peak and 128 m in the PM peak. This queue does not extend back through the proposed first internal intersection along the main entry boulevard (estimated to be in the order of 200 m from Port Wakefield Road).

In summary, the SIDRA Intersection performance measures confirm that satisfactory operation of the entry boulevard intersection with Port Wakefield Road can be expected beyond 2021. It is recognised, nevertheless, that traffic patterns can change over time, and these will need to be monitored to assess the need for any traffic management or other measures in the future to accommodate unforseen traffic impacts.

Beyond 2021, options for increasing access capacity include:

- Upgrade of the initial signalised intersection.

- Construction of a second signalised intersection between Park Road and Port Wakefield Road. (As an alternative access/egress for Buckland Park, this would require upgraded linkages between Buckland Park and Park Road, and an upgrade of the Park Road standard.)

- A grade separation of the signalised intersection at Angle Vale Road. Such a concept envisages locating Port Wakefield Road on an overpass of the initial signalised intersection. This concept would have the combined benefits of enabling staged construction of an overpass with traffic operations on Port Wakefield Road continuing at an acceptable level, with operation of the proposed signalised intersection to also continue. This form of grade separation would also effectively enable the removal of a signalised intersection from Port Wakefield Road operations.

First intersection on Entry Boulevard west of Port Wakefield Road Intersection

This intersection is a four way junction, with the northern approach leg being a sub-arterial link via a mixed use zone through the northern part of Buckland Park; the southern approach leg is an arterial road providing access to the District Centre, (and which is likely to need to be constructed as a 2+2 lane road past the District Centre to accommodate the future traffic movements expected to access the Centre).

SIDRA analysis results for this intersection are provided in Appendix B.2 of this report. The results show that:

- The intersection will need to be constructed with signalised control in place by 2031.

- In the AM peak hour, all measures of performance are satisfactory both in 2031 and 2036. The estimated queue lengths on the western approach (which may impact on the second intersection on the entry boulevard) are 271 m and 304 m respectively in 2031 and 2036; these lengths are less than the proposed separation distance between the two intersections.

- In the PM peak hour, all performance measures are satisfactory. The estimated queue lengths on the eastern approach (back towards the Port Wakefield Road intersection) are estimated at 291 m and 346 m respectively in 2031 and 2036; these may impact on the main entry boulevard intersection with Port Wakefield Road at that time. These queue lengths are expected to be contained within the available storage length in 2021.

Further refinement to the design layout will be made as part of the detailed design phase for the intersection. There may be potential for the intersection to be initially constructed as a roundabout, but this will require further investigation.

Second intersection on Entry Boulevard west of District Centre

This intersection is a four way junction, with the northern approach leg being a sub-arterial link via a residential precinct in Stage 1 thence through the northern part of Buckland Park; the southern approach leg is a distributor road) providing access along the southern side of Stage 1.

SIDRA analysis results for this junction are provided in Appendix B.3. These show that:

- The intersection can satisfactorily operate as a roundabout through to 2036.

- In the AM peak hour, all measures of performance are satisfactory both in 2031 and 2036.

- In the PM peak hour, all performance measures are satisfactory. The estimated queue lengths on the eastern approach (back towards the first intersection) are estimated at 73 m and 93 m respectively in 2031 and 2036; these can be accommodated within the proposed separation distance between the intersections (nominally 400 m).

Further refinement to the design layout will be made as part of the detailed design phase for the intersection.

9.1.2.3 Staging of road construction

As noted above, staging of road construction will be managed during the detailed design and planning approvals process for each successive stage, ensuring the required capacity and connectivity is achieved. There is, nevertheless, potential to stage construction of the two carriageways along the entry boulevard. Potentially a single carriageway could be constructed initially, with the second carriageway being added when warranted by demand. If this approach was to be adopted, then staging of the first and second intersections would also need to be planned and managed.

9.1.2.4 Road structure

The Master Plan design process included the identification of a proposed road network down to the level of collector roads. This network provides connectivity throughout Buckland Park,

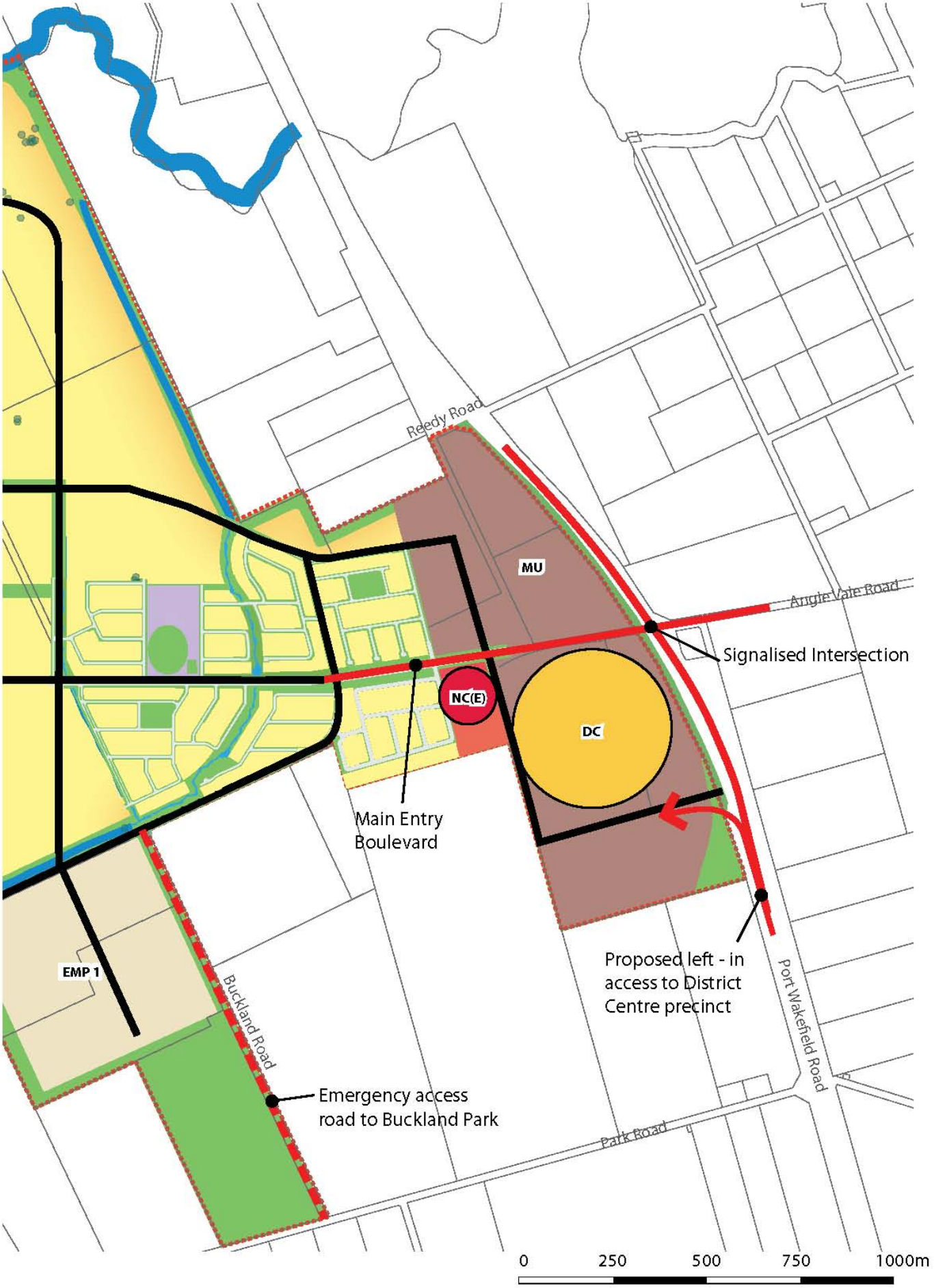


FIGURE 9.1
Entry boulevard intersection

between residential precincts and education/employment precincts, with external linkages to Port Wakefield Road. The road layout and established hierarchy seek to balance the distribution of traffic through the land division (e.g. arterial roads are not directly connected to the local road network).

The arterial/sub-arterial/distributor network has a grid structure, with a spacing of approximately 1 km; this will enable efficient bus operations through Buckland Park.

9.1.2.5 Form of road junctions

Intersection treatments are expected to require signals at key locations along the entry boulevard, with roundabouts at other locations. Functional design of intersections will be determined during the later detailed design of subsequent stages, but each will have the following characteristics:

- In general, junctions are created between adjacent (or at worst, second adjacent) road classes. Junctions between Arterial or Sub-Arterial and Collectors or Local Roads are actively avoided.
- Four-way junctions will generally be managed via the incorporation of roundabouts, unless the warrant for traffic signals is met.
- Stop sign management of four-way junctions will be avoided.

9.1.3 External traffic impacts

The assessment of traffic impacts on the external road network is based on an analysis of forecast link flows for 2031, (with reference to indicative 2036 volumes); the assessment also makes reference to select link traffic assignments which demonstrate the pattern of movements of traffic generated by Buckland Park residents/activity centres. The potential impacts of a commuter rail extension to Virginia on AM peak traffic movements in 2031 are also assessed.

9.1.3.1 Arterial road impacts

This section focuses on impacts on Port Wakefield Road and Angle Vale Road.

Select link analysis

Select link plots have been prepared for AM and PM peak hour movements for 2031, for traffic movements on the entry boulevard inside Buckland Park immediately adjacent to the intersection with Port Wakefield Road. These plots (refer Appendices C.1 and C.2 respectively) show the movements of traffic on this link on external links (and on the internal Buckland Park road network). The main findings drawn from the plots are:

AM Peak

There is a relatively balanced split between exiting trips on Port Wakefield Road and Angle Vale Road. This pattern reflects high proportion of travel demands to destinations in the northern suburban area for work (principally) and other purposes.

- Trips along Port Wakefield Road split between Waterloo Corner Road (to Salisbury) and to destinations further to the south (including the CBD). These total about 1,600 trips to

the south. South of the Northern Expressway interchange, southbound trips split in similar proportions between Port Wakefield Road and the Northern Connector.

- Trips on Angle Vale Road (1320 trips east of Port Wakefield Road) have major destinations towards Angle Vale/Gawler, with secondary movements via Old Port Wakefield Road to Virginia and on via Penfield Road towards Edinburgh Parks. East of Old Port Wakefield Road, the increase in traffic is some 830 trips in the AM peak.

PM Peak

The PM peak hour plot shows a similar pattern as for the morning peak, but with higher numbers of trips returning to Buckland Park via Angle Vale Road compared to Port Wakefield Road. Northbound movements on Port Wakefield Road past Buckland Park total in the order of 1,060 trips.

Impacts on link flows

Summary details of peak traffic movements attributable to Buckland Park are reported in Table 9.1. This shows forecast peak flows for the 2031 case of Buckland Park not being constructed, and cases for 2031 and (indicative) 2036 flows with Buckland Park assumed to be constructed.

Table 9.1 Forecast peak traffic impacts on Port Wakefield Road and Angle Vale Road (number of trips)

Year/peak period	Port Wakefield Road[1]	Angle Vale Road	
		West of Old Port Wakefield Road	East of Old Port Wakefield Road
AM Peak			
East/South			
2031-no BP	430	40	30
2031-with BP	2,020	1,230	800
2036-with BP	2,390	1,340	980
West/North			
2031-no BP	300	20	20
2031-with BP	620	800	570
2036-with BP	760	990	700
PM Peak			
East/South			
2031-no BP	430	40	30
2031-with BP	960	1,300	1,030
2036-with BP	1,190	1,580	1,260
West/North			
2031-no BP	500	40	30
2031-with BP	1,700	1,605	1,140
2036-with BP	2,090	1,670	1,290

Source: MASTEM forecast analysis

[1] South of intersection at Angle Vale Road

The table shows that Buckland Park is forecast to generate very significant traffic impacts on both Port Wakefield Road and Angle Vale Road:

- The growth in peak demand on Port Wakefield Road can be accommodated by the existing 2+2 lane cross section. Its impact on level of service is discussed below.
- The forecasts suggest that Angle Vale Road would need to be widened to a 2+2 lane cross section between Port Wakefield Road and Old Port Wakefield Road (i.e. 1.3 km) between 2028 and 2031.
- Additional analysis of 2036 forecasts on Angle Vale Road east of Old Port Wakefield Road shows that the existing lane cross section should be able to accommodate growth in traffic attributable to Buckland Park. (Maximum peak flows are in the order of 1300 vph between Gawler Road and Heaslip Road.)

Impact of potential rail extension to Virginia

It was estimated (Appendix A) that a train service to Virginia might reduce AM peak traffic movements to the CBD by 285 cars in 2031. If achieved this would have two impacts:

- Peak southbound traffic movements on Port Wakefield Road would reduce from 2,020 to some 1,735 trips. This would impact on Port Wakefield Road only in terms of level of service (see below).
- In the order of an additional 285 cars would access the train at Virginia as park-and-riders. This would increase peak traffic flows on Angle Vale Road between Port Wakefield Road and a rail station to about 1,645 in the AM. This increase would be accommodated within the duplication of Angle Vale Road as noted above.

Impacts on level of service on Port Wakefield Road

DTEI have stipulated a requirement that a level of service (LOS) B standard should be maintained on Port Wakefield Road with Buckland Park in place. (This LOS standard reflects operation of the road as a key national highway freight route.)

Estimates of peak LOS in 2031 and indicatively in 2036 have been derived, as reported in Table 9.3; these reflect LOS criteria as described by AustRoads[5], and as summarised in Table 9.2.

Table 9.2 AustRoads level of service criteria

Criterion	Level of service				
	A	B	C	D	E
Max. service flow rate (pcu/h/l)	700	1100	1400	1750	2000
V/C ratio	0.35	0.55	0.70	0.88	1.00

Source: AustRoads

[5] *AustRoads Guide to Traffic Engineering Practice Part 2: Roadway Capacity for multilane roads with a 110 km/h design speed.*

Table 9.3 Estimated peak level of service on Port Wakefield Road

Year	Period	Direction	Car volume (vph)	Truck volume (vph)	No of traffic lanes	PCUs	PCU/lane/ hour	LOS
2031	AM	Northbound	620	80	2	820	410	A
		Southbound	2020	90	2	2245	1123	C
	PM	Northbound	1700	80	2	1900	950	B
		Southbound	960	70	2	1135	568	A
2036	AM	Northbound	760	70	2	935	468	A
		Southbound	2390	90	2	2615	1308	C
	PM	Northbound	2090	90	2	2315	1158	C
		Southbound	1190	70	2	1365	683	A

Source: Consultant analysis
Note: PCU calculations based on an average of 2.5 pcus per heavy truck, reflecting the mix of rigid trucks, semi-trailers, B-doubles and road trains operating on Port Wakefield Road.

The results presented in Table 9.3 suggest that the target LOS B standard may be exceeded by 2031 for southbound AM peak traffic. Whether this will occur will depend on a wide range of future issues including:

- Achieved growth rate of Buckland Park
- Travel patterns of residents, including the potential for increased ride sharing and public transport ridership as the cost of car travel increases. (Section 9.2 considers ways in which these activities can be actively encouraged).

It is recommended that growth in traffic on Port Wakefield Road be monitored over time, to identify the future sources of traffic growth, (for example from Buckland Park or from regional areas to the north of the Gawler River), and to determine a cost attribution method to increase capacity on Port Wakefield Road between Angle Vale Road and the Northern Expressway to 3+3 lanes, to maintain a LOS B standard.

If a rail service was to be extended to Virginia, then LOS B would be maintained in 2031, but marginally exceeded by 2036.

9.1.3.2 Other road impacts

The select link assignment plots in Appendix C also enable the direct impacts of Buckland Park traffic on other local roads east of Port Wakefield Road to be assessed. The main roads (other than Angle Vale Road as described in section 9.1.3.1) impacted are:

- Old Port Wakefield Road
- Penfield Road
- Curtis Road
- Heaslip Road.

Table 9.4 summarises the incremental additional peak traffic movements on these roads in 2031, attributable to Buckland Park. The main outcomes are:

- Incremental growth on Old Port Wakefield Road attributable to Buckland Park is forecast to be in the order of 500 vehicles in the AM peak (southbound), and 735 vehicles in the PM peak (northbound). Part of this traffic has destinations/origins in

Virginia, whilst the balance has destinations/origins in the Edinburgh Parks/Elizabeth area (via Penfield Road). The net traffic volumes on Old Port Wakefield Road are within reasonable service capacity levels.

- Incremental growth on Penfield Road, (the most direct route between Buckland Park and Edinburgh Parks/Elizabeth), is in the order of 258 vehicles in the AM peak (southbound), and 456 vehicles in the PM peak (northbound). The net overall flows on Penfield Road in the respective AM and PM peaks are within service capacity limits of the road.

Table 9.4 Incremental traffic impacts on other roads: 2031

Road	AM peak		PM Peak	
	East/South	West/North	East/South	West/North
Old Port Wakefield Rd				
Incremental traffic[1]	492	220	271	735
Total traffic	690	290	380	990
Penfield Road[2]				
Incremental traffic[1]	258	–	–	456
Total traffic	380	230	170	710
Curtis Road[3]				
Incremental traffic[1]	166	115	249	296
Total traffic	200	150	300	320
Heaslip Road[4]				
Incremental traffic[1]	161	–	–	238
total traffic	**1210**	**1220**	**1360**	**1230**

Source: MASTEM traffic forecasts
[1] Attributable to Buckland Park
[2] East of Old Port Wakefield Road
[3] South/east of Angle Vale Road
[4] Between Penfield Road and Womma Road

- Incremental growth on Curtis Road is in the order of 166 vehicles in the AM peak (southbound), and 296 vehicles in the PM peak (northbound). The net overall flows on Curtis Road in the respective AM and PM peaks are within service capacity limits of the road.

- The forecast incremental flows on Heaslip Road are relatively minor. The increases would comprise those vehicles travelling via Penfield Road to Womma Road, and thence onwards to Edinburgh Parks/Elizabeth.

In summary, whilst there are forecast to be significant movements from Buckland Park along these local roads, the level of increased demand is not likely to impact on their operating function or standards of service.

9.1.3.3 Impacts on Virginia

Traffic generated by Buckland Park will impact on Virginia in two ways:

- Travel to Virginia to access employment/services, especially in the early years of project development.

- Travel through Virginia to the Edinburgh Parks/Elizabeth region as noted in section 9.1.3.2 above.

Table 9.5 summarises the growth in travel in these two categories over the period from 2016 to 2031.

Table 9.5 Growth in traffic to/from and through Virginia: 2016 to 2031[1]

Year	Trips to/from Virginia[4]		Trips through Virginia	
	AM peak[2]	PM peak[3]	AM peak[2]	PM peak[3]
2016	180	220	20	30
2021	220	260	50	60
2026	300	360	130	150
2031	690	990	380	710

Source: MASTEM forecasts
1 Total directional peak traffic movements for each design year
2 Trips to the east/south of Buckland Park
3 Trips to the west/north towards Buckland Park
4 On Old Port Wakefield Road – these include trips passing through to Penfield Road, and intra-regional trips from the north having destinations in Virginia.
5 Measured by movements on Penfield Road just to the east of Virginia.

The main conclusions to be drawn from the table include:

- Incremental growth in peak traffic movements through Virginia to/from Penfield Road are forecast to be relatively small up to 2026. After this time, MASTEM is forecasting a significant increase in peak traffic – in the order of 200 trips in the AM peak, and 560 trips in the PM peak.

- Incremental growth in peak traffic to/from Virginia, inferred from the volumes on Old Port Wakefield Road and Penfield Road, is relatively minor beyond 2016. (This trend is consistent with the creation of activity centres and retail facilities within Buckland Park. It is also a reflection of relatively low proportions of shopping and other personal business trips taking place during peak periods.) It is likely that there will be more significant increases in off-peak traffic movements to/from Virginia over time, but these are currently not modelled within MASTEM.

The forecast increases in through traffic movements (to/from Penfield Road) will have the biggest impact on the roads and intersections within Virginia. There is expected to be a need for longer term traffic management improvements to the two key intersections of Old Port Wakefield Road and Gawler Road and Penfield Road respectively within Virginia. The timing and potential form of such improvements will be better defined in the future, and would be the subject on monitoring of traffic movements through the town over time after Buckland Park begins to roll out.

9.1.3.4 Impacts on local users west of Port Wakefield Road

Traffic generated by Buckland Park will not impact directly on the local road network west of Port Wakefield Road. This is because there is no direct connection proposed for traffic movements between the local network and Buckland Park. (An emergency access route off Park Road via Buckland Road into the site is planned, but this link is not intended for general day to day use by Buckland Park residents.

The major impact on local residents will be in the form of right turn access from Park Road, Thompson Road and McEvoy Road onto Port Wakefield Road as peak traffic movements along Port Wakefield Road increase over time. Alternative access will be provided to/from this wider region west of Port Wakefield Road as part of the Northern Connector project – there are expected to be selected upgrades to the local road network to link into the proposed Waterloo Corner interchange. This will represent a safe route for local traffic to access the Northern Connector/Port Wakefield Road for travel to the south. Travel to the north (with left turns onto local roads) will still be able to be made safely from Port Wakefield Road.

So while Buckland Park will impact on Port Wakefield Road, convenient alternative access/egress will be provided for local residents via upgrades being developed as part of the Northern Connector project.

9.2 Public transport network

9.2.1 Overall objectives

A critical element in the earliest planning for Buckland Park has been the provision of a public transport service that links residential precincts with services, activity centres, schools and employment nodes. This requirement is to provide basic accessibility for persons not owning a car, or to avoid the need for households to purchase a second car.

An efficient and effective public transport system for Buckland Park will also contribute to improving the use of other sustainable transport modes. Thus bus services need to complement the provision of convenient walk and cycle networks within Buckland Park.

It is also important that public transport access be extended beyond Buckland Park, especially in the early years of construction and occupation, when services within Buckland Park are expected to be limited. Thus bus services will need to be linked to external school, shopping and related commercial facilities, and to other long haul rail services to the City.

A broad strategy for service provision has been developed in conjunction with DTEI, and this is outlined below in section 9.2.4.

It is also important that public transport provision within Buckland Park, and on external linkages, contributes to the Government's Strategic Plan. i.e. to achieve overall average ridership levels across Adelaide of 10% mode share by 2018. Potential patronage outcomes for Buckland Park are reported on in section 9.2.3.

9.2.2 Proposed 2031 network

An indicative peak bus period bus route structure was developed in conjunction with DTEI for 2031 (and beyond). This structure formed a key input to the MASTEM modelling of peak and daily travel demand within and into/out of Buckland Park. The broad structure is illustrated in Figure 9.1. It is envisaged that bus route and service arrangements would evolve over time as succeeding stages of the Master Plan are constructed and occupied, potentially to the form as illustrated in Figure 9.3.

Key attributes of the service concept are envisaged to include:

- In 2031, the bus services would be operated by MetroTicket buses under contract to the Government. Within Buckland Park, these services would link residential precincts to schools, neighbourhood centres, the District Centre, and employment nodes. Externally, the routes would indicatively extend as staged bus services to the respective Munno Para, Elizabeth and Salisbury shopping and rail interchanges. Services to Elizabeth and Salisbury could be routed through Virginia, replacing the current Route 900 loop service from Salisbury to Elizabeth.

- Service standards to comprise:
  - route spacing approximately 1 km
  - typical stop spacing in the order of 300–350 m
  - typical peak service headways are envisaged to be at least 15 minutes
  - buses would stop at partially indented bays along the arterial and sub-arterial roads, and within the indented parking bays on distributor and collector roads
  - peak bus services would not operate on local streets.

- In addition to on-street stops, it is envisaged that interchanging would be provided near to the district centre, together with park-and-ride spaces. More limited park-and-ride spaces might also be provided at neighbourhood centres.

- The route structure shown in Figure 9.1 provides a good coverage of residential precincts, with the majority of residents being within an average walk of about 500m of a bus service, consistent with Metropolitan standards. Services are more direct towards the district centre, becoming less direct on the outer fringes. Marginal additional travel times on the outer sections of the routes offset shorter walk access times.

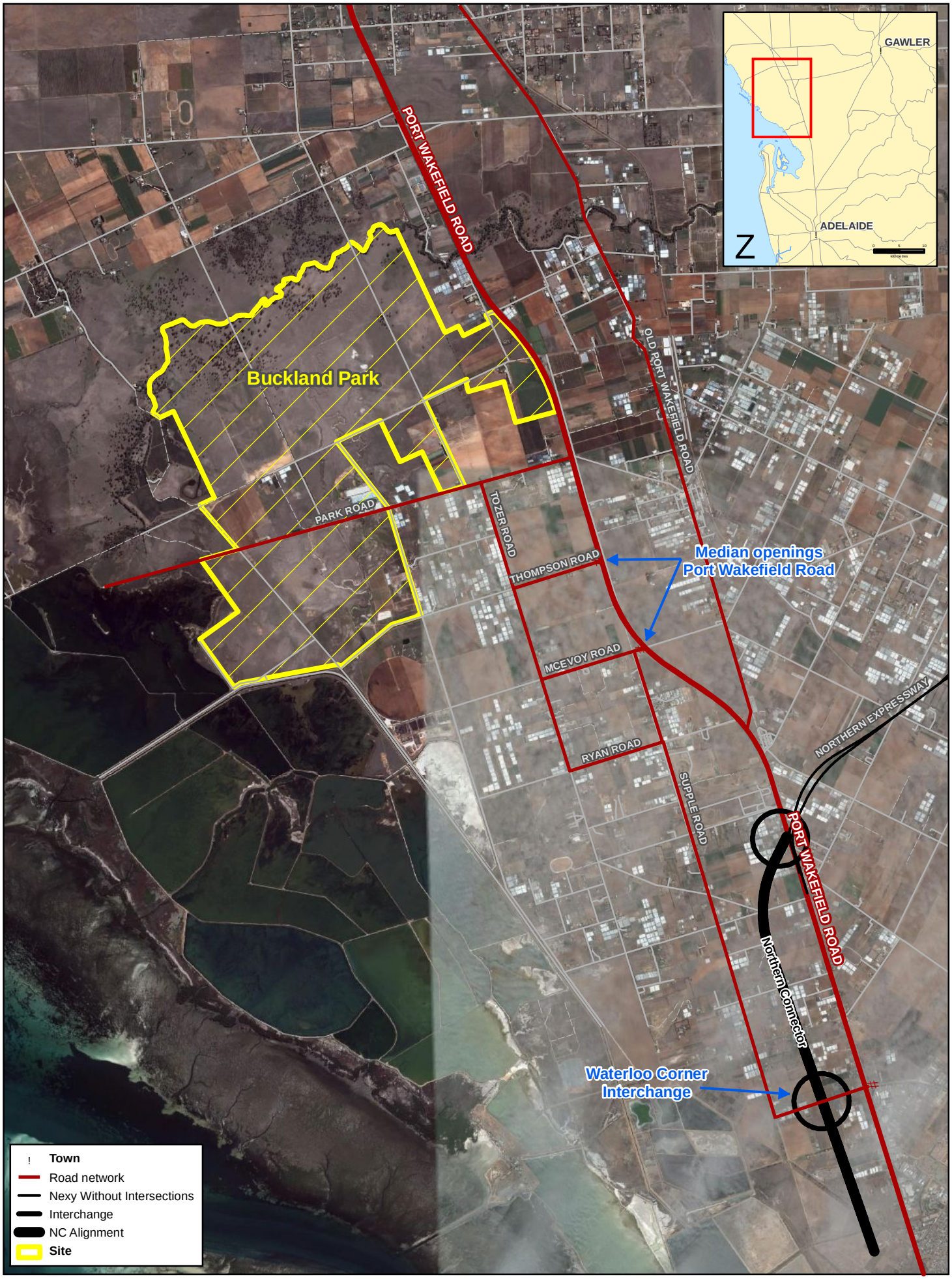
- It is expected that the peak bus route patterns in Figure 9.1 might vary in off peak periods to provide differing foci on activity centres.

9.2.3 Potential patronage levels

Section 7.3.2 reported forecast levels of daily public transport trips and corresponding mode shares by design year from 2016 to 2036. The forecast levels of ridership for each of the three routes through Buckland Park, at the load point adjacent to the District Centre, are reported in Table 9.6 for 2031 and 2036. Comparative ridership levels for earlier years are not provided, as far more detailed bus service planning would be needed to provide efficient interim bus service arrangements; only 2031 and 2036 have been modelled in detail.

Table 9.6 Forecast peak hour patronage levels in 2031 and 2036 by route, at Port Wakefield Road[1]

Route/design year	AM peak hour		PM peak hour		Daily	
	In[2]	Out[3]	In[2]	Out[3]	In[2]	Out[3]
Red Route[4]						
2031	64	35	11	13	518	475
2036	52	31	10	13	466	441
Green Route[5]						
2031	53	44	9	16	542	540
2036	55	59	9	16	589	583



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Coord: GDA 94 MGA 54

Source: Connell Wagner, DEH, Google Earth (c) Digital Globe

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Drawing No:	2112592A_GIS_F005		
Revision:	B1	Date:	27/11/2008
Drawn By:	TK	Checked by:	YMC
Client Ref:	WALKER CORP		

Local road network connectivity to Port Wakefield Road

Figure 9.2

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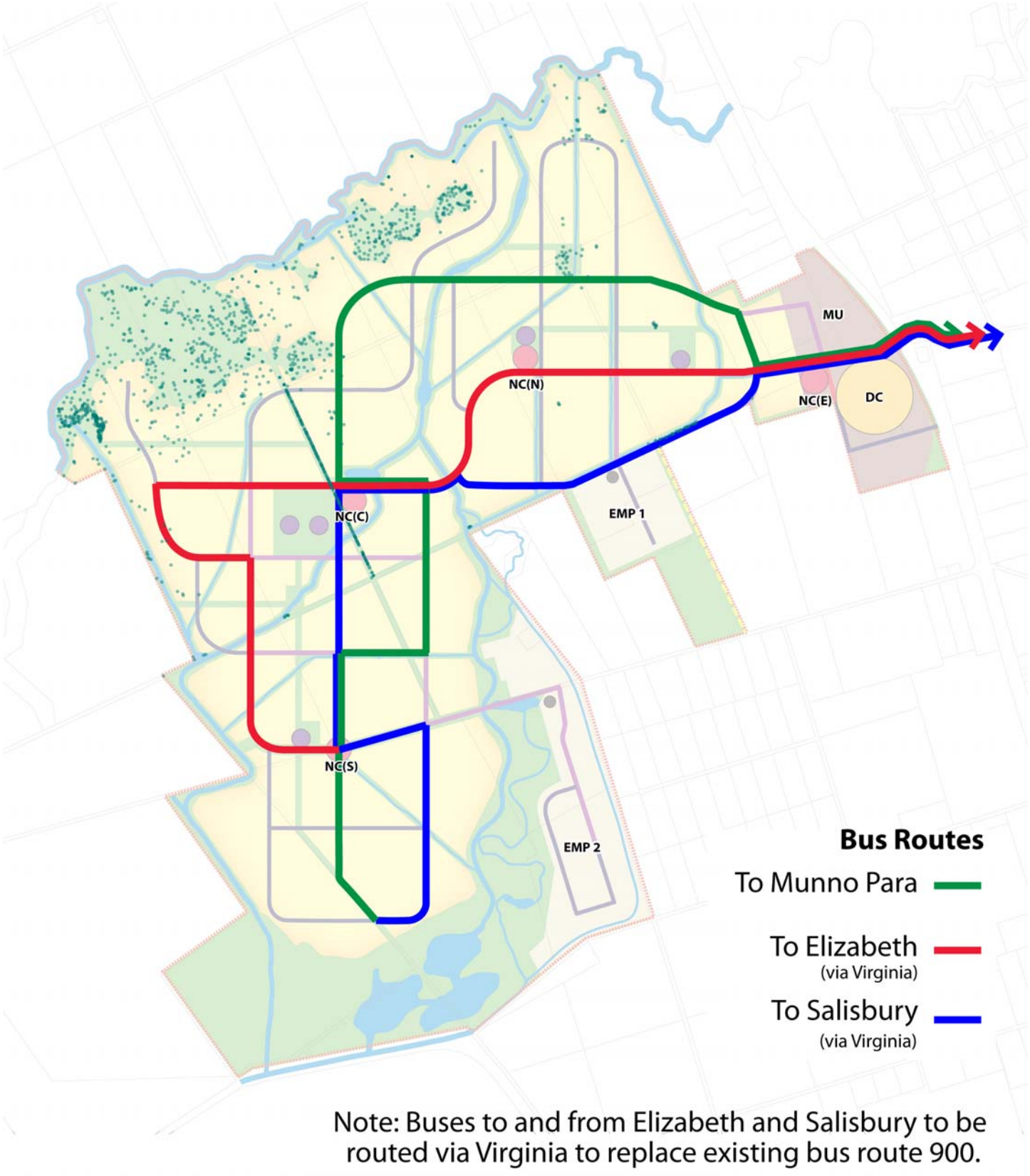


FIGURE 9.3
Proposed bus route strategy 2031

Route/design year	AM peak hour		PM peak hour		Daily	
	In[2]	Out[3]	In[2]	Out[3]	In[2]	Out[3]
Blue Route[6]						
2031	64	105	31	25	852	900
2036	69	141	37	30	944	984

Source: MASTEM model output

1 At district centre
2 Entering Buckland Park/travelling away from District Centre
3 Exiting from Buckland Park/travelling towards District Centre
4 Route along entry boulevard
5 Route along sub-arterial road
6 Route along southern side of Stage 1

Maximum load points are located within Buckland Park, typically just to the west of the Stage 1 development.

9.2.4 Potential staged bus network development

The way in which the bus network develops within Buckland Park will be closely related to the staging plans, including the timing of the schools and employment nodes. Reflecting the current precinct staging concept, an indicative bus route staging plan has been developed for the period 2021–2036. This is illustrated in Figure 9.4.

The service structures do not define the types of buses that would be operating in 2021 (and possibly 2026), nor the frequency of service. Decisions on these matters will be the subject of future discussions between DTEI, the proponents and the City of Playford.

9.2.5 Measures to improve bus service accessibility

The attractiveness of bus services to users will be influenced by a range of factors. These will all need to be considered as part of a package to provide a high level of accessibility for intra-Buckland Park travel by bus, and for external travel to regional destinations. Only in this way will bus travel be attractive to users as an alternative to car.

The measures include:

- Stop location: Nominal stop spacings of 300–350 m are proposed. It is important, however, that individual stop locations are selected to be as accessible as possible, with walk access times minimised. Principles in stop location will include:
  - stops should be relatively close to intersections
  - stops should be close to locations where pedestrian network paths intersect with bus routes
  - walkways should be provided through residential precincts where possible to provide direct movements to stops.
- All stops need to be fully accessible under Disability Discrimination Act (DDA) legislation.
- Shelters should be provided at most stops, particularly at major stops.

- Park-and-ride (P&R) facilities: These encourage the usage of bus for longer bus trips, particularly to destinations outside of Buckland Park. It is proposed that P&R facilities be provided near to major generators within the development, including neighbourhood centres and adjacent to the district centre.

- Bus interchanging: Given the nature of the external bus route structure, it is proposed that there be a combined bus:bus interchange/P&R facility abutting the District Centre. This is the location where the proposed routes will converge prior to exiting from Buckland Park; passengers may wish to transfer between routes depending on their regional destinations. This interchange facility should desirably be located such that bus movements into/out of the facility can be provided with priority treatments. Direct and convenient linkages to the District Centre should also be provided.

- A satellite bus depot could be established at Buckland Park, once MetroTicket bus services begin to operate from Buckland Park (refer section 9.2.6). This arrangement would ensure buses departed on time in the morning peak period. The provision of layover facilities within Buckland Park would assist in maintaining scheduled run times at other times of the day.

As the detailed design process evolves for later stages of Buckland Park, opportunities for providing bus priority treatments should be considered. Such treatments could include short bus only lanes and B-phases where intersections are under traffic signal control.

9.2.6 Potential funding/operational arrangements

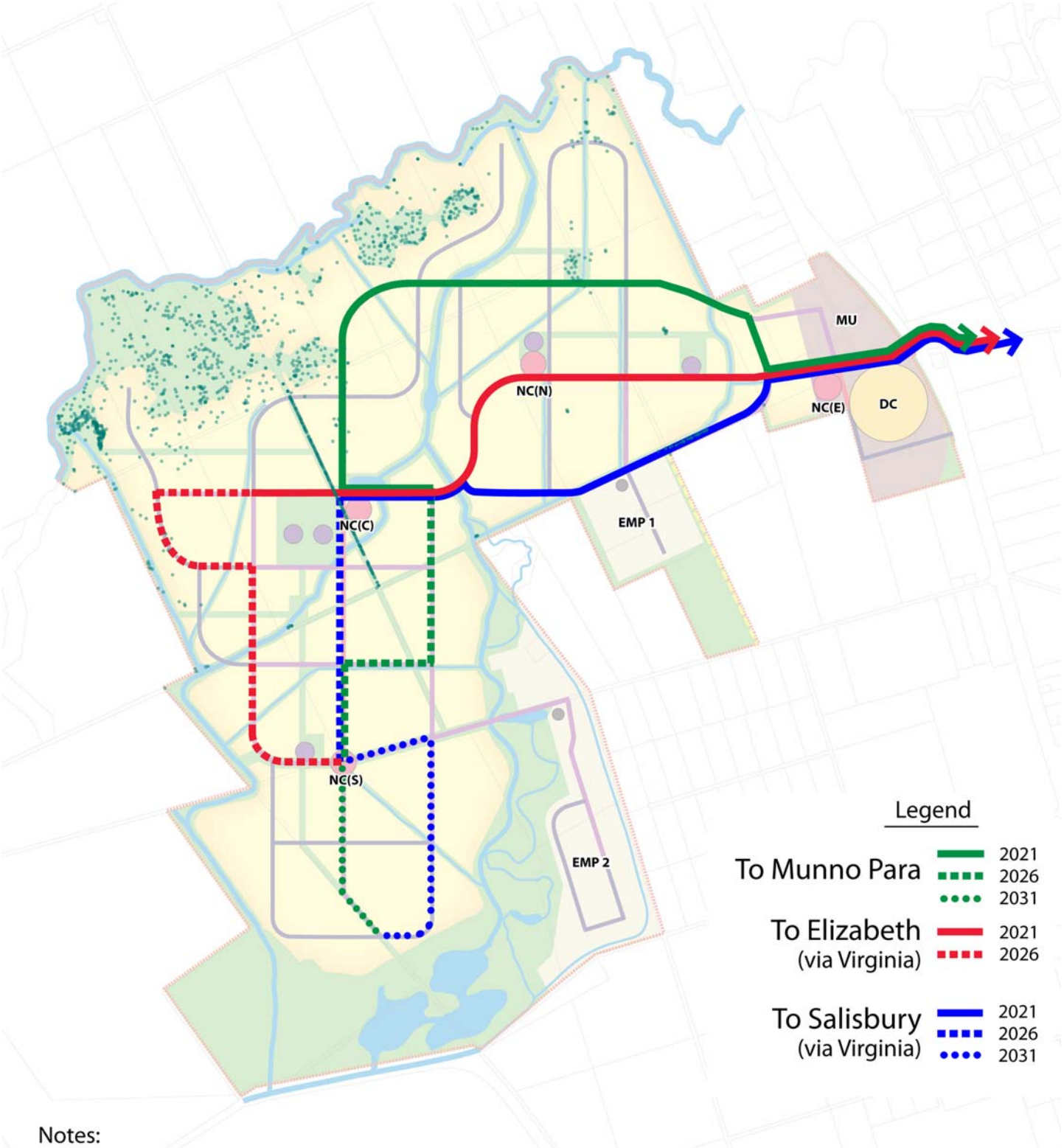
Provision of an effective public transport service from the early days of occupation is recognised by all interested parties – the proponents, the State Government, local government and other stakeholders – as being a critical element to the financial and social success of Buckland Park. Preliminary discussions have been held with DTEI to consider how bus services might best be provided, having regard to changing patterns of demands – both levels of demand, and the destinations that will need to be served.

These discussions have suggested that bus services might be provided in three stages under the following model:

- A local commuter bus service be operated initially, subsidised by the Proponent. It is envisaged that these services would commence soon after residents move into Buckland Park, using indicatively 15 seat minibuses. They would link residential precincts in Stage 1 to shops, schools and other community facilities external to Buckland Park, until such facilities were constructed within Buckland Park. Initially such services would link to Virginia, Angle Vale and potentially to Munno Para. Passengers wishing to travel to Elizabeth or Salisbury could transfer to the government route 900 loop service from Salisbury town centre via Virginia to the Elizabeth town centre. Route 900 provides connections to the Gawler rail line at the Salisbury and Elizabeth interchanges.

- As residential growth in Buckland Park increases, with corresponding growth in patronage demand, then DTEI has advised that the Government will consider the provision and timing of a subsidy to operate the community bus service.

- In the third stage of bus service provision, DTEI has indicated that the Government would consider the introduction of a regular MetroTicket bus services from Buckland



Notes:

1. Buses to and from Elizabeth and Salisbury to be routed via Virginia to replace existing bus route 900.
2. Number of external destinations in 2021 and 2026 dependent on demand and government approval.

FIGURE 9.4
Proposed staged development of bus route strategy 2020–2031

Park. The threshold at which this might occur has not been indicated, and would depend on levels of patronage demand, and hence on discussions with DTEI.

Under the model, it is expected that bus routes would progressively extend with Buckland Park as successive residential stages are occupied. Increases in service frequencies would also need to commensurately increase as levels of demand increase, to maintain reasonable load standards and to increase frequencies to make the service even more attractive to the community.

An illustration as to how the service/funding model may develop is shown in Figure 9.5. This broadly relates service type to the indicative development schedule.

Service Type	Indicative Development Timescale																									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
# Occupied HH x Year	0	0	120	280	480	780	1180	1660	2260	2860	3460	4100	4740	5380	6020	6660	7300	7940	8580	9220	9860	10500	11140	11780	12000
1. Local Commuter[1]																									
2. Subsidised Commuter[2]																									
3. MetroTicket Buses[3]																									

Note: Timing of arrangements subject to negotiations with Government

(1) Local commuter bus service, subsidised by Proponent. This is envisaged to link new homes to external services initially before establishment of facilities within Buckland Park. For example, links to Virginia, Angle Vale and Munno Para

(2) Extended local service, subsidised by Proponent with an additional proposed Government subsidy

(3) Standard MetroTicket bus service, funded by the Government

FIGURE 9.5
Potential staged development of bus services

9.3 Pedestrian/cyclist network

9.3.1 Promoting cycling and walking

The promotion of cycling and walking as a realistic and relatively efficient form of movement through Buckland Park is a key consideration in the Master Plan layout.

Cycling and walking opportunities will be promoted through the provision of a generous network of on– and off-street facilities. The proposed grid pattern of the road network layout will support the efficient movement of pedestrians and cyclists; this is further enhanced by the inclusion of an extensive off-road network through the open space corridors.

9.3.2 Off-road shared paths

Off-road shared paths cater for the combined movements of both pedestrians and cyclists, and are cost effective facilities (rather than separate pedestrian and cyclist paths) given their versatility to cater for a range of users.

Shared paths often experience a mix of simultaneous commuting and recreational use and should therefore have a minimum width of 3.5 m, and be designed to a high standard which provides adequate sight distance between cyclists and other users. Major recreational paths should be designed with a minimum width of 4.0 m; conversely key commuter routes (i.e. where travel speeds are frequently in excess of 30 km/h) should be a minimum of 3.0 m in width.

Off-road shared paths will be incorporated as part of the open space corridors through Buckland Park, and have been designed to provide efficient linkages between residential areas, local, neighbourhood and district centres, schools, recreational spaces and employment areas.

For local and collector roads, it is desired that vehicles have priority treatment at the intersection of roads and paths. Where an off-road shared path intersects with a major collector or busier road, it will be necessary to provide dedicated facilities, either in the form of controlled crossings or physical refuges. Controlled crossings may include signalised or unsignalised pedestrian crossings (including school crossings); signalised crossings will preferably be integrated as part of signalised intersections. Refuges offer the benefit of allowing pedestrians and cyclists to cross the road in two stages and can be installed at relatively low cost. These installations are generally 2.0 m wide and include a holding rail to allow a stationary cyclist to remain mounted within the refuge area. All crossing point installations will need to meet the requirements of Council and/or DTEI as relevant.

9.3.3 Cycling linkages to the external road network

Angle Vale Road and Port Wakefield Road will provide the key linkages for cyclist movements between Buckland Park, the surrounding northern areas and metropolitan Adelaide. Cycling linkages will therefore be provided between Buckland Park and the external road network via the proposed intersection at Angle Vale Road/Port Wakefield Road.

The main entry boulevard will have shared pedestrian and cycle paths on both sides. The main entry boulevard intersection at Port Wakefield Road will incorporate pedestrian/cyclist crossings, feeding into single direction bicycle provisions on the sealed shoulders along Port Wakefield Road and Angle Vale Road. These crossings at the signalised intersection provide safe and efficient crossings for pedestrians and cyclists.

Traffic signals at the first intersection along the entry boulevard (west of Port Wakefield Road) will enable safe cyclist and pedestrian crossing movements of the main entry boulevard, to and from the adjacent District Centre.

9.4 Summary overview of transport planning for Buckland Park

This section provides a summary overview of the key transport planning issues relating to the satisfying of travel demands by future residents of Buckland Park. In this respect, it is noted that the transport planning process has considered requirements for both internal and external travel, with the latter including a focus on major employment and service destinations.

Buckland Park is located approximately 32 km from the Adelaide CBD. It is 12 km from the industrial and employment precincts of Playford, Edinburgh Parks and Direk, and some 27 km from Pt Adelaide. It is connected to these employment precincts via Port Wakefield

Road; future connections to the south will be improved following completion of the proposed Northern Connector (in about 2016).

Public transport access to/from Buckland Park will be provided by a mix of local and trunk bus services. It is anticipated this will form the most efficient type of public transport services in the future. The need for regional bus service connections has been considered and included in the proposed service arrangements.

In respect of transport planning within Buckland Park, the fundamental approach has been to ensure that employment opportunities, services and social infrastructure are provided for within the Master Plan. These are inter-connected by internal bus routes, and pedestrian and bike ways.

The approach to transport planning for Buckland Park thus differs from the historical approach typically undertaken elsewhere in Adelaide. Key aspects of the planning relating to car dependency are summarised in the following paragraphs.

9.4.1 Self containment

Buckland Park's Master Plan aims to achieve a high level of self containment for day to day trip making, in terms of demand for services (schools, retail, social services, commercial etc). It also includes higher levels of other employment than is typical in new residential areas in Adelaide's outer areas. To achieve this objective, the Masterplan includes provision for:

- A high end District Centre near to Port Wakefield Road, integrated with a large mixed use precinct – total area of 47 ha.
- Three Neighbourhood Centres located within the residential precincts, supported by other light industrial/manufacturing employment in dedicated precincts – overall employment area of 61 ha.
- A temporary Neighbourhood Centre within Stage 1 which will provide services to the first residents occupying the proposal.
- Five schools comprising:
  - Government Schools
    - 1 x R-7
    - 1 x R-12
  - Non-government Schools
    - 2 x R-7
    - 1 x Y8-12

By comparison, most other new outer residential areas offer relatively low levels of trip containment, relying instead on existing services in other adjoining areas.

9.4.2 Car dependency

Buckland Park's Masterplan aims to reduce levels of dependency on car ownership, particularly the necessity for households to purchase a second car. This aim will be achieved through a combination of:

- A network of on-street and off-street pedestrian and cycle paths to link residential precincts as directly as possible with activity centres.

- Provision of a bus service from the beginning of residential occupation. The service will link residential precincts with activity centres within Buckland Park, and with larger centres in Virginia, Angle Vale, Munno Para, Elizabeth, and Salisbury. The bus service will link Buckland Park to the metropolitan rail network.

The modelled mode share statistics (Table 7.2) report relatively high levels of internal travel within Buckland Park from 2016 through to 2031 by walk/cycle and public transport modes (total mode share of some 50%). These high levels of non car mode shares are reflective of lower car dependency levels (and trip containment where these modes are convenient for local travel).

9.4.3 Public transport services

In other new residential areas in outer Adelaide, bus services are typically provided as incremental extensions of existing service arrangements. Each increment follows well after residents have occupied the new area, meaning there is a lag in public transport provision. By the time public transport is provided, many residents have established car reliant travel patterns, and may have made expensive commitments to second cars.

To achieve a better outcome at Buckland Park, the proponents will provide a local bus service to residents at the beginning of occupation. This service will comprise a small bus providing regular services to Virginia and Angle vale, and potentially to Munno Para; the services would connect with the existing Route 900 loop service which links the Salisbury and Elizabeth and suburban rail interchanges via Virginia. The new service service will be designed to provide access between residential precincts and services within Buckland Park, and in the wider northern area as described above. It is understood that such services have not typically been provided in other large scale new outer residential areas.

In terms of location, Buckland Park can be compared to Gawler, which is located 38 km from the Adelaide CBD. Unlike Buckland Park, Gawler has no internal regular public transport service, (only an irregular community bus service operated by the local council). While there is a reasonably high level of trip containment within Gawler, there is a higher dependency on the use of cars for day to day activities, such as trips to school, shops and for other personal business.

Unlike Buckland Park, Gawler has very limited designated pedestrian and cycle infrastructure. (There are short sections of on-street and off-street paths, but these are not interconnected. Also these paths do not link directly to schools and other major facilities.) This makes walking and cycling inconvenient, thereby encouraging car dependency. By comparison, Buckland Park will have a convenient and well planned internal bus system, integrated with its centres and cycle and pedestrian networks.

10. Contribution to a sustainable transport system

There is a well recognised need for the provision of sustainable transport systems, driven by the need to reduce our consumption of natural resources, and in particular fossil fuels. The greenfields development at Buckland Park provides a wealth of opportunities for the implementation of sustainable transport initiatives at all levels, ranging from strategic transport planning principles through to the encouragement of people to walk and cycle more often.

In conjunction with the Passenger Transport Division (PTD) of DTEI, an initial bus route structure has been defined for Buckland Park for 2031. The overall aim of an early-commencing bus service is to reduce the need for households to purchase a second car.

This network comprises a set of services that encompass inter- and intra- regional destinations, including links between residential, district and neighbourhood centres and employment nodes.

There are also future opportunities for the suburban electrified rail network to be extended to Virginia as part of the upgrade to the Gawler line, along the alignment of the current interstate standard gauge mainline. The likely level of shift from car driver to passenger rail travel has been included in the assessment process.

A generous network of on- and off-street facilities will offer a number of walking and cycling opportunities through the development. In addition, the grid pattern of the road network layout will support the efficient movement of pedestrians and cyclists; this is further enhanced by the inclusion of an extensive off-road network through the open space corridors.

Appendix A

Assessment of potential electrified rail extension to Virginia

Assessment of potential electrified rail extension to Virginia

The current MASTEM model does not provide an appropriate basis for assessing potential demand for an electrified rail service to Virginia. Demand for such an extension by Buckland Park residents would largely be driven by commuters wishing to park-and-ride (P&R) at a station near to Virginia; there would also be other commuter demand by persons who would travel to a station by feeder bus. Additional demand would be generated for non work travel by Buckland Park residents, plus work/non work travel by other residents in the immediate region east and north of Buckland Park. MASTEM can model feeder bus access, but does not currently have a P&R capability that is suitable for use.

Given the above, a first principles analysis of potential demand was undertaken with reference to data from Gawler. This comprised:

- 2006 Journey to Work data
- Boarding statistics for the three Gawler stations in 2006.

Gawler is similar to Buckland Park in terms of distance from the CBD, and has an established rail service to the CBD. Analysis of data from there provides a first order estimate of possible patronage for travel between Buckland Park and the CBD, **if a rail service was to be provided**.

The process adopted for the analysis is summarised in the following steps:

A. Basic Gawler characteristics

1. % Trips to CBD by train: 60% (this is the % of trips by car driver, car passenger and public transport modes)
2. Work trip capture rate in Gawler: 34%
3. Number of trips to work in the CBD by train (2006): 210
4. Population in Gawler in 2006 = 18913.

B. Assessment of rail potential for Buckland Park

1. Assume 85% of JTW trips occur in the AM peak hour: 0.85 * 210 = 180 trips

2. Total rail boardings in Gawler in the AM peak hour in 2006 = 478 (at Gawler Central, Gawler Oval, and Gawler). These boardings estimated to comprise:

    - 180 work trip boardings
    - 75 work trips by residents outside of Gawler (Barossa Valley etc)
    - 223 non work trips by Gawler/non Gawler residents (education and other purposes)

3. CBD rail potential from Buckland Park:

    - Pro-rate trips to work based on relative population:
        - 2036 population in Buckland Park = 33,000 (full development)
        - 2031 population in Buckland Park = 26,400
        - Number of rail trips to the CBD in 2036 = 210 * (33,000/18913) = 366 trips.

    - Assume 85% of trips to work occur in the AM peak hour = 0.85 * 366 = 310 rail trips

- Assume number of other AM peak regional work trips = 50 (conservative)
- Assume number of other non work trips in AM peak hour = 100 (Buckland Park + regional areas). This is again conservative.
- Total AM peak rail trips in 2036 = 460
- Estimated number of AM peak rail trips in 2031 = 460 * (26,400/33,000) = 370 trips
- Equivalent reduction in car trips = 370 /1.3 = 285 cars (assume average occupancy = 1.3 persons per vehicle for peak trips).

4. Park-and-ride space estimation

An initial estimate of parking space requirements for a station north of Virginia was derived on the following basis:

- in 2036, the 366 work trips to Virginia station would be via car and feeder bus
- assume 75% of trips to station by car, requiring P&R spaces: 275 spaces
- assume all other regional work trips are by car: 50 spaces
- assume 50% of non work trips (Buckland Park + regional) by car to railway station: 50 spaces.

Total potential spaces estimated in 2036 = 375 spaces.

It is proposed that a reasonable supply of spaces to be provided might be in the order of 400+ spaces, given the convenience a P&R facility would offer to the wider region, not just Buckland Park.

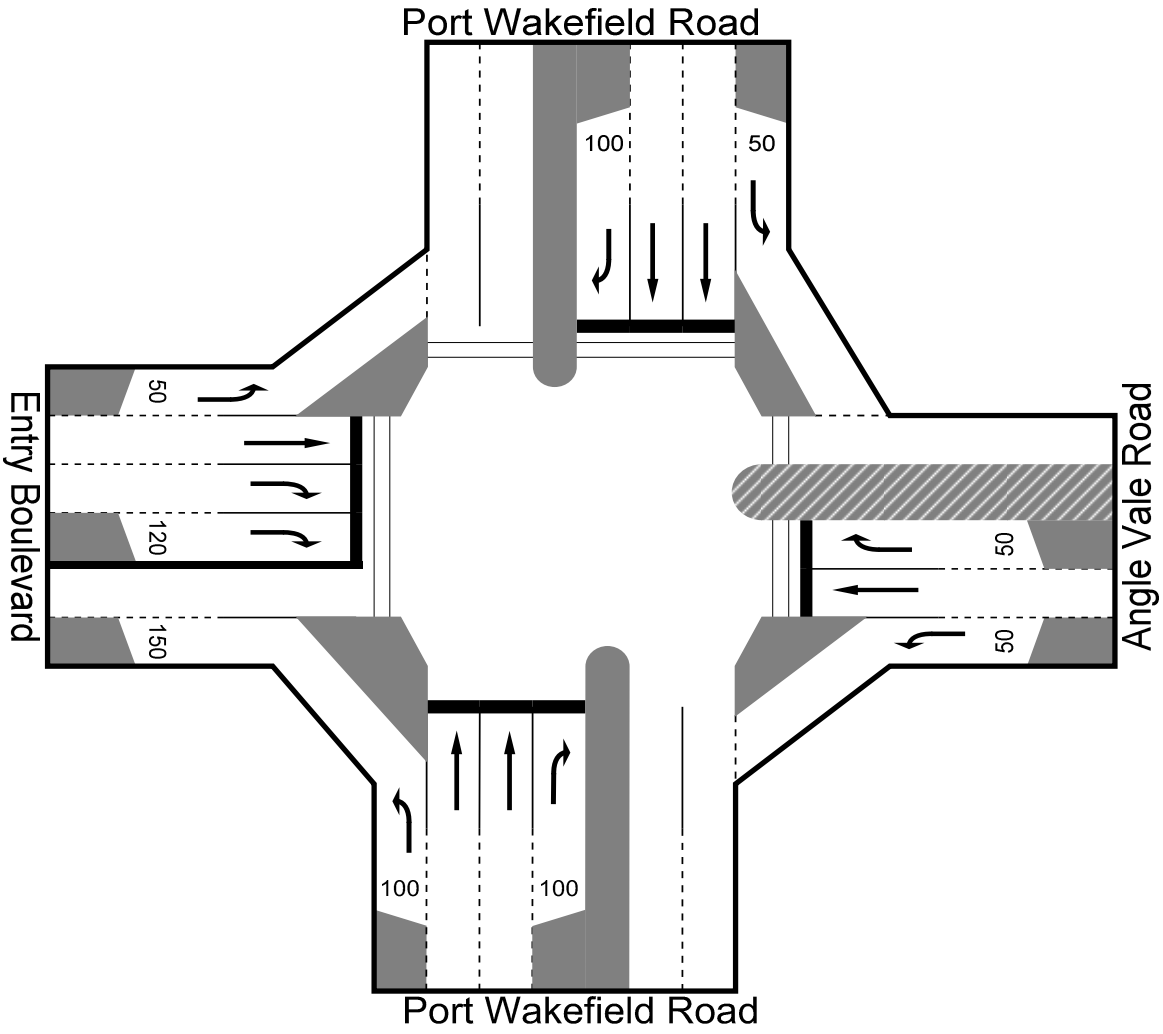
Appendix B

SIDRA analysis results

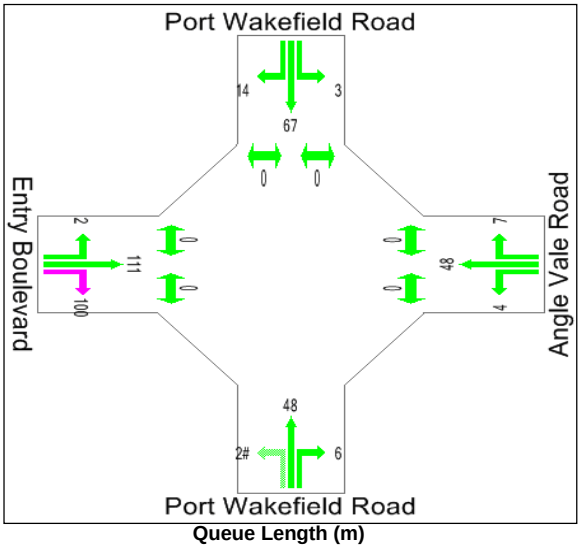
Appendix B.1

Main entry boulevard/Port Wakefield Road/Angle Vale Road signalised intersection

Buckland Park Entry Boulevard/ Port Wakefield Road
INTERSECTION GEOMETRY



Buckland Park Entry Boulevard/ Port Wakefield Road
2021 AM Peak



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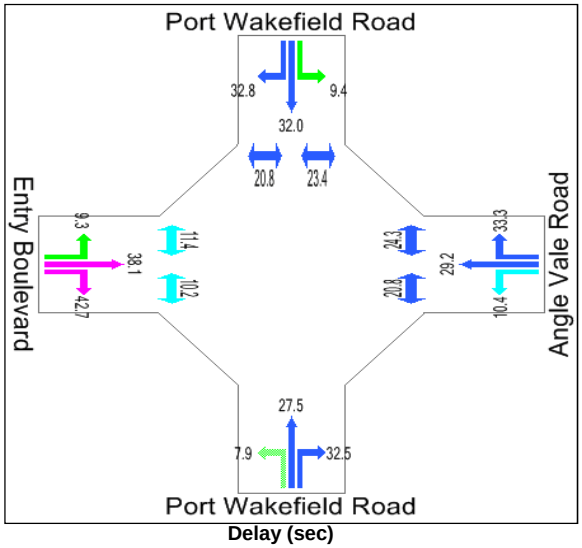

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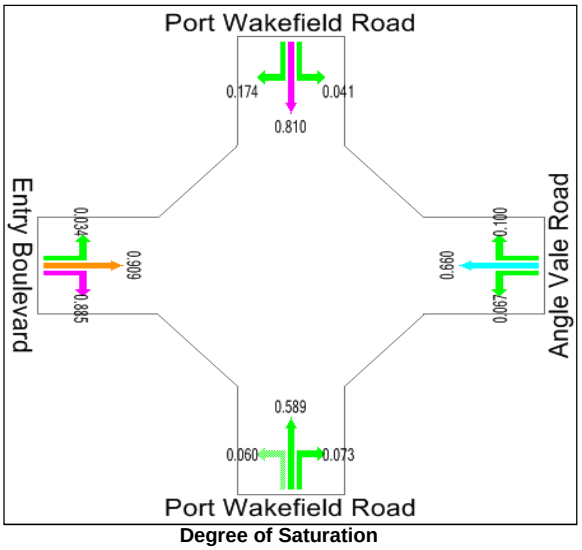

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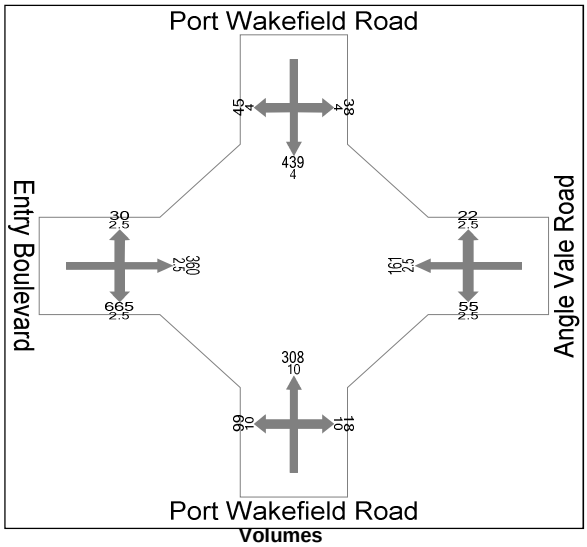

Volumes

Level 16 1 King William St Adelaide SA 5000 (08) 84054300	**Client** Walker Corporation **Project** Buckland Park	Designed YMC 20/03/2009 Drawn YMC 20/03/2009 Checked GRB 20/03/2009 Approved GRB 20/03/2009 Init. Date **Scale** N/A	**Job No.** 2112592A **Title** Entry Boulevard/ Port Wakefield Road 2021AM

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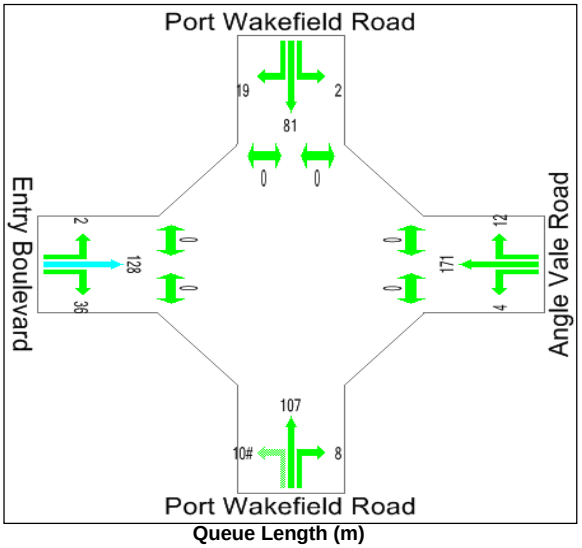
Buckland Park Entry Boulevard/ Port Wakefield Road
2021 PM Peak



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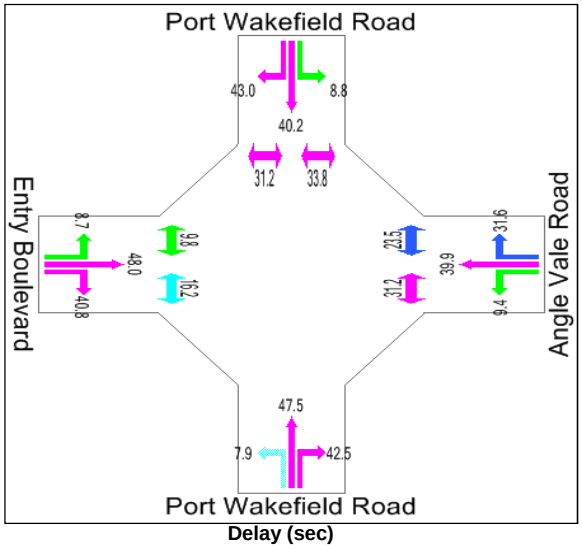

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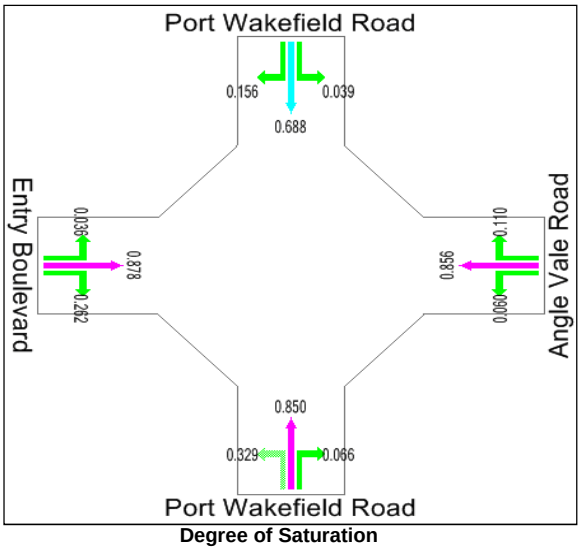

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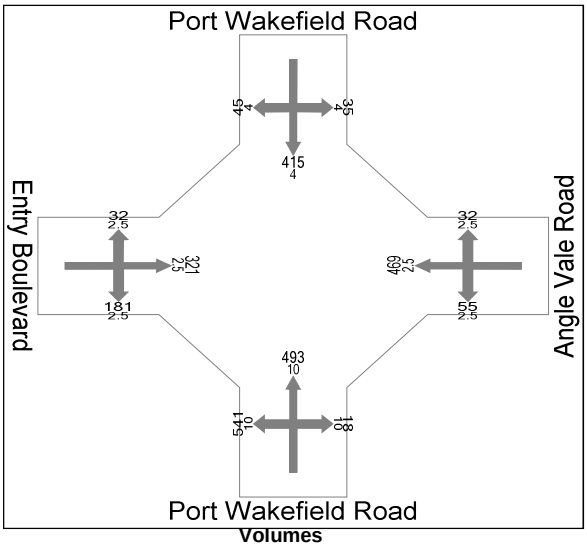

Volumes

PB 100 YEARS	**Client** Walker Corporation	Designed YMC 20/03/2009
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		Job No. 2112592A **Title** Entry Boulevard/ Port Wakefield Road 2021 PM

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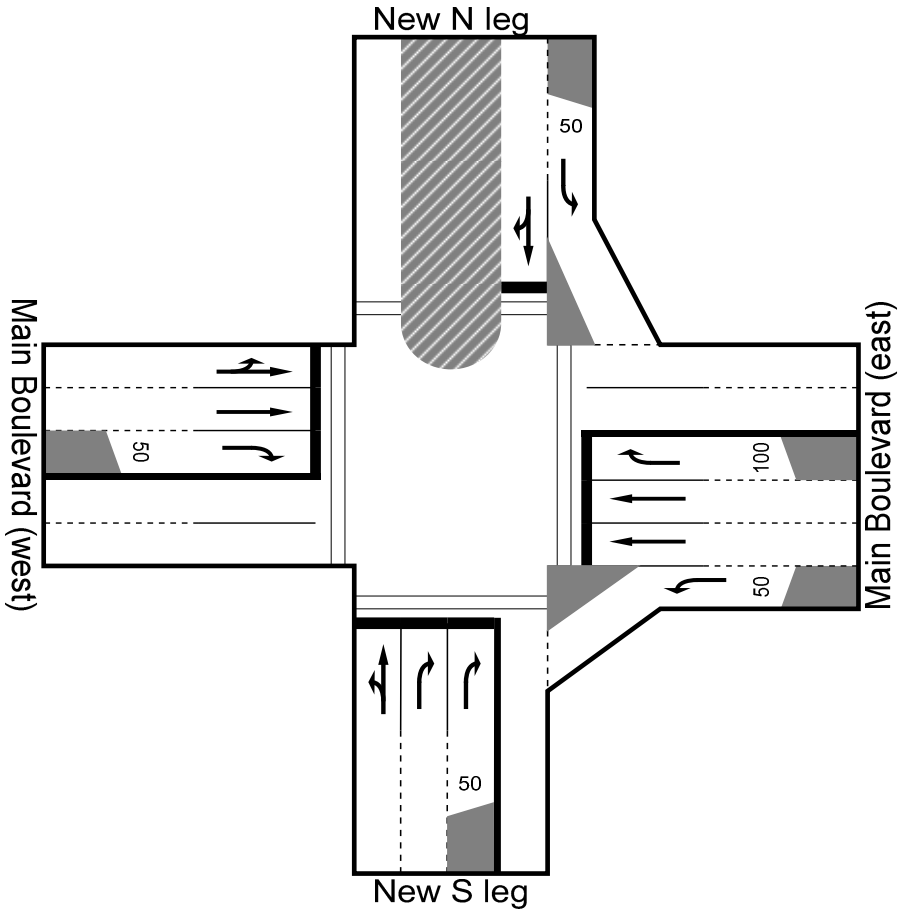
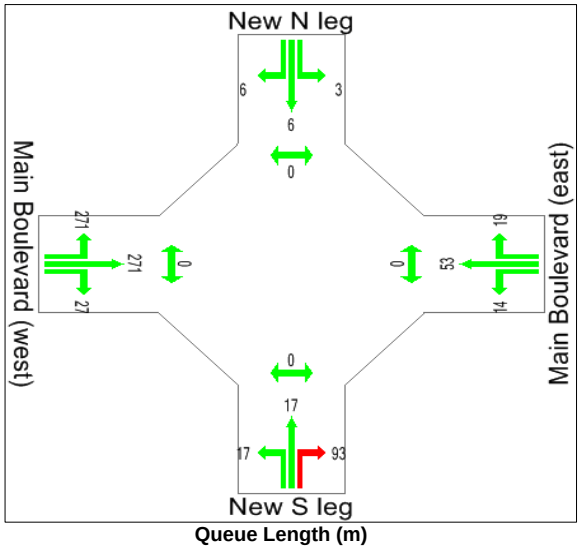
Appendix B.2

First intersection in Buckland Park

First Intersection within Buckland Park
Intersection geometry



First Intersection within Buckland Park
2031 AM Peak



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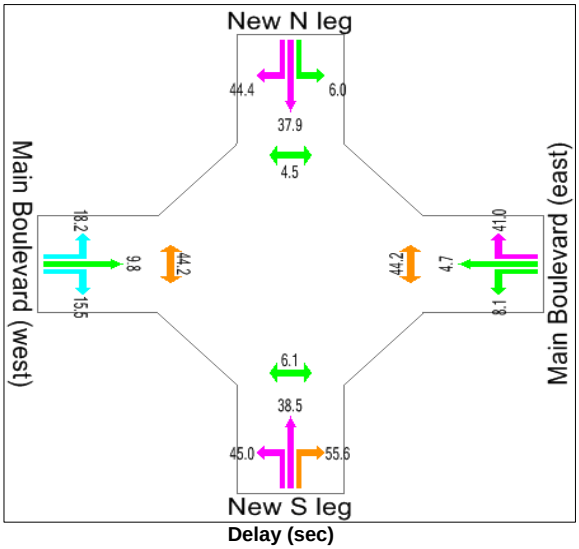

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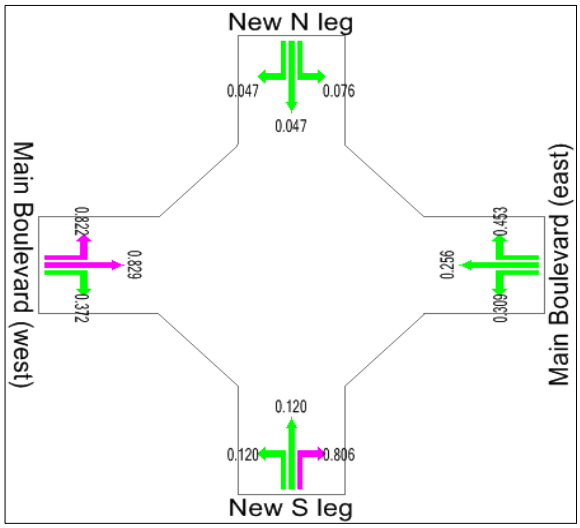

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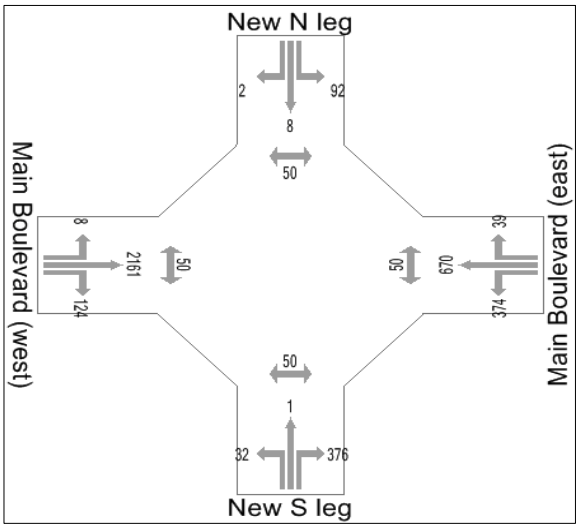
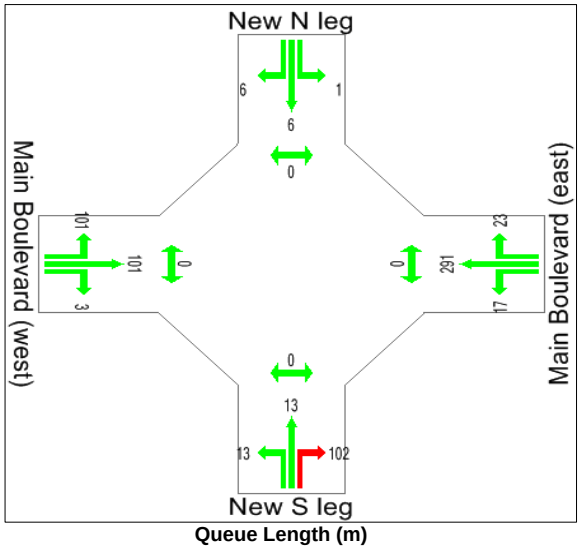


Volumes

PPK House 101 Pirie St Adelaide SA 5000 (08) 84054300	**Client** Walker Corporation **Project** Buckland Park	Designed DLK 10/10/2008 Drawn DLK 10/10/2008 Checked GRB Approved GRB Init. / Date **Scale** N/A	**Job No.** 2112592A **Title** First Intersection within Buckland Park

First Intersection within Buckland Park
2031 PM Peak



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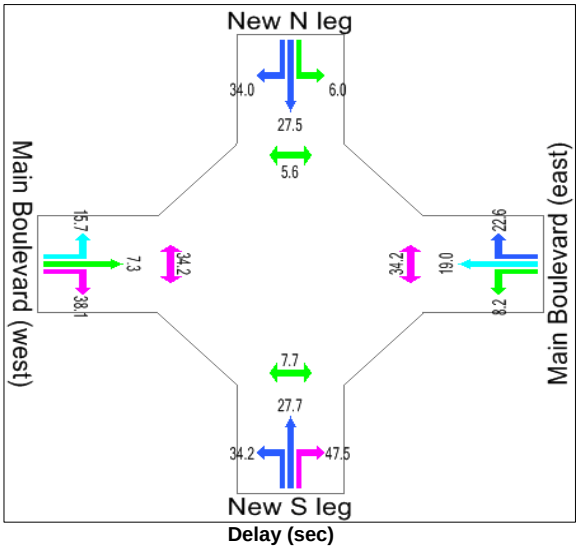

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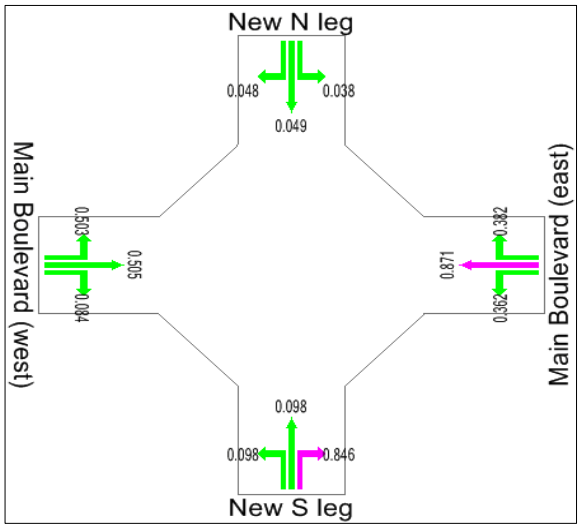

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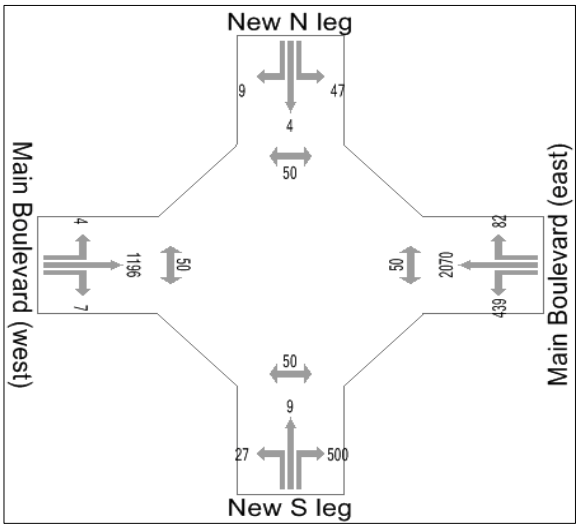
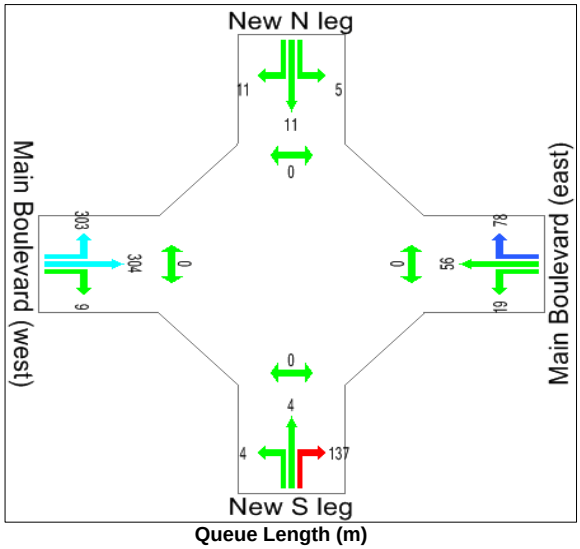


Volumes

PPK House 101 Pirie St Adelaide SA 5000 (08) 84054300	**Client** Walker Corporation **Project** Buckland Park	Designed DLK 10/10/2008 Drawn DLK 10/10/2008 Checked GRB Approved GRB Init. / Date **Scale** N/A	**Job No.** 2112592A **Title** First Intersection within Buckland Park

First Intersection within Buckland Park
2036 AM Peak



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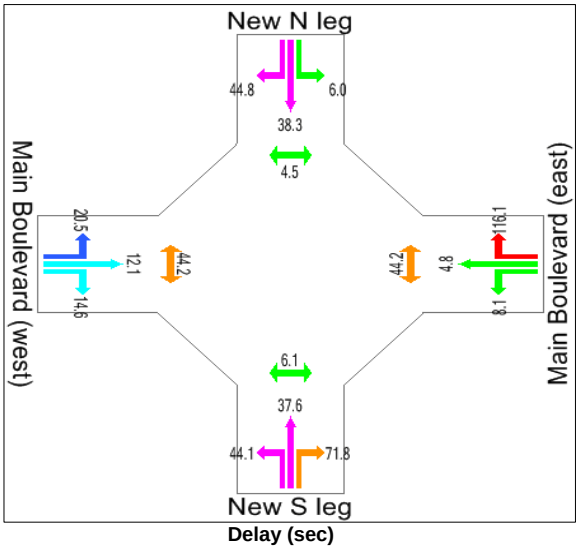

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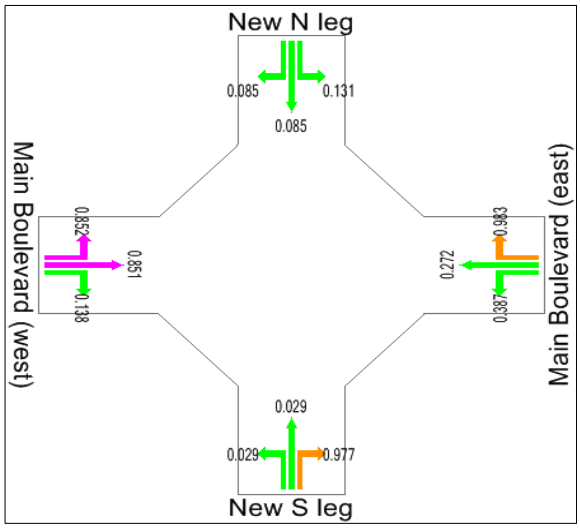

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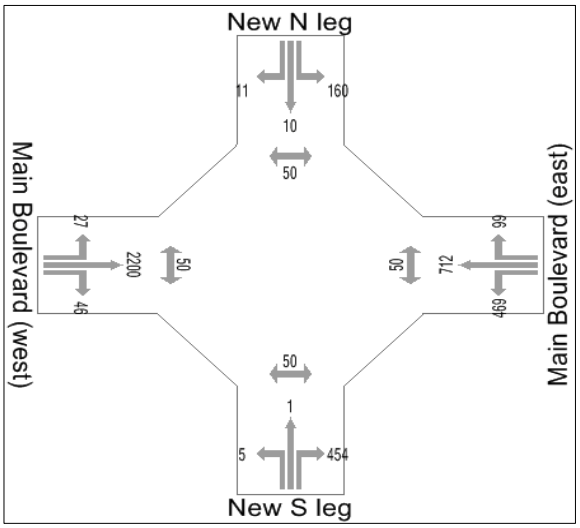
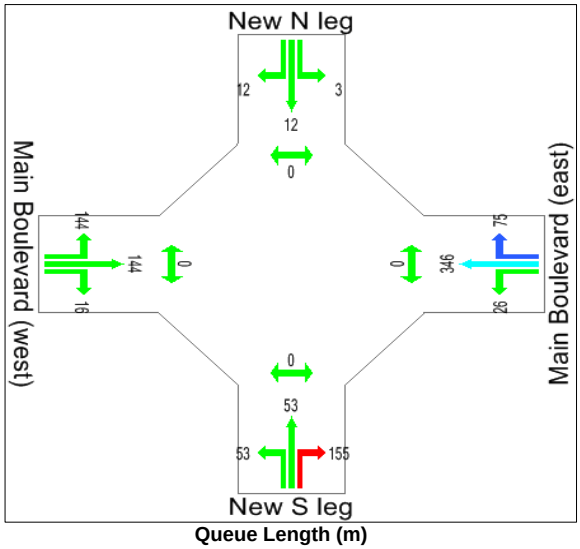


Volumes

PPK House 101 Pirie St Adelaide SA 5000 (08) 84054300	**Client** Walker Corporation **Project** Buckland Park	Designed DLK 10/10/2008 Drawn DLK 10/10/2008 Checked GRB Approved GRB Init. / Date **Scale** N/A	**Job No.** 2112592A **Title** First Intersection within Buckland Park

First Intersection within Buckland Park
2036 PM Peak



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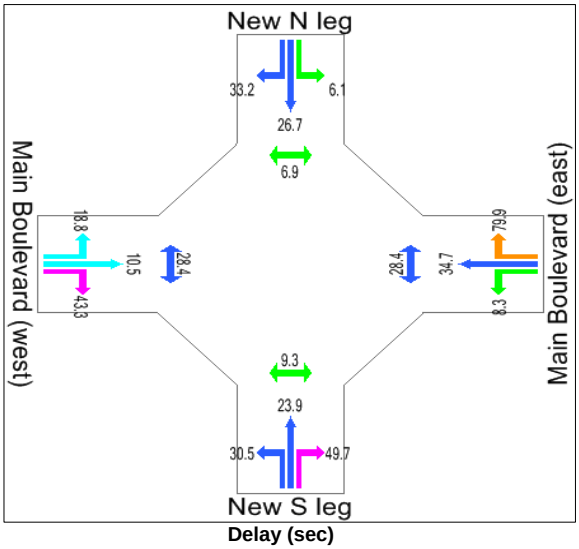

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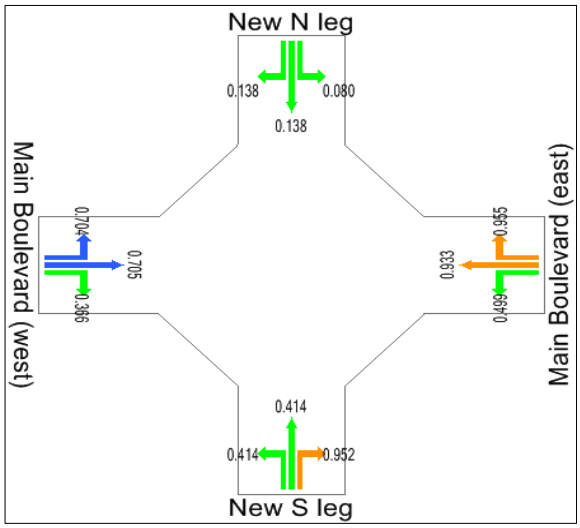
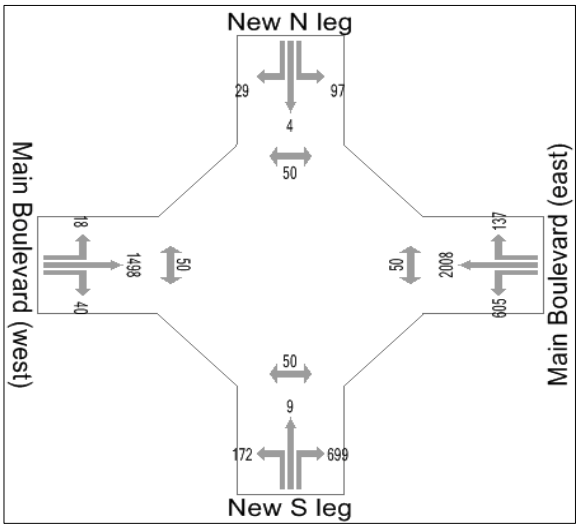


Degree of Saturation



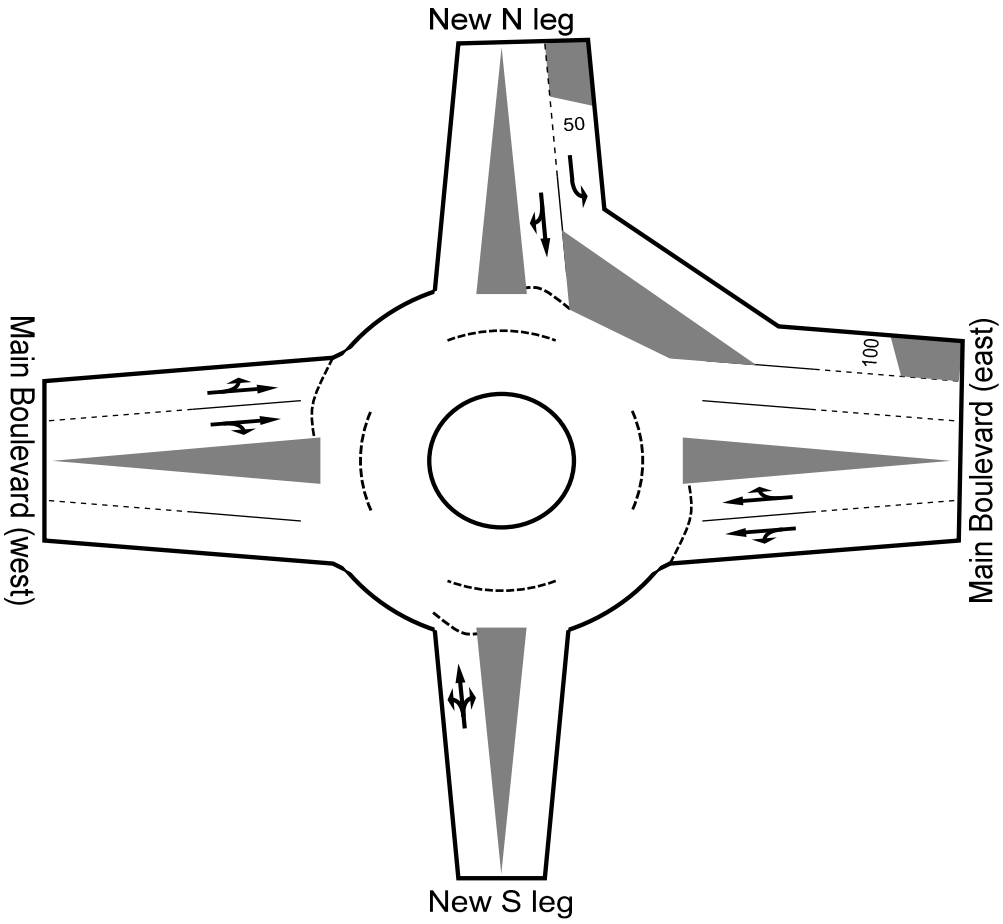
Volumes

PPK House 101 Pirie St Adelaide SA 5000 (08) 84054300	**Client** Walker Corporation **Project** Buckland Park	Designed DLK 10/10/2008 Drawn DLK 10/10/2008 Checked GRB Approved GRB Init. / Date **Scale** N/A	**Job No.** 2112592A **Title** First Intersection within Buckland Park

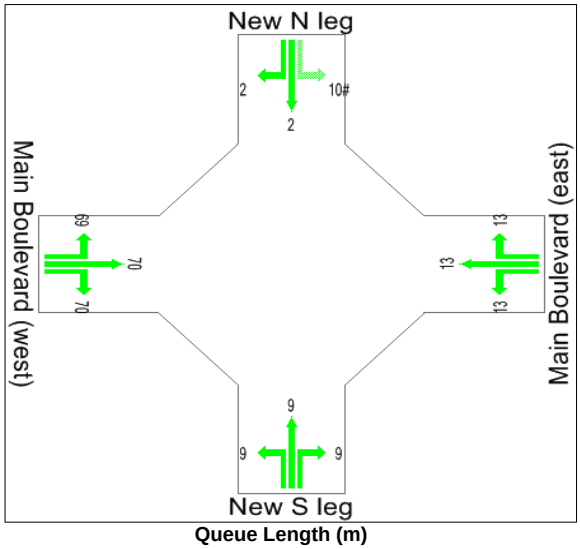
Appendix B.3

Second intersection in Buckland Park

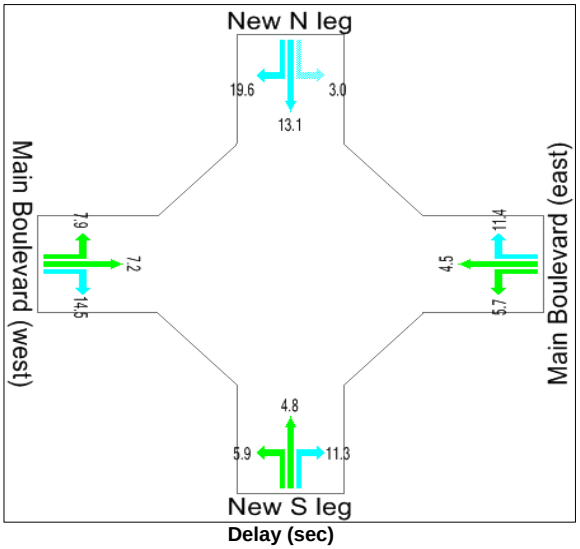
Second Intersection within Buckland Park
Intersection geometry



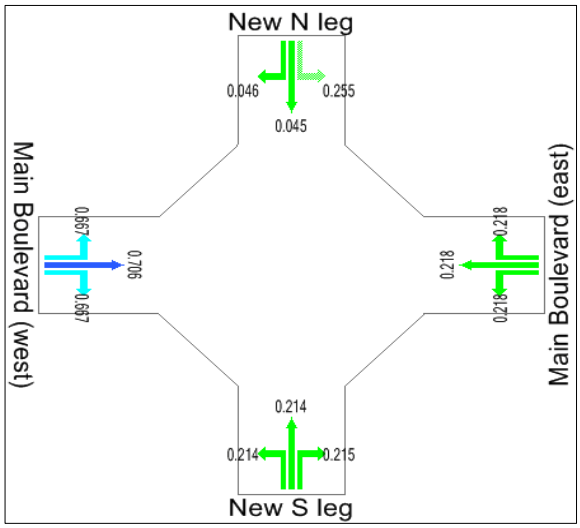
Second Intersection within Buckland Park
2031 AM Peak



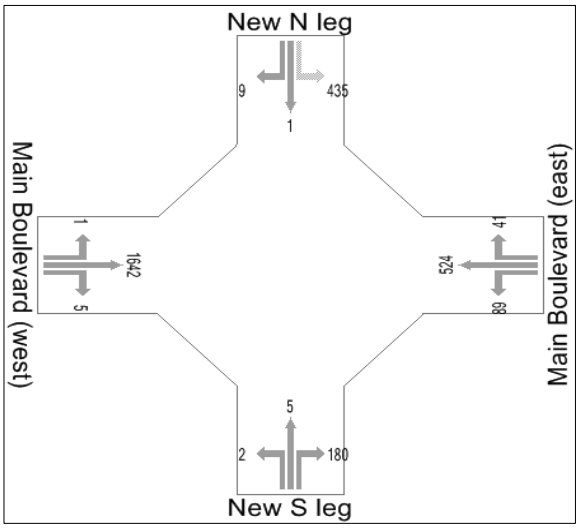
Queue Length (m)



Delay (sec)



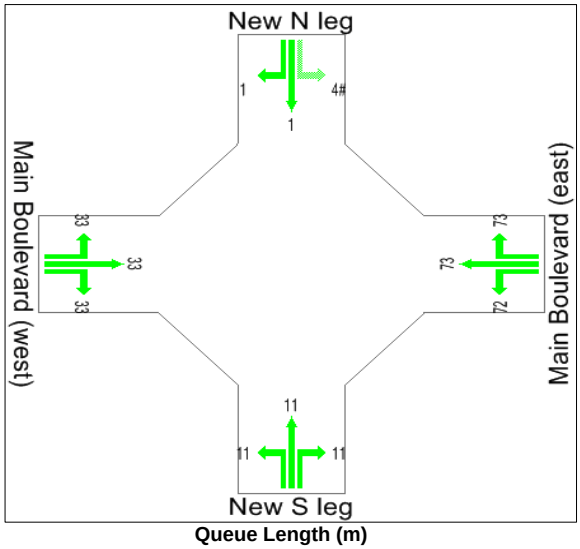
Degree of Saturation



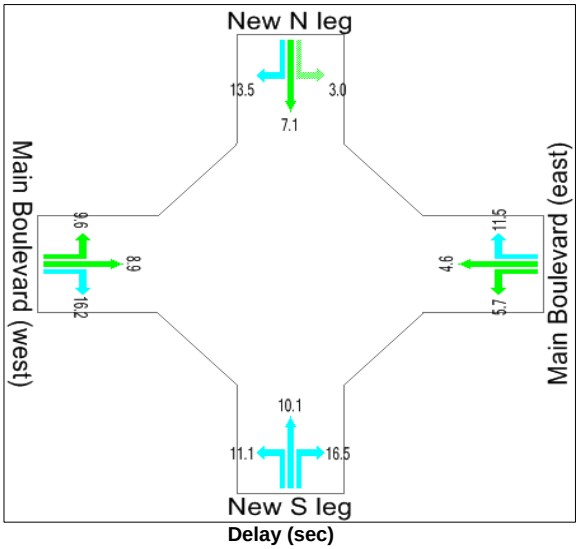
Volumes

PPK House 101 Pirie St Adelaide SA 5000 (08) 84054300	**Client** Walker Corporation **Project** Buckland Park	Designed DLK 10/10/2008 Drawn DLK 10/10/2008 Checked GRB Approved GRB Init. / Date **Scale** N/A	**Job No.** 2112592A **Title** Second Intersection within Buckland Park

Second Intersection within Buckland Park
2031 PM Peak



Queue Length (m)



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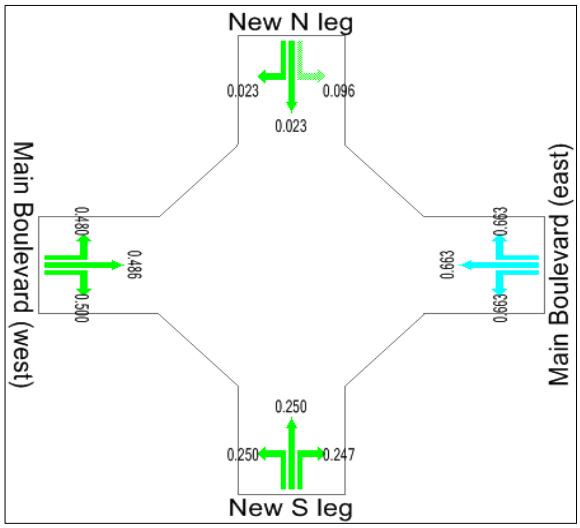
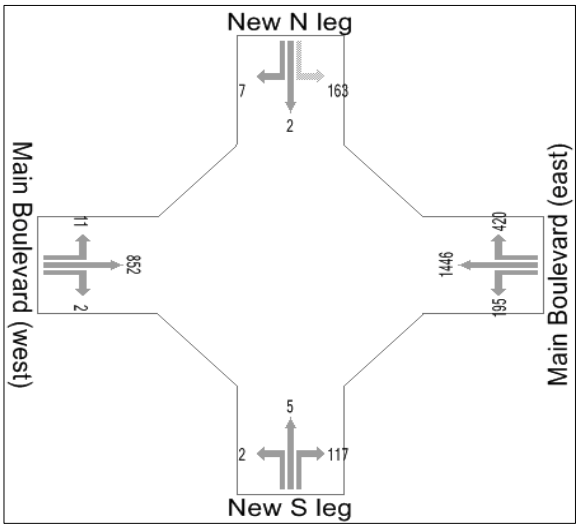


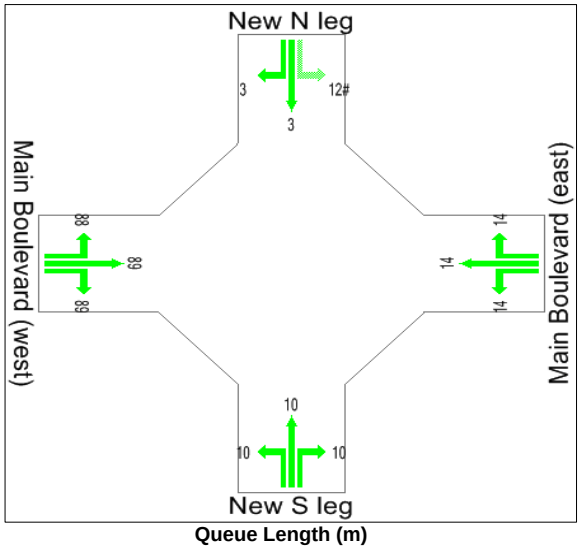
Degree of Saturation



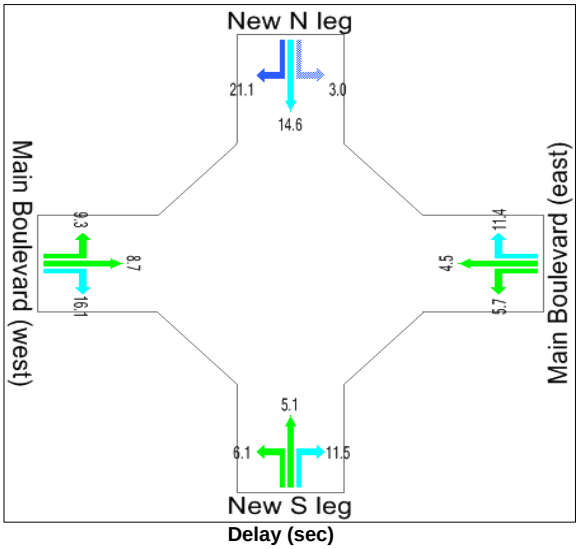
Volumes

PPK House 101 Pirie St Adelaide SA 5000 (08) 84054300	**Client** Walker Corporation **Project** Buckland Park	Designed DLK 10/10/2008 Drawn DLK 10/10/2008 Checked GRB Approved GRB Init. / Date **Scale** N/A	**Job No.** 2112592A **Title** Second Intersection within Buckland Park

Second Intersection within Buckland Park
2036 AM Peak



Queue Length (m)



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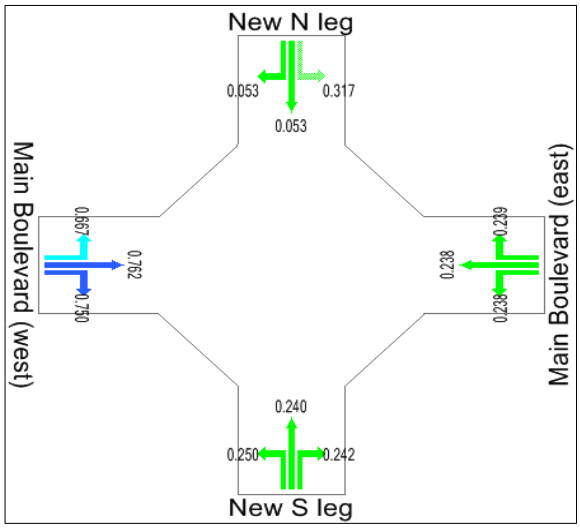
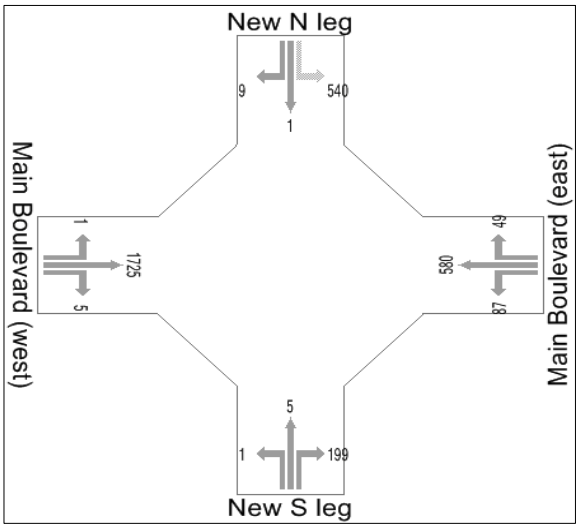


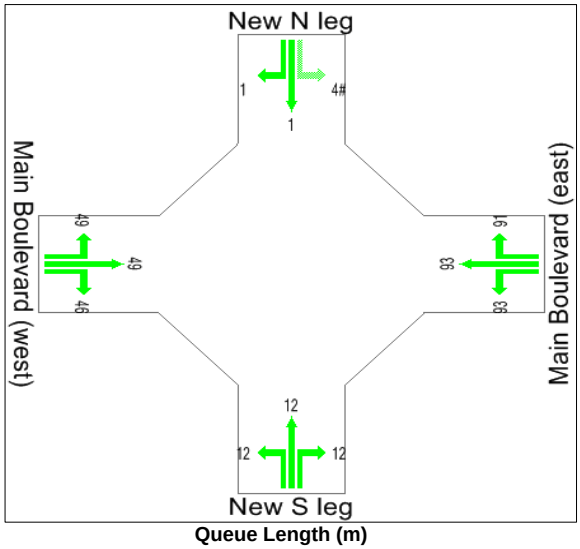
Degree of Saturation



Volumes

PPK House 101 Pirie St Adelaide SA 5000 (08) 84054300	**Client** Walker Corporation **Project** Buckland Park	Designed DLK 10/10/2008 Drawn DLK 10/10/2008 Checked GRB Approved GRB Init. / Date **Scale** N/A	**Job No.** 2112592A **Title** Second Intersection within Buckland Park

Second Intersection within Buckland Park
2036 PM Peak



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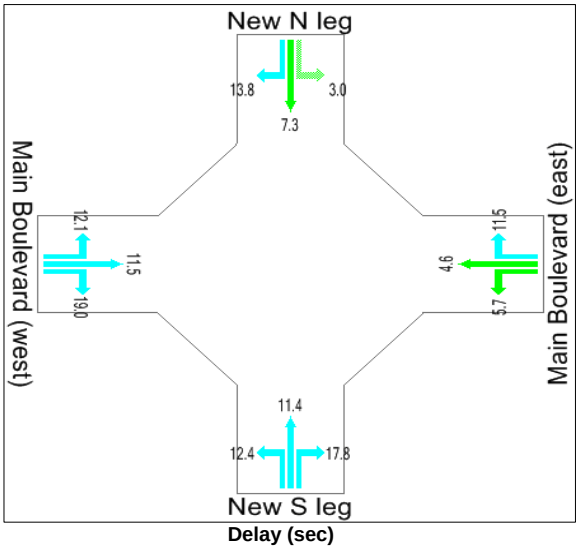

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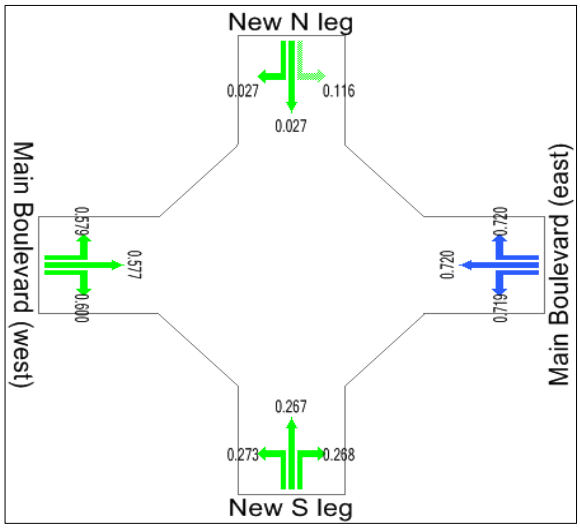
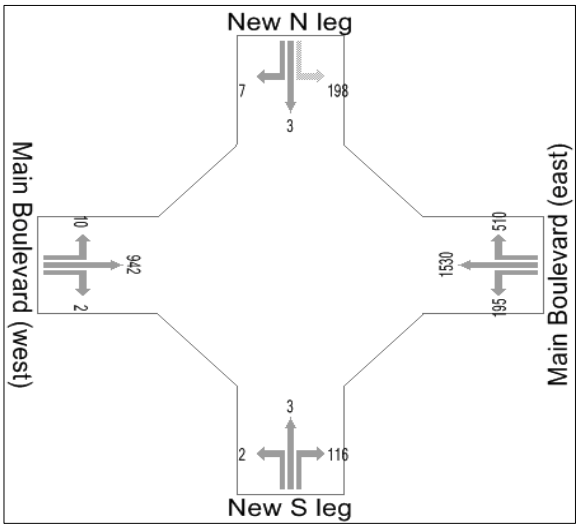


Degree of Saturation



Volumes

PPK House 101 Pirie St Adelaide SA 5000 (08) 84054300	**Client** Walker Corporation **Project** Buckland Park	Designed DLK 10/10/2008 Drawn DLK 10/10/2008 Checked GRB Approved GRB Init. / Date **Scale** N/A	**Job No.** 2112592A **Title** Second Intersection within Buckland Park

Appendix C

2031 Select link assignment results

Appendix C.1

Select link assignment AM peak 2031

Appendix C.2

Select link assignment PM peak 2031