WEST SALE AND WURRUK INDUSTRIAL SUPPLY STRATEGY

APPENDICES REPORT

NOVEMEBER 2017 WELLINGTON SHIRE COUNCIL

Urban Enterprise Urban Planning / Land Economics / Tourism Planning / Industry Software

www.urbanenterprise.com.au

APPENDIX A INFRASTRUCTURE REPORT

INFRASTRUCTURE REPORT

WEST SALE AND WURRUK LAND SUPPLY STRATEGY

AUGUST 2017

Infrastructure Report

WEST SALE AND WURRUK LAND SUPPLY STRATEGY

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1 Introduction

This report supports the Strategy which is to provide a land use planning rationale to justify, rezone and facilitate the development of an appropriate area of land, in the short-medium term, within West Sale and Wurruk in accordance with the recommendations of the adopted 'Sale, Wurruk and Longford Structure Plan (2010)'.

The three sites nominated within the Structure Plan for potential future industrial growth are located:

- **Site 1**

To the west of the existing industrial zoned land in Wurruk; The site is within Wurruk and lies to the west of the existing industrial estate, between the Princes Highway (and railway line) to the south and the Thompson River to the north. It is approximately 42Ha in area and is currently within the Farming Zone. The site is partially affected by the Flood and Land Subject to Inundation Overlays to the north. Figure 1 outlines the area for Site 1.

Figure 1: Site 1

- **Site 2**

Site 2 lies to the north of the Princes Highway and to the east of the West Sale Aerodrome. Figure 2 outlines the Site 2 area.

The site is approximately 79Ha in area and is currently within the Farming Zone. Both the Airport Environs Overlay 1 & 2 apply to the land. The activities of the adjacent Aerodrome are a potential constraint on the land – particularly given that a process is currently underway to facilitate a 300m extension to the eastern end of the existing runway. Recent discussions between Urban Enterprise and

the Aerodrome Manager and Wellington Shire Council has indicated a land swap is required to facilitate an extension to the runway at the aerodrome. With this land swap the area adjustment is a definite 54.5ha with a potential 3.8ha another 2.0ha which is considered unlikely to be included. This land swap arrangement for Site 2 is detailed in Figure 3.

- **Site 3**

Site 3 lies to the east of the Fulham Correctional Centre and to the south of the Princes Highway. The land is approximately 104Ha in area and is currently within the Farming Zone. The land is affected by the Airport Environs Overlay 2. Figure 2 outlines the Site 3 area.

Figure 2: Site 2 and 3

Figure 3: Site 2 modified

This report focuses on:

Identifying the key infrastructure requirements (including associated financial costs) that are necessary to 'unlock' the potential for the development of the identified additional land in the short-medium term that will assist in delivering the land to the market.

The following areas will be subjects of interest focussed on in this report:

- Water supply.
- Sewerage.
- Local government development requirements.
- Stormwater and issues inherent from local flooding and catchment management.
- Electricity.
- Gas supply.
- Telecommunications.

2 Summary of Previous Studies

A number of previous studies including the development Sale, Wurruk and Longford Structure plan have been undertaken in recent times and provide the platform for the West Sale and Wurruk Industrial Land Supply Strategy. Below is a brief summary of the previous investigations relevant to infrastructure in the West Sale and Wurruk area:

- Sale, Wurruk and Longford Structure Plan including Issues and Options Paper (2010):

  The structure plan identified the areas in West Sale and Wurruk to facilitate industrial development. It is was acknowledged capacity issues associated with providing cost-effective service infrastructure (e.g. piped water and sewerage) was apparent.

- Wellington Shire Council: Economic Development Strategy (2016-2022)

  This report identified facilitating investment in infrastructure with the need to continue to invest in ports, rail and roads.

- Gippsland Regional Growth Plan (2014)

  This report is a broader scale assessment and identifies Sale as an area that contains infrastructure. However, to facilitate growth it requires mid to high levels of investment to deliver infrastructure to support future growth.

- Wellington Planning Scheme Policy and Zone Amendments – Industrial and Business Zones (October 2007)

  The report identified the West Sale Aerodrome and adjoining land as favourable sites suitable to accommodate future industrial land provision but acknowledged one of the major constraints to be the lack of infrastructure provision.

- Sale Industrial Land and Retail Assessment (May 2006)

  This report identifies the need for any future industrial land supply to have appropriate transport connectivity and available infrastructure to service development.

- Sale Industrial and Bulky Goods Zone Areas Review (October 2004)

  This report identifies that most industries require a range of services in order to operate effectively. While most industries have a standard requirement for services, it is important to acknowledge few industries are heavy users of various services and this is an important consideration when assessing existing infrastructure or new infrastructure.

3 Site infrastructure assessments

3.1 Water Supply

Gippsland Water is the authority responsible for the provision of water facilities. The advice provided by Gippsland Water (GW) is:

Gippsland Water (GW) have completed water modelling to determine the effect of the three candidate sites on the existing infrastructure and advise what upgrades are required to service the ultimate scenario. For the base case GW used 500 lots via a sole feed from the residential area known as "The Ridge" water main. This was to test the existing 225mm main within Wurruk. Beyond 500 lots in Wurruk a secondary interconnection main is needed along Settlement Road. A copy of the water modelling report is in Appendix 1 of this report which includes a plan detailing the three nominated sites and the future residential growth area included in the modelling.

The three identified areas, as well a future subdivision were assigned relevant diurnal patterns to simulate their usage: The diurnal pattern applied for the Industrial sectors were based on the existing pattern for the Wurruk/Sale Industrial sector and an additional 20%. The current residential pattern in the catchment was applied to the 500 lot subdivision.

An average peak demand was applied to each of the areas by assuming a peak day consumption rate of 1300 L/Lot/Day and 5 lots per hectare for the industrial areas.
The peak hour demands of the three industrial areas were:

- Site 1 = 6.1 L/s
- Site 2 = 10.1 L/s
- Site 3 = 20.2 L/s

The findings from modelling undertaken by Gippsland Water are:

- Site 1 can be serviced without any upgrades to the existing system, via an extension of the 150 mm main along Hunt Place. For modelling purposed a 180 OD HDPE 100 main was used.

- Site 2 and Site 1 + Site 2 can be serviced with the existing network if moderate headlosses are accepted, particular with the later scenario,

- Site 3 individually will require a minimum upsize to 300 mm to avoid moderate to high headlosses along the 225 mm distribution main (4.2 km section).

- Any of the remaining options including Site 3, requires the 225 mm distribution main to upgraded to a 375 or 450 mm. Furthermore the pumps at the Wurruk TWPS would need to be replaced in order to accommodate the increased flows and subsequent headlosses.

Basically the preliminary modelling and analysis indicates that Site 1 and Site 2 could be supported with minor pump station upgrades. Beyond that the 5km distribution main will need to be increased from 225mm to likely 375mm.

3.2 Sewer

Gippsland Water is the authority responsible for the provision of sewerage reticulation. The advice provided by Gippsland Water (GW) is:

Sewer - Site 1 (about 30 developable hectares)

The current Wurruk Estate has a SPS (sewer pump station) with capacity for the additional 30 hectares.

The current sewer main to the north of current estate (Riverside Drive) has a sewer main with an Upstream Invert Level of 9.91 metres.

To service all of the area, with a sewer main extension the IL at the west extent of Area 1 will need to be about 17 metres.

Therefore about 50% of this area can gravitate and the other 50% will need to have a new sewer pump station.

All of the costs for this infrastructure would be borne by the developer.

Depending on the loading from the new estate the existing 150mm main may need to be increase to 225mm.

Figure 4: Site 1 – Existing Sewer Infrastructure

Sewer - Site 2 (about 50 developable hectares) – assessed individually

There is no sewer in this area. The rising main from the Fulham Correctional Facility SPS runs up Hopkins Road and then along the Princes Hwy into Wurruk (roundabout before bridges). About 7600 metres in length.

The rising main is DN200 DICL PN35 RRJ.

The typical dry weather loading in GW region for light industrial is about 6500 litres/day/hectare. Therefore an average dry weather of 3.8 l/s for the 50 hectares.

With wet weather added – increase by factor of 6 (rule of thumb) – therefore about 22.8 l/s.

Potentially this 22.8 l/s could be injected in the rising main, at chainage 1600 metres, however this will significantly impact the flow rate of the Fulham Correctional SPS (FC SPS).

The frictional headloss of the FC SPS is currently about 35 metres (35 l/s). Adding an additional 22.8l/s at chainage 1600, will increase the frictional headloss by another 52 metres.

For this area to go either the FC SPS will need to be upgraded (pumps, electrics, detention storage) or the rising main increased to reduce the frictional headloss.

Sewer – Site 3 (about 100 developable hectares) – assessed individually

There is no sewer in this area. The rising main from the Fulham Correctional Facility SPS runs up Hopkins Road and then along the Princes Hwy into Wurruk (roundabout before bridges). About 7600 metres in length.

The rising main is DN200 DICL PN35 RRJ.

The typical dry weather loading in GW region for light industrial is about 6500 litres/day/hectare. Therefore an average dry weather of 7.6 l/s for the 100 hectares.
With wet weather added – increase by factor of 6 (rule of thumb) – therefore about 45.6 l/s.
The injection point would be at chainage 300m, and again will significantly affect the flow rate of FC SPS.

The frictional headloss of the FC SPS is currently about 35 metres. Adding an additional 45.6l/s at chainage 300, will increase the frictional headloss by another 143 metres (178 metre of friction).

For this area to go **BOTH** the FC SPS will need to be upgraded **AND** the rising main increased to reduce the frictional headloss.

Old rising main from Fulham.

Figure 5 details an abandoned GW rising main which has been identified by the water authority as a potential item of infrastructure that could potentially be utilised as a stormwater outlet. It may have a benefit to provide a slow release outlet for stormwater from future development in the area. The condition of the rising main is considered to be fair.

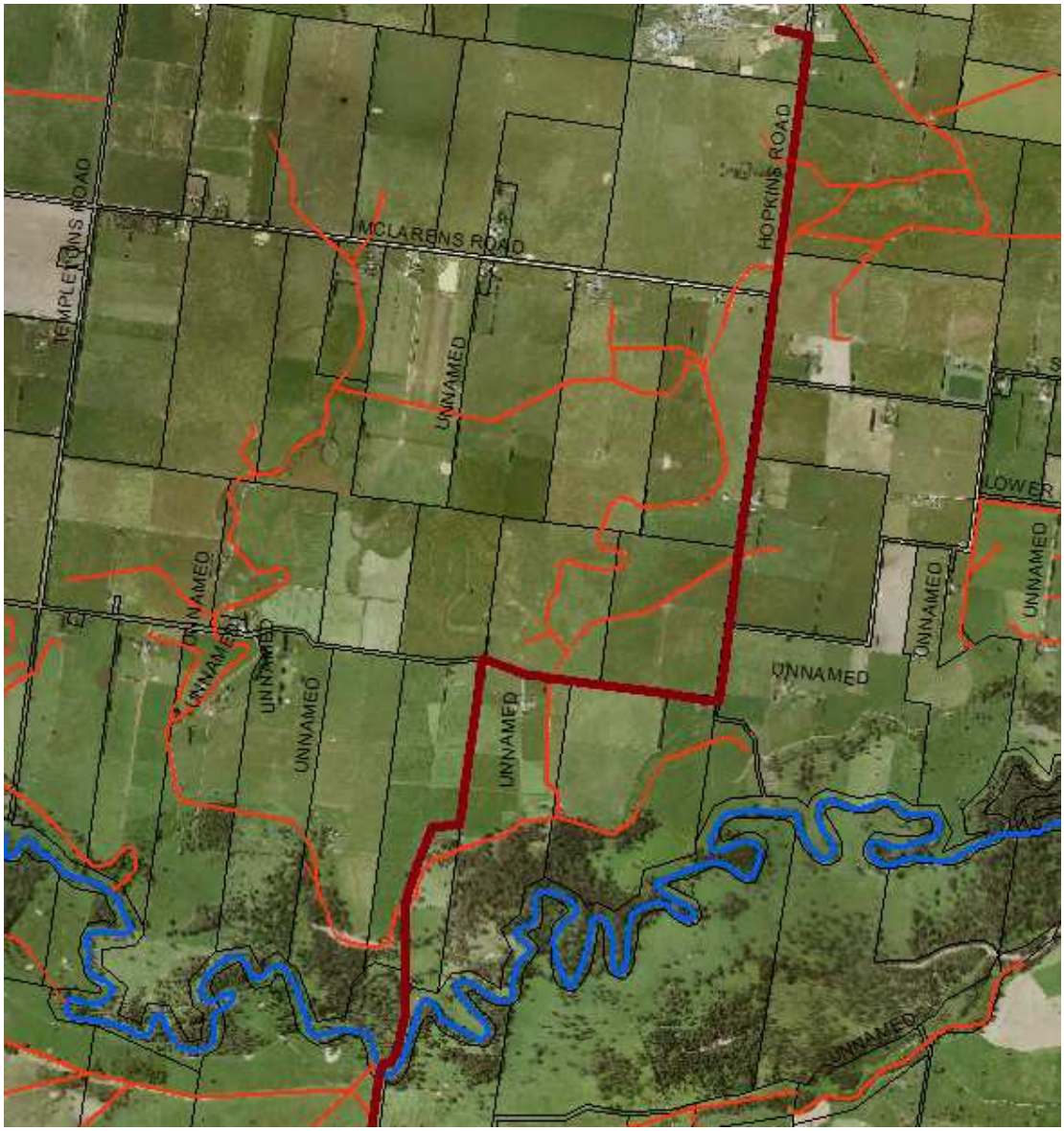

Figure 5: Old 150mm diameter rising main from Fulham

3.3 Stormwater

Wellington Shire Council

The existing local drainage is maintained by Wellington Shire Council (WSC). Advice from Wellington Shire Council engineering department is:

The typical IDM industrial street cross section drawing of. Table 2 Urban Road / Street characteristics in the IDM (refer Figure 6 below) would enable for appropriate overland flow paths for stormwater.

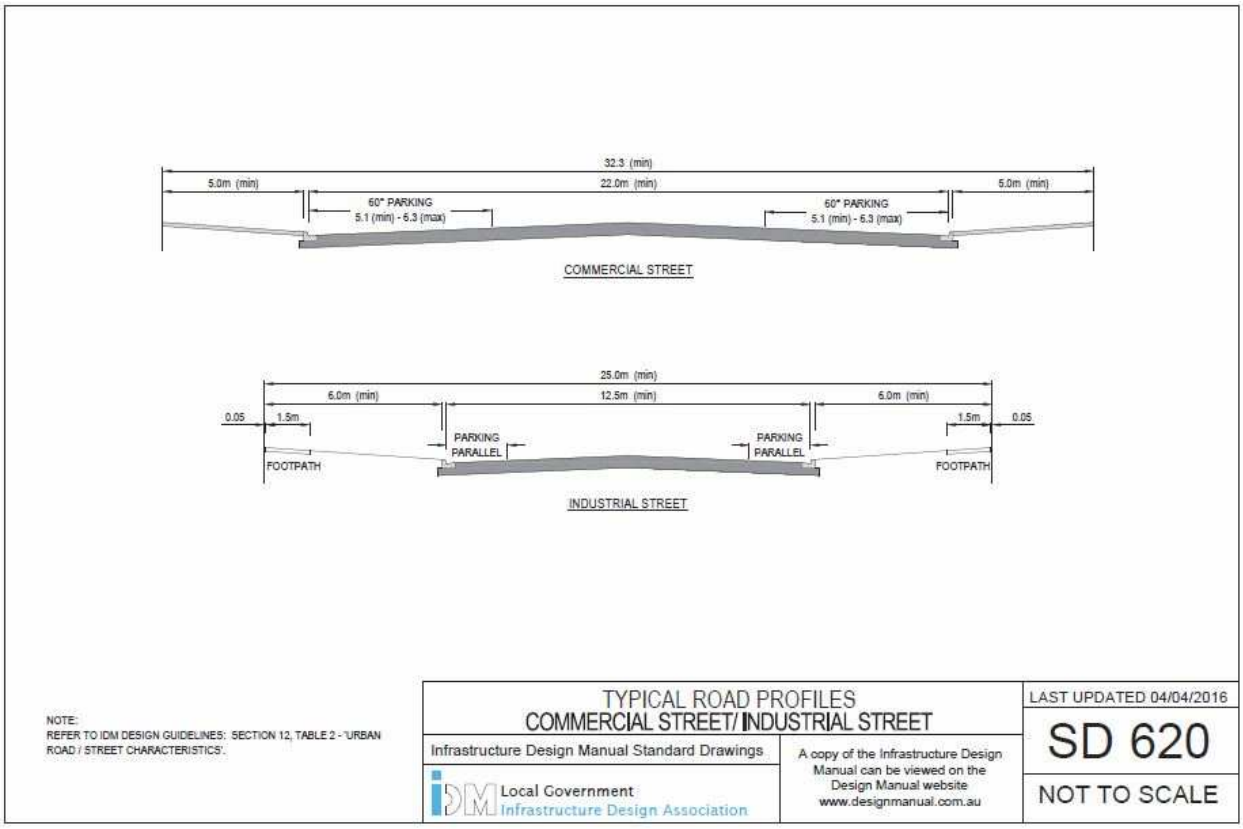

Figure 6: Typical industrial street cross section

Drainage will follow the same approach as a typical low density residential zone development. Industrial subdivisions drainage must cater for the 10% AEP event with 1% event typically as overland flow. Outfalls for the candidate areas are described below:

- **Site 1**

Subject to West Gippsland Catchment Management Authority (WGCMA) approval/conditions but likely to the Thompson River to the north of the site. Overland flow to river will be okay with treatment;

- **Site 2**

There is an existing drain along the eastern extent airfield which eventually drains down to the Central Gippsland No. 4 drain as highlighted in Figure 7. Overland flow is expected to be okay with typical levels of retention though it will require further detailed investigation. There is a current project to extend the runway which Wellington Shire Council will be required to re-arrange the final drainage in this area but it will ultimately drain to the same No. 4 drain.

Figure 7: Central Gippsland Drain No.4

- **Site 3**

There is a nominated drain which is part of the Kilmany drainage system as per Figure 8. The site can discharge into this drain however the final stormwater strategy may need to take into account for a higher level of retention as any water not lost through evaporation and transpiration may ultimately drain to the private levee near the outlet to the Latrobe River. Any future development needs to account for any additional overflow from the land which would need to be managed by water harvesting or retention before ever hitting the levee bank which is approximately 7km away from the site.

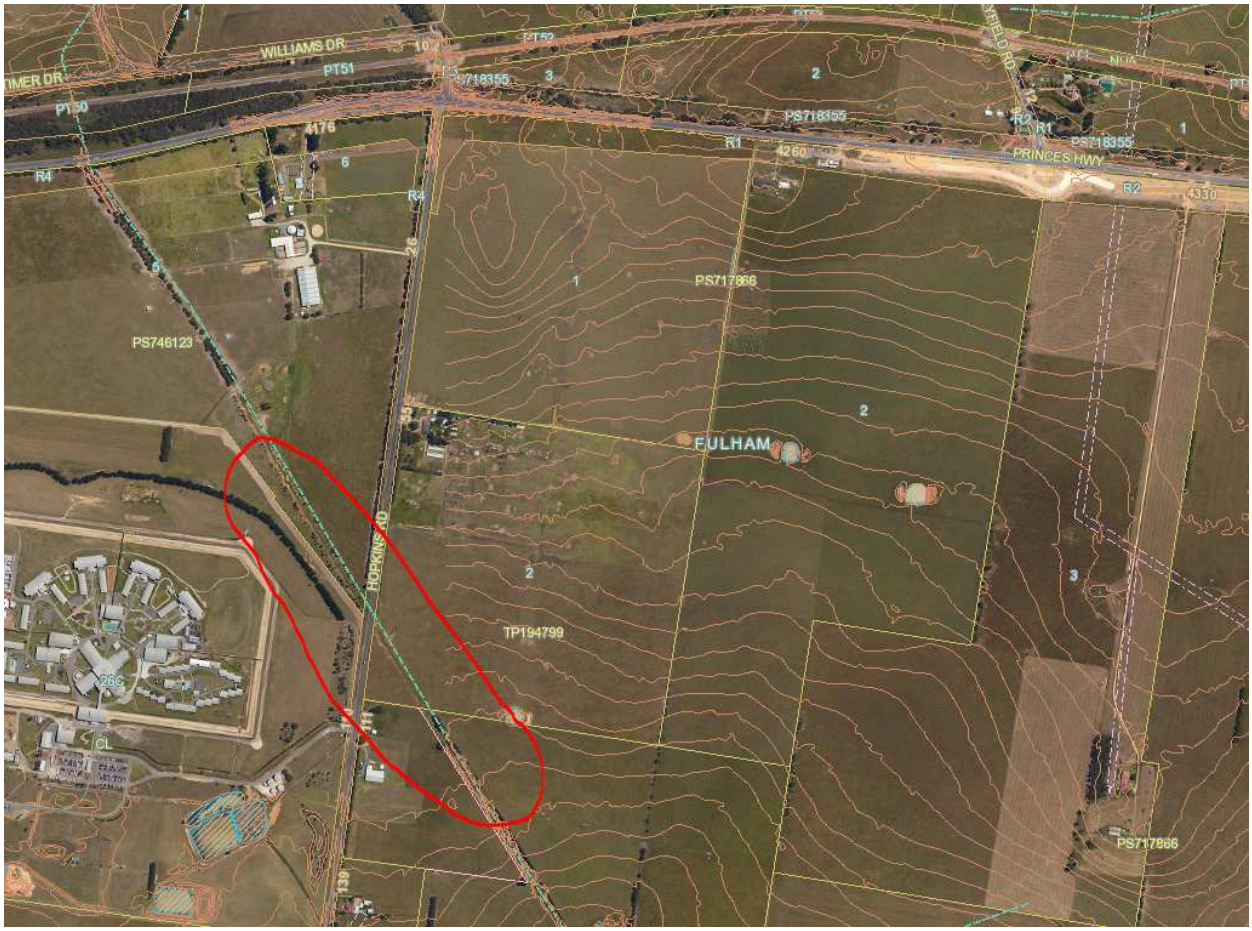

Figure 8: Kilmany Drain

West Gippsland Catchment Management Authority

West Gippsland Catchment Management Authority (WGCMA) are a government organisation responsible for managing the land and water resources in West Gippsland. Advice from the West Gippsland Catchment Management Authority (CMA) includes:

Figure 9 highlights the designated waterways and known flood extents in the Wurruk area.

Unique to this area is a flood levee known as the Kilmany Levee Bank. Although this area is unique as any significant stormwater flow that drains to this area needs to be pumped past the levee bank, it is acknowledge that pumping of stormwater is very infrequent. The actual flow from the catchment that reaches the levee bank is very minimal as most water is either stored in existing farm dams, waterways and lost through evaporation and transpiration. The cost of pumping the stormwater falls to the land holders who own land behind the levee.

It is likely that part of Site 2 and all of Site 3 would drain to this point. Without further detailed hydrological and hydraulic analysis which is not included in this study, it is difficult to determine the actual size of sub catchment within site 2 that drains to the Kilmany drain. However, the land in the region is reasonably flat and therefore future development can be engineered to ensure a significant portion of the catchment drains to the north and discharges into the Central Gippsland Drain No.4.

In Figure 9 WGCMA have highlighted the drainage path from Site 2 and Site 3 to the Kilmany Levee which is shown as a red line.

If stormwater does drain to this location it will need to be managed to meet best practice stormwater quality targets as well as ensure that the quantity is managed. This will potentially require additional on site storage compared to traditional best practice stormwater treatment.

Based on the above requirements TGM have calculated that to manage stormwater runoff to pre development rates and volumes requires drainage reserves to be set aside to enable stormwater detention. The encumbered land for:

- Site 2 is 4.06ha
- Site 3 is 8.48ha

Which equates to approximately 8 % of the land area. The above is based on a rudimentary calculation and does not include any detailed assessment to calculate flood hydrographs and assess streamflow routing. Hence the area required to set aside for stormwater detention may possibly be of a greater percentage that those above. The above also assumes an average storage depth of 0.5m. If the storage depth can be increased this can reduce the actual area required for detention.

As noted in section 3.2 Gippsland Water have advised of a redundant rising main that heads to the La Trobe River from Fulham correctional facility via Hopkins Road. This a 150mm diameter pipe which would have capacity to discharge a small amount of stormwater. It would have minimal benefit to reduce the on site detention. To provide a more appropriate sized drainage outlet along this route a nominal size 900mm diameter pipe is recommended. The distance to the La Trobe River is 400m so the cost to deliver this this drainage outfall is approximately $3.0 million.

It is noted that Site 1 does not require the same level of stormwater detention as there is a great ability to discharge the stormwater to the Thompson River. However, Site 1 is subject to flooding from the Thompson River and therefore is affected by a flood extents. The area that is encumbered by a flood extents can be utilised so locate a stormwater treatment system including any additional flood storage. Final approvals would be subject to WGCMA assessment.

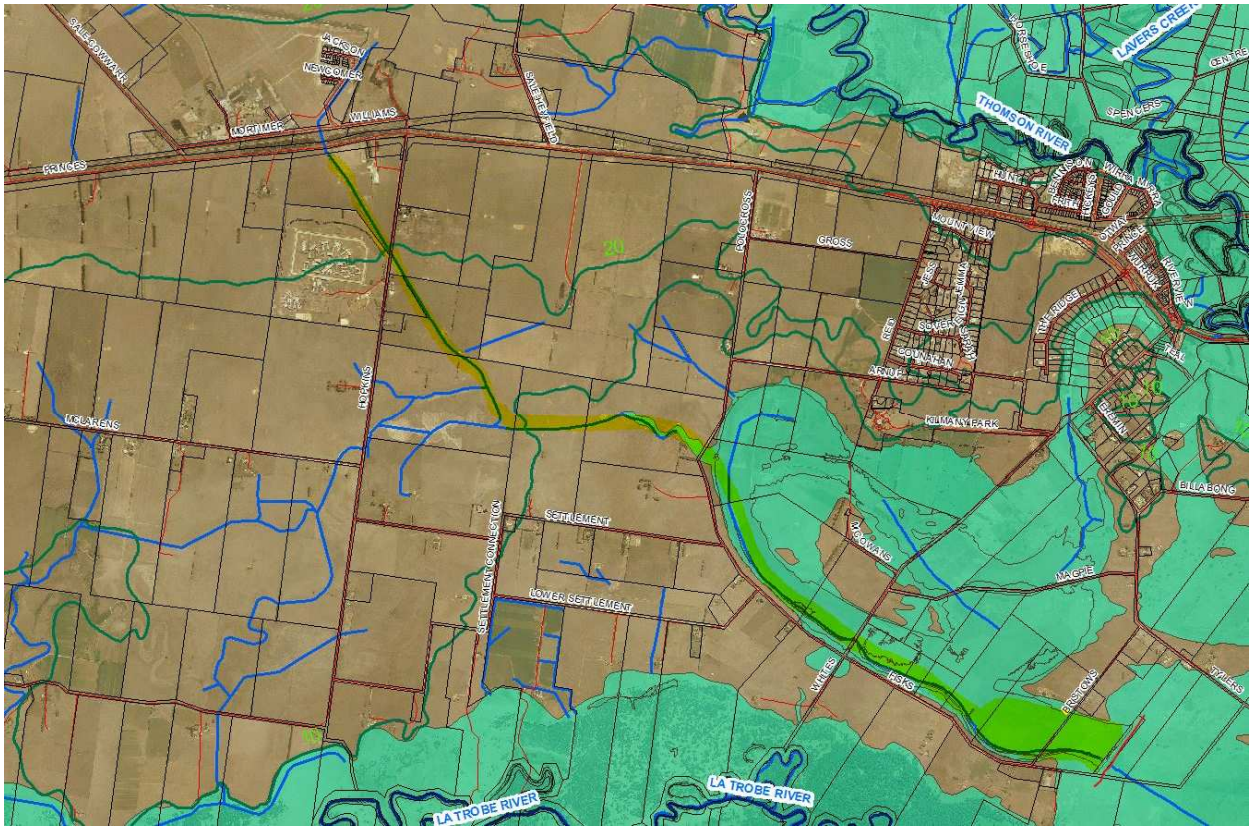

Figure 9: Designated Waterway and Kilmany Drain

3.4 Electricity

The advice from Ausnet, the electrical authority responsible for electricity infrastructure, is that it appears the current infrastructure is sufficient to support additional loading of 1–2 MVA in the shorter term.
As shown in Figure 10 AusNet Services has two rural style 22kV line known as MFA23 and SLE14 distribution feeders.

- These feeders presently have the capability to support 1-2MVA in the location shown.
- This should be suitable for the first stages of development.
- This may not be capable of supporting the ultimate demand of these sites. This will depend significantly on the electrical demand of customers within the estate.
- Augmentation two the lines can be undertaken and this will increase the availability of power. This can be determined once development is undertaken.
  Normal supply policy contribution and cost will be incurred to reticulate the site.

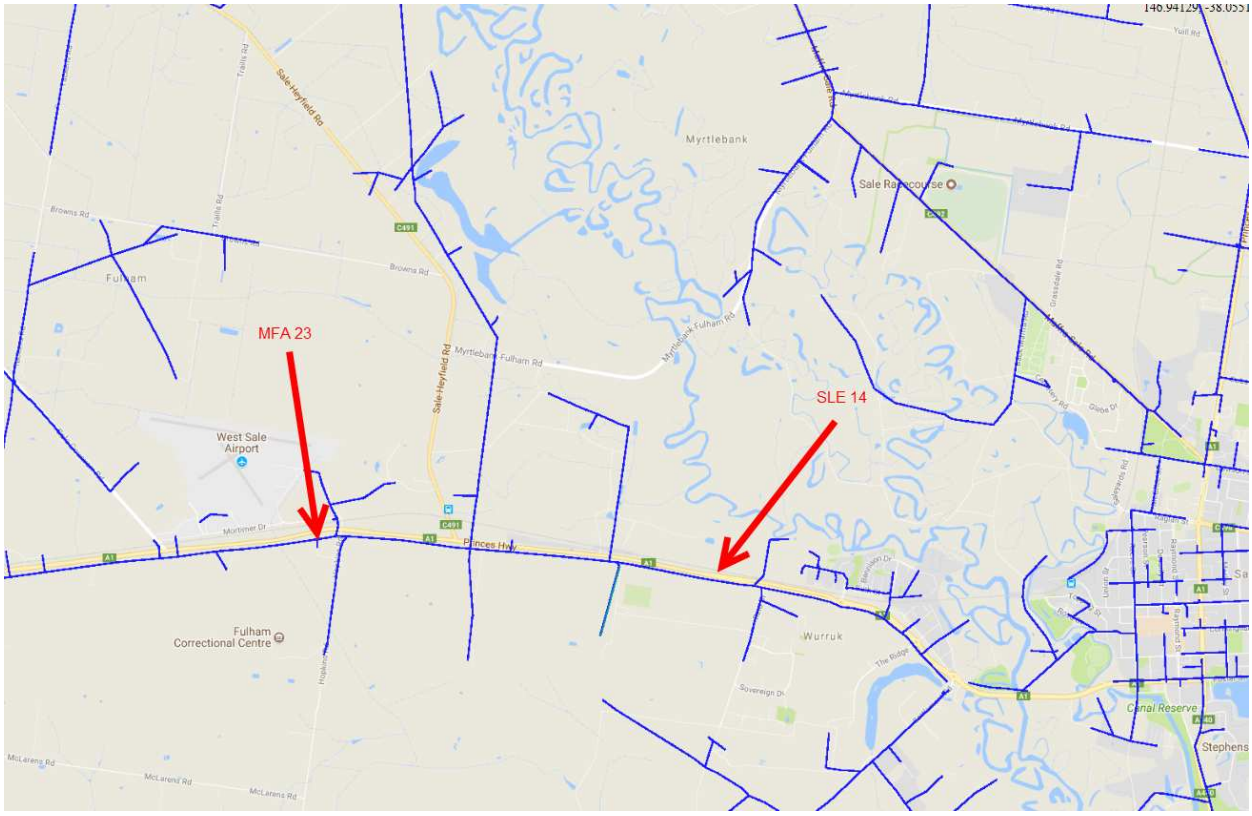

Figure 10: Electricity – Existing Infrastructure

3.5 Gas

APA Group are responsible for managing the gas supply network in Sale. The advice received from APA includes:

- The subject sites are adjacent to existing gas reticulation infrastructure but not of a capacity to support any major industrial loads. The current infrastructure has been installed to suit the supply required for Fulham and the Aerodrome.
- APA Networks do not automatically reticulate industrial estates, supply is determined from customer connection requests – generally made through a retailer.
- To supply any major load, either duplication of the existing supply main or upstream augmentation maybe required.

3.6 Telecommunications

The agent for the roll out of the telecommunication services will be the responsibility of the National Broadband Network (NBN).

The Dial before you Dig information indicates NBN assets are located within this region. According to the NBN website it is also noted that the Wurruk region is NBN ready and new and existing developments can connect to the NBN service through a NBN provided.

There is no expectation for any backhaul charges.

4 Site Infrastructure Comparison

Based on the infrastructure assessments the below table assesses a comparison between each site in terms of what infrastructure upgrades are necessary and what the potential costs are required for upgrade to these area to meet the future development. The below table is based on a light industry demand.

	Site 1		Site 2		Site 3	
Infrastructure Item	Description of Upgrade	Cost ($ mil)	Description of Upgrade	Cost ($ mil)	Description of Upgrade	Cost ($ mil)
Water	Can be serviced without any upgrades to the existing system, via an extension of the 150 mm main along Hunt Place	$0	Site 2 and Site 1 + Site 2 can be serviced with the existing network	$0	Site 3 individually will require a minimum upsize to 300 mm to avoid moderate to high headlosses along the 225 mm distribution main (4.2 km section) (@$500/m)	$2.1 mil
Sewer	New sewer pump station for 50% of site.	$0.75	Fulham Correction SPS to be upgraded	$1.5	The Fulham Correction SPS will need to be upgraded ($2.1mil) **AND** the rising main upgraded (7.6km). (4.2km @ $500/m)	$4.2
Stormwater	Wetland/ Detention System	$1.0	Wetland/ Detention System	$2.0	Wetland/ Detention System ($2.5mil) and 900mm dia outfall (4.0km @$750/m)	$5.5
Electricity		$0		$0		$0
Gas	Upgrade gas main to site	$0.18	Upgrade gas main to site	$1.35	Upgrade gas main to site	$1.50
Telecommun-ications		$0		$0		$0
TOTAL		$1.93		$4.85		$13.30

Figure 11: Infrastructure comparison

5 Summary

The three nominated sites in West Sale and Wurruk have been assessed to determine whether existing infrastructure can support future industrial development and where necessary, what investments are necessary and what constraints exists. The assessment was based on assessing existing data and reports, and consultation with key authorities and stakeholders.

Based on previous studies it was identified the areas had a reasonable level of infrastructure in the area but there was a definite need for investment to facilitate future growth.

The study has determined that Site 1 has the least investment required while Site 3 requires the highest investment. It is important to acknowledge the land areas are not equal so it is disproportionate. If the areas were of equal size the actual costs would change. However, it is clear that site 2 and 3, regardless of their size do have infrastructure constraints, namely sewer and stormwater.

It was established that Site 3 is heavily constrained with site stormwater management in that any increase in stormwater outflow from future development impacts downstream landowners who are required to manage existing stormwater from upstream properties. Changes to the stormwater conditions adversely impacts these landowners. Site 2 also has a sub catchment area subject to the same conditions to site 3. Hence, to manage stormwater for Site 2 and 3 land from these areas are to be made available for on-site detention.

Site 1 is subject to having access to the existing industrial area to the east and has been assumed in this report. Therefore direct access to this industrial area is necessary to ensure development of Site 1, otherwise, the infrastructure investment will be more significant.

Finally, this report has assessed the land use for industrial growth primarily on light industry demand. Should there be an industrial business that require a heavy demand on infrastructure it would result in the need for larger infrastructure upgrades to those identified in this report. However, given the assessment is based on the same industrial demand for each of the candidate sites it is a relative comparison and it would be expected similar differences but on larger cost scales.

1 Appendix 1 (Gippsland Water - Water Modelling Report)

APPENDIX B TRAFFIC REPORT

TraffixGroup

Traffic Engineers and Transport Planners

Traffic Engineering Assessment

West Sale and Wurruk Industrial Land Supply Strategy

Prepared for

Urban Enterprise

November, 2017
22735R-02A

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Traffic Engineering Assessment

West Sale and Wurruk Industrial Land Supply Strategy

Document Control

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Our Reference: 22735R-02A

Table of Contents

1 Introduction

Traffix Group has been engaged by Urban Enterprise to undertake a traffic engineering assessment of the West Sale and Wurruk Industrial Land Supply Strategy being undertaken by Urban Enterprise on behalf of Wellington Shire Council.

This report provides a traffic engineering assessment of the three candidate areas under consideration as part of the Strategy.

2 West Sale and Wurruk Industrial Land Supply Strategy

2.1 Overview

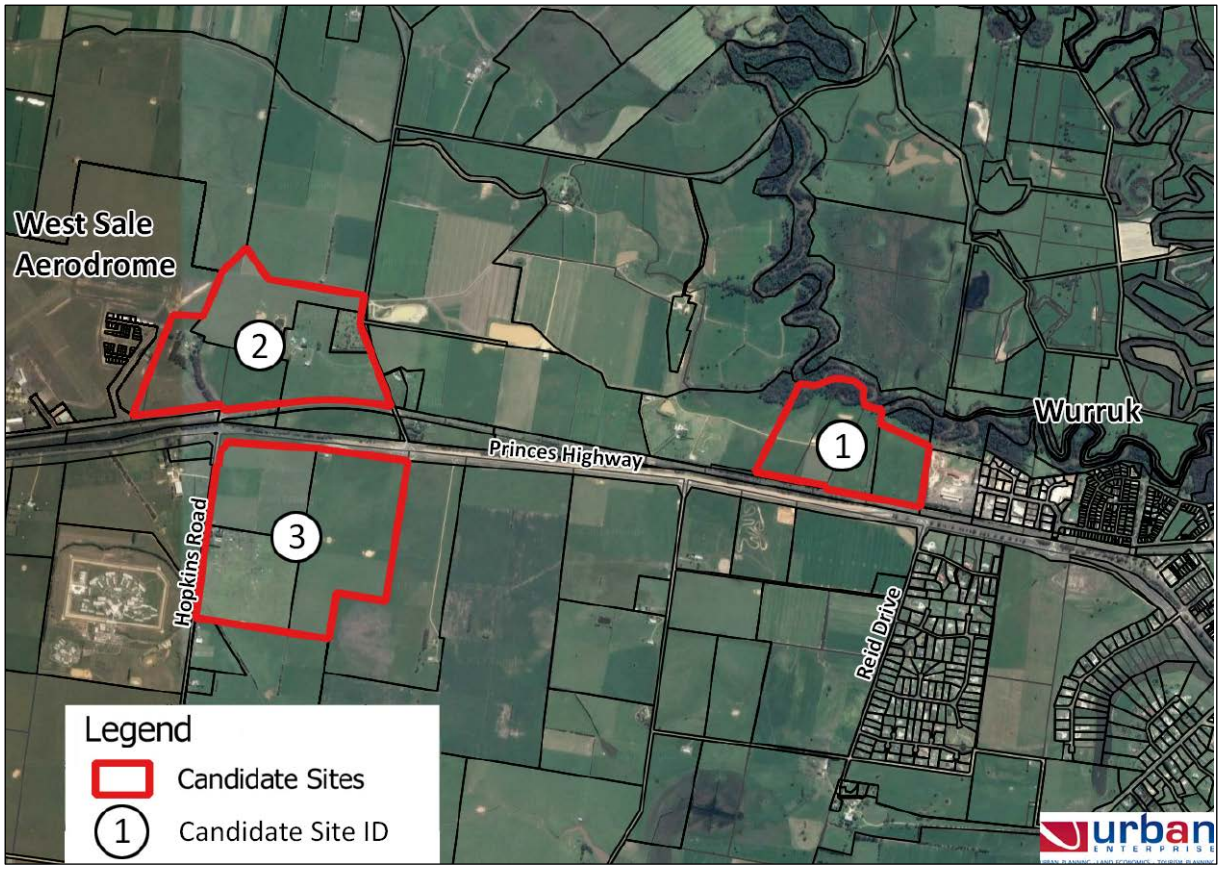
Wellington Shire Council has engaged Urban Enterprise to prepare the West Sale and Wurruk Industrial Land Supply Strategy. The Strategy will review the provision of existing industrial land, assess nominated future sites and consider future land requirements over the short to medium term in Wurruk and West Sale.

2.2 Candidate Areas

Three candidate areas have been nominated for review as part of the Strategy. These are described as follows:

- Candidate Area 1: Wurruk
  - West of the existing industrial zoned land in Wurruk
  - Land area: 42 ha
- Candidate Area 2: West Sale Aerodrome
  - North of Princes Highway and east of West Sale Aerodrome (west of Sale-Heyfield Road)
  - Land area: 55 ha
- Candidate Area 3: Fulham
  - South of Princes Highway and east of Fulham Correctional Centre (east of Hopkins Road)
  - Land area: 100 ha

The locations of the three candidate areas are shown in Figure 1.



Source: Urban Enterprise

Figure 1: Candidate Area Locations

3 Existing Conditions

3.1 Road Network

3.1.1 Princes Highway

Princes Highway is a State Highway under the control of VicRoads. It is in the Road Zone Category 1 (RDZ1) under the Wellington Planning Scheme.

In the vicinity of the candidate sites it has recently been upgraded to a duplicated road from a two way road.

Roundabouts control its intersections with Hunt Place and Sale-Heyfield Road. Its intersections with Reid Drive, Polocross Lane and Hopkins Road/Williams Drive are controlled by wide median treatments (with Princes Highway having priority).

The speed limit along Princes Highway is 80 km/h eastwards from approximately 300m west of Hunt Place and 100 km/h from that point west to west of Hopkins Road.

Princes Highway in the vicinity of the candidate sites is shown in Photographs 1 and 2. It is noted that at the time the road was inspected, the duplication was not completed.

Photograph 1: Princes Highway View East from Reid Drive (Westbound Carriageway)

Photograph 2: Princes Highway View West from Reid Drive (Eastbound Carriageway)

3.1.2 Sale-Heyfield Road

Sale-Heyfield Road is a State Arterial Road under the control of VicRoads. It is in the Road Zone Category 1 (RDZ1) under the Wellington Planning Scheme. It extends north/northwest from its T-intersection with Princes Highway (controlled by a roundabout).

In the vicinity of Candidate Area 2 it comprises a 7.0m wide two lane two way rural road with gravel shoulders.

Sale-Heyfield Road crosses Melbourne-Bairnsdale railway line approximately 200m north of Princes Highway. The railway level crossing is controlled by flashing lights and boom gates.

The speed limit along Sale-Heyfield Road is 80 km/h between Princes Highway and the bend to the north, and 100 km/h north of that point.

Sale-Heyfield Road in the vicinity of the candidate site is shown in Photographs 3 and 4.

Photograph 3: Sale-Heyfield Road View South to Railway Level Crossing

Photograph 4: Sale-Heyfield Road View North to Bend North of Princes Highway

3.1.3 Hopkins Road

Hopkins Road is a local road under the control of Wellington Shire Council. Hopkins Road is aligned in a north-south direction, intersecting as a cross road with Princes Highway/Williams Drive to the north (controlled by a wide median treatment with priority to Princes Highway) and extending south to Settlement Road (approximately 4.4km). It provides access to Fulham Correctional Centre and rural properties.

In the vicinity of Candidate Area 3 it comprises a 6.4m wide two lane two way rural road.

Wellington Shire Council's Register of Public Roads classifies Hopkins Road as Local Access A - Road (*A major access road for local residential or commercial traffic or public facility. Must be a through road or road to significant destination.*) with an indicative daily traffic volume of 150-1,500 vpd.

Hopkins Road in the vicinity of the candidate site is shown in Photograph 5.

Photograph 5: Hopkins Road View South from Princes Highway

3.1.4 Other Roads

Hunt Place

Hunt Place is a local road under the control of Wellington Shire Council. It is an industrial road with a carriageway width of 12.3m and kerb and channel. It extends north from its T-intersection with Princes Highway (controlled by a roundabout) before turning east-west and terminating as a dead end (court bowl) at its western end. It provides access to the industrial zone in Wurruk.

Hunt Place crosses Melbourne-Bairnsdale railway line approximately 50m north of Princes Highway. The railway level crossing is controlled by flashing lights and boom gates.

Wellington Shire Council's Register of Public Roads classifies Hunt Place as Local Access A - Road (*A major access road for local residential or commercial traffic or public facility. Must be a through road or road to significant destination.)* with an indicative daily traffic volume of 150-1,500 vpd.

Hunt Place is shown in Photographs 6 to 9.

Photograph 6: Hunt Place View West to End from Riverside Drive

Photograph 7: Hunt Place View East from Riverside Drive

Photograph 8: Hunt Place View North from Railway Level Crossing

Photograph 9: Hunt Place View South Across Railway Level Crossing to Princes Highway

Riverside Drive

Riverside Drive is a local road under the control of Wellington Shire Council. It is an industrial road with a carriageway width of 12.3m and kerb and channel. It extends north from its cross-intersection with Hunt Place/Plant Court (Hunt Place has priority) before turning northwest and terminating as a dead end (court bowl) at its western end. It provides access to the industrial zone in Wurruk.

Wellington Shire Council's Register of Public Roads classifies Riverside Drive as Local Access B - Road (*A minor access road for local residential or commercial traffic.*) with an indicative daily traffic volume of 30-500 vpd.

Riverside Drive is shown in Photographs 10 and 11.

Photograph 10: Riverside Drive View Southeast from End

Photograph 11: Riverside Drive View to Courtbowl

Williams Drive

Williams Drive is a local road under the control of Wellington Shire Council. It extends north from its cross-intersection with Princes Highway/Hopkins Road (controlled by a wide median treatment with priority to Princes Highway) before turning west and then north before terminating at West Sale Aerodrome. It also provides access to Victorian Emergency Management Training Complex, Gippsland Armed Forces Museum and Federation Training - Fulham Campus via Mortimer Drive.

Williams Road crosses Melbourne-Bairnsdale railway line approximately 70m north of Princes Highway. The railway level crossing is controlled by flashing lights.

Wellington Shire Council's Register of Public Roads classifies Williams Drive as Local Access A - Road (*A major access road for local residential or commercial traffic or public facility. Must be a through road or road to significant destination.*) with an indicative daily traffic volume of 150-1,500 vpd.

Williams Drive is shown in Photographs 12 to 14.

Photograph 12: Williams Drive View North to Railway Level Crossing

Photograph 13: Williams Drive View West from Bend North of Princes Highway

Photograph 14: Williams Drive View Southwest from Airport End of Road

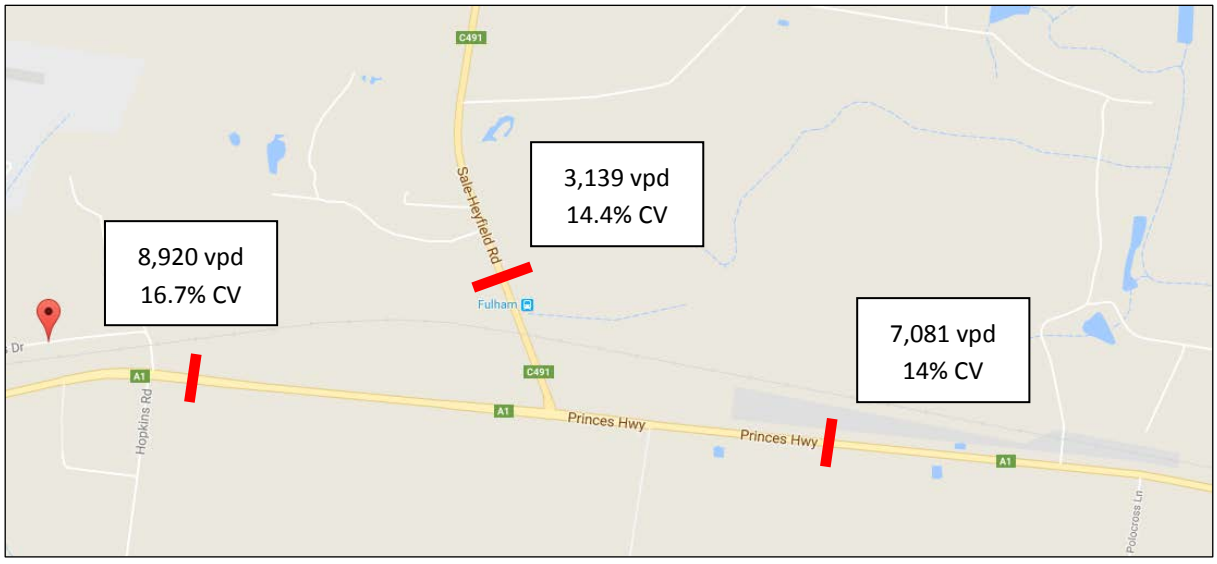
3.2 Traffic Volumes

Traffic volume data provided by VicRoads is shown in Table 1. The locations of the counts are shown in Figure 2.

Table 1: Traffic Volumes (1)

Location	Two Way Daily Volume	% Commercial Vehicles
Sale-Heyfield Road 200m North of Princes Highway	3,139 vpd	14.4%
Princes Highway Between Sale-Heyfield Road and Polocross Lane	7,081 vpd	14%
Princes Highway 320m West of Sale-Heyfield Road	8,920 vpd	16.7%

(1) Dates of counts unknown.



Source: Google Maps

Figure 2: Traffic Count Locations

Wellington Shire Council has no traffic volume data for Hopkins Road, Hunt Place, Riverside Drive or Williams Drive. Based on Council's Road Management Plan, these roads have the following indicative daily traffic volumes:

- Hopkins Road: 150-1,500 vpd
- Hunt Place: 150-1,500 vpd
- Riverside Drive: 30-500 vpd
- Williams Drive: 150-1,500 vpd

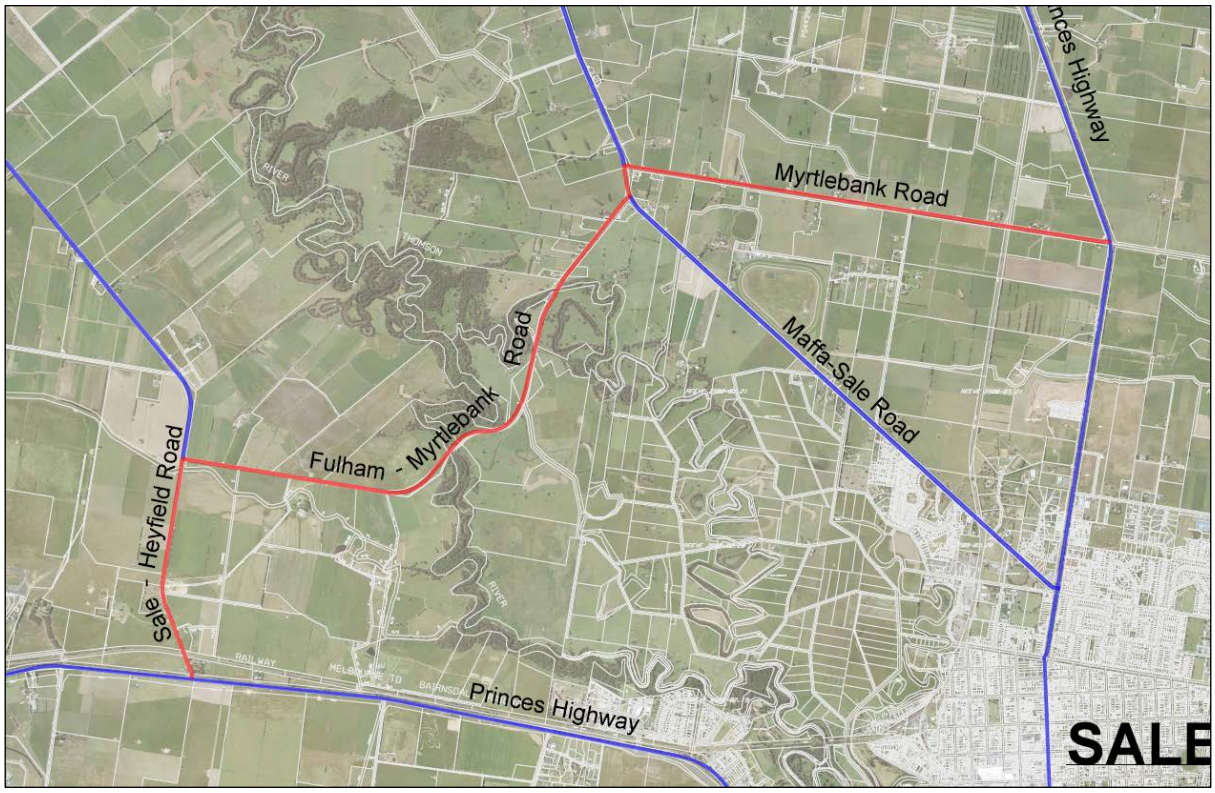
3.3 Crash History

Princes Highway between Hopkins Road and Reid Drive has recently been upgraded to a duplicated road from a two way road. Accordingly, recent crash history is no longer relevant to an assessment of the safety of this section of road.

4 Sale Alternative Truck Route

The Victorian Government has allocated funds to investigate the feasibility of formalising the Sale Alternative Truck Route, with a business case to be submitted for funding consideration by November, 2017. VicRoads and Wellington Shire Council are jointly involved with this project as the roads are both arterial and municipal maintained.

Figure 3 shows a plan with the route highlighted in red.



Source: VicRoads

Figure 3: Sale Alternative Truck Route

As part of the planning works VicRoads is investigating a number of intersection improvements with potential land acquisition requirements to accommodate these, as well as an increased road reserve on the Sale-Heyfield Road. No information is currently available as to the location and width of this increased road reserve.

5 Traffic Generation Rates

5.1 Overview

Guide to Traffic Generating Developments Version 2.2 October 2002 (RTA NSW) (the "RTA guide") provides guidance as to the traffic generation of a range of land uses, including industrial uses.

The RTA guide provides the following overview of industry traffic generation:

The peak traffic generation period for industrial land use is generally determined by three key factors: employee density, travel mode and peak period travel distribution. The employee density will vary with the industry type - from a low density at traditional warehouses to a high density at high-tech *industrial developments. The peak period travel distributions (i.e. the proportion of workers who travel to or from the site in the peak hour), varies with the type and extent of development. A single use factory generally has a higher proportion of workers travelling in the peak hour than a factory unit development, where different employees have different work patterns. As work patterns continue to overlap, the percentage of those travelling in the peak hour declines.*

The generation rates given below are for single use developments. Lower rates might be appropriate for multiple-use developments, as discussed above.

5.2 Factories

The RTA guide provides the following traffic generation rates for factories:

- Daily vehicle trips: 5 per 100m^2 gross floor area
- Evening peak hour vehicle trips: 1 per 100m^2 gross floor area

5.3 Warehouses

The RTA guide provides the following traffic generation rates for warehouses:

- Daily vehicle trips: 4 per 100m^2 gross floor area
- Morning peak hour vehicle trips: 0.5 per 100m^2 gross floor area

5.4 Adopted Traffic Generation Rates

The critical time period for traffic impact assessment is typically the evening peak hour.

For the purposes of this assessment, the traffic generation rates for "factories" have been adopted (being the higher daily rate and having an evening peak hour rate); namely:

- Daily vehicle trips: 5 per 100m^2 gross floor area
- Evening peak hour vehicle trips: 1 per 100m^2 gross floor area

It is noted that these rates have generally been derived from metropolitan areas. Experience suggests that traffic generation rates for industrial uses in regional areas could be in the order of 20% less than these rates.

The adoption of these rates for the West Sale and Wurruk Industrial Land Supply Strategy therefore may result in an overestimation of the volumes of traffic likely to be generated by the candidate areas and, subsequently, an overestimation of the likely traffic impact of the development of the candidate areas.

5.5 Floor Areas

The traffic generation rates detailed above are based on floor areas of the land use. At strategic planning level, floor areas are typically not known, as is the case here. For the purposes of this assessment, the following "rules of thumb" have been applied:

- Proportion of total site area available for industrial use: 80% (1)
- Proportion of industrial land available for buildings: 40% (2)

(1) Allows for access roads, reserves, floodways, water treatment ponds, etc.

(2) Allows for accessways, car parking, etc.

Therefore, the traffic generation rates detailed in Section 5.4 will be applied to 32% (= 80% x 40%) of the total land area of each candidate area.

5.6 Broad Traffic Distribution

All candidate areas are located some 5km west of Sale and some 40km east of Traralgon. Accordingly, it is assumed for the purposes of this assessment that 40% of employees will reside in Traralgon and 60% will reside in Sale.

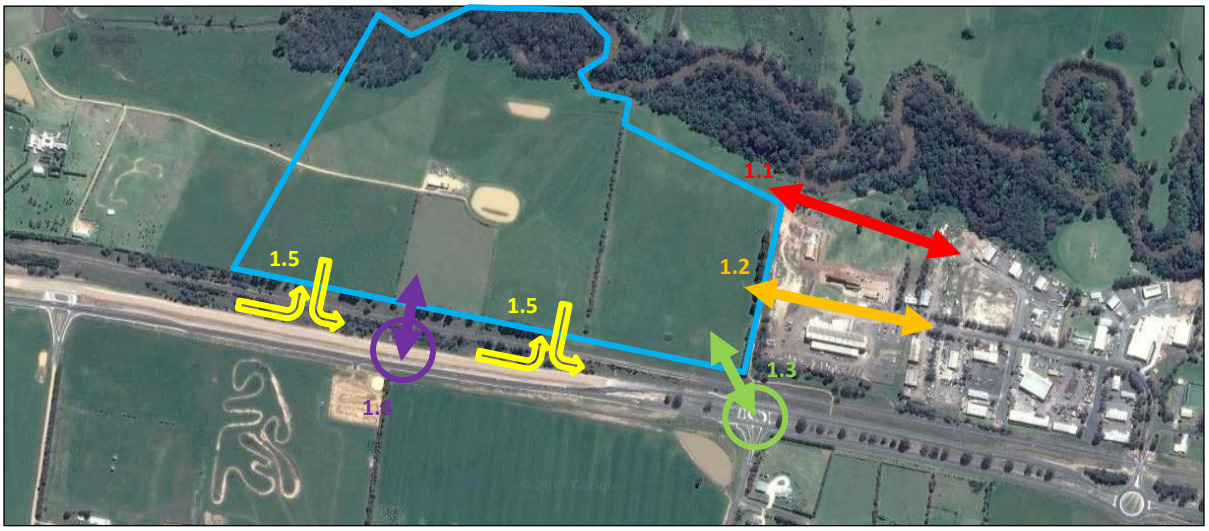
Also for the purposes of this assessment, it is assumed that 90% of the evening peak hour traffic generated by the candidate areas will be outbound movements and 10% will be inbound movements.

6 Traffic Engineering Impact Assessment of Candidate Areas

6.1 Candidate Area 1: Wurruk

6.1.1 Potential Access Options

Five potential access options have been identified for Candidate Area 1. These are shown diagrammatically in Figure 4 and described below.



Source: NearMap

Figure 4: Candidate Area 1 - Potential Access Options

Option 1.1

- Connection through existing industrial estate via extension of Riverside Drive and via Hunt Place roundabout on Princes Highway.

Option 1.2

- Connection through existing industrial estate via extension of Hunt Place and via Hunt Place roundabout on Princes Highway.

Option 1.3

- New access opposite Reid Drive.
- Change existing wide median treatment to a roundabout.
- Add fourth leg on north side.

Option 1.4

- New roundabout on Princes Highway.
- Location to be determined.
    - No sight distance constraints.

Option 1.5

- Left in/left out to Princes Highway.
- One or two accesses?
- Use existing wide median treatments at Polocross Lane and Reid Drive for vehicles to U-turn.
- Location(s) dependent on weaving distances.

6.1.2 Traffic Generation

Candidate Area 1 has a land area of 42 ha.

The resultant likely traffic volumes generated by Candidate Area 1 are therefore:

- Daily vehicle trips: 6,720 vpd
- Evening peak hour vehicle trips: 1,344 vph

6.1.3 Traffic Distribution

All traffic generated by Candidate Area 1 will be generated to or from Princes Highway. As detailed in Section 6.1.1, access to Candidate Area 1 is, in essence, via either the Hunt Place roundabout on Princes Highway or via a new connection(s) across the Melbourne-Bairnsdale railway line (and potentially together with via the Hunt Place roundabout on Princes Highway).

The provision of a new railway level crossing(s) on the Melbourne-Bairnsdale railway line is unlikely to be achieved. Accordingly, from a capacity perspective, only access via the Hunt Place roundabout on Princes Highway has been assessed. This is the most conservative approach as all traffic generated by Candidate Area 1 will access the area by a single access point.

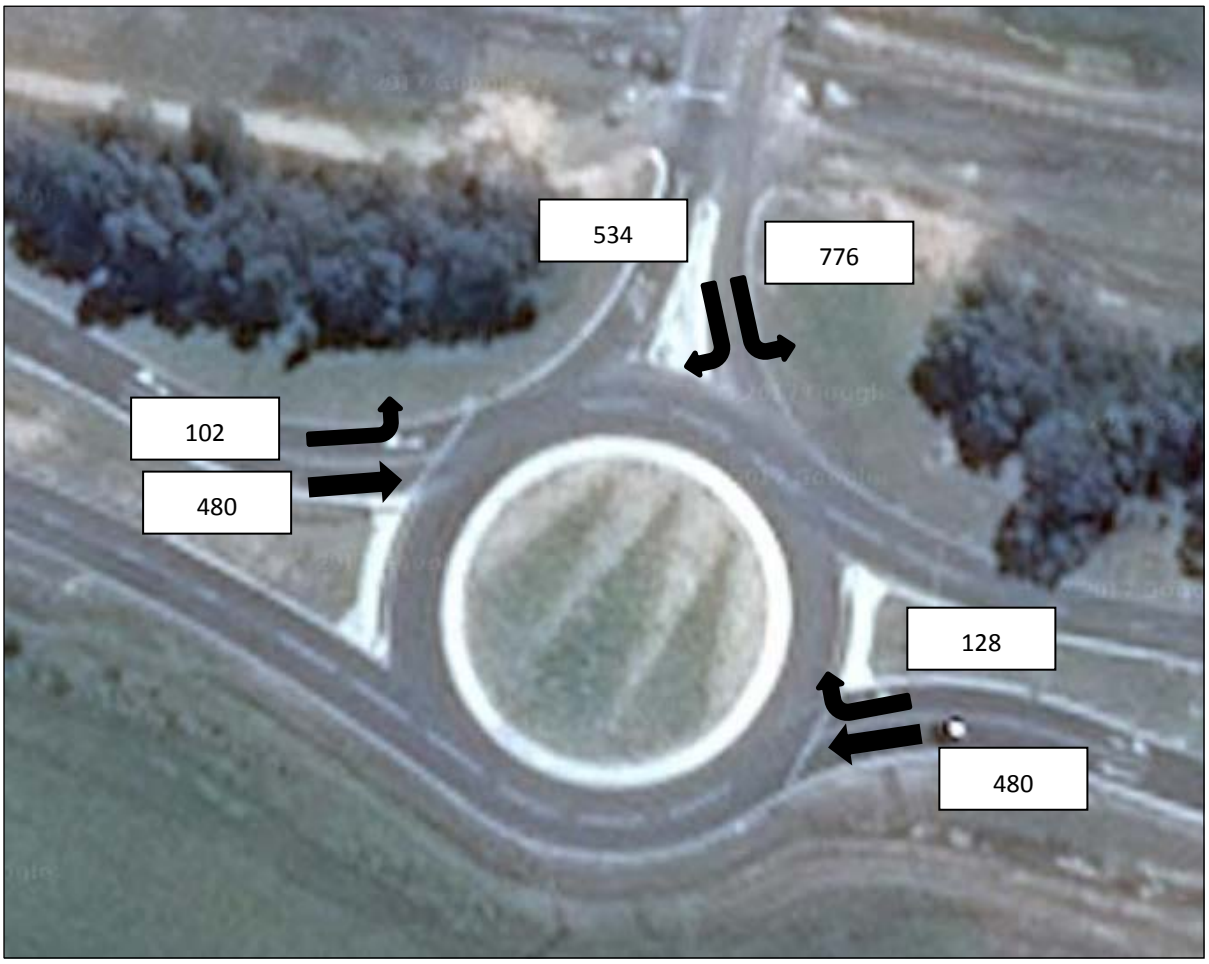
6.1.4 Traffic Volumes

As shown in Figure 2, Princes Highway east of Sale-Heyfield Road carries in the order of 7,100 vpd. Assuming that the evening peak hour volume is 15% of the daily volume equates to an evening peak hour volume of 1,065 vph. It is anticipated that this volume will be roughly evenly split between eastbound and westbound, ie 530 vph in each direction.

No traffic volume data is available for Hunt Place. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

Candidate Area 1 is anticipated to generate 1,344 vph in the evening peak hour. It is assumed that this will comprise 1,210 vph outbound and 130 vph inbound, split 40% to/from the west and 60% to/from the east (as detailed in Section 5.6).

This analysis and assumptions result in the traffic volumes shown in Figure 5.



Source: NearMap

Figure 5: Candidate Area 1 Traffic Volumes
Princes Highway/Hunt Place

It is noted that this does not allow for any growth in traffic volumes along Princes Highway. Also, it is assumed that Candidate Areas 2 and 3 are not developed.

6.1.5 Traffic Impact

SIDRA has been used to analyse the capacity of the affected intersections. SIDRA provides information about the capacity of an intersection in terms of a range of parameters, described as follows:

- **Degree of Saturation (DoS)** is the ratio of the volume of traffic observed making a particular movement compared to the maximum capacity for that movement. Various values of degree of saturation and their rating are shown in Table 2.
- The **95th Percentile Queue** represents the maximum queue length, in metres, that can be expected in 95% of observed queue lengths in the peak hour.
- **Average Delay** (seconds) is the average delay time that can be expected for all vehicles making a particular movement in the peak hour.

Table 2: SIDRA Levels of Service

Level of Service		Intersection Degree of Saturation		
		Unsignalised Intersection	Roundabout	Signalised Intersection
A	Excellent	≤ 0.60	≤ 0.60	≤ 0.60
B	Very Good	0.60 - 0.70	0.60 - 0.70	0.60 - 0.70
C	Good	0.70 - 0.80	0.70 - 0.85	0.70 - 0.90
D	Acceptable	0.80 - 0.90	0.85 - 0.95	0.90 - 0.95
E	Poor	0.90 - 1.00	0.95 - 1.00	0.95 - 1.00
F	Very Poor	≥ 1.0	≥ 1.0	≥ 1.0

Princes Highway/Hunt Place

The traffic volumes shown in Figure 5 and the existing geometry of the intersection were input into SIDRA to assess the likely performance of the Princes Highway/Hunt Place intersection. The analysis showed that an additional lane (short left turn) was required on the northern leg (Hunt Place) to achieve acceptable intersection performance.

The output of the SIDRA analysis (including the adopted geometry) for the modified geometry is attached at Appendix A and is summarised in Table 3.

Table 3: Candidate Area 1 - Princes Highway/Hunt Place SIDRA Analysis

Movement	Degree of Saturation	Average Delay	95th Percentile Queue
Princes Highway (East Approach)			
Through	0.32	8.4 sec	21.4m
Right	0.32	16.8 sec	18.6m
Hunt Place (North Approach)			
Left	0.68	6.3 sec	44.2m
Right	0.59	13.2 sec	31.6m
Princes Highway (West Approach)			
Left	0.21	5.7 sec	12.2m
Through	0.21	6.0 sec	12.21m

The intersection operates with on overall Level of Service A.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the existing Princes Highway/Hunt Place roundabout (with a second lane added to the Hunt Place approach) to accommodate the adopted traffic volumes.

Hunt Place

Hunt Place has a carriageway width of 12.3m and is classified by Council as a Local Access A - Road with an indicative daily traffic volume of 150-1,500 vpd.

Assuming that Hunt Place currently carries 1,000 vpd (at Princes Highway), this volumes will increase to 7,720 vpd following development of Candidate Area 1. Whilst this exceeds the indicative daily traffic volume for a Local Access A - Road, Hunt Place nonetheless has a cross-section and industrial environment that can accommodate this volume of traffic.

Riverside Drive

Riverside Drive has a carriageway width of 12.3m and is classified by Council as a Local Access B - Road with an indicative daily traffic volume of 30-500 vpd.

Assuming that Riverside Drive currently carries 300 vpd (at Hunt Place), this volume will increase to 7,020 vpd following development of Candidate Area 1 (assuming no connection to Candidate Area 1 via Hunt Place). Whilst this exceeds the indicative daily traffic volume for a Local Access B - Road, Riverside Drive nonetheless has a cross-section and industrial environment that can accommodate this volume of traffic.

Connection Through to Riverside Drive or Hunt Place

Access to Candidate Area 1 via the Princes Highway/Hunt Place roundabout requires the extension of either (or both) Riverside Drive or Hunt Place through existing privately owned industrial land at the western end of the Wurruk industrial estate. These are shown diagrammatically in Figure 6 and Figure 7.

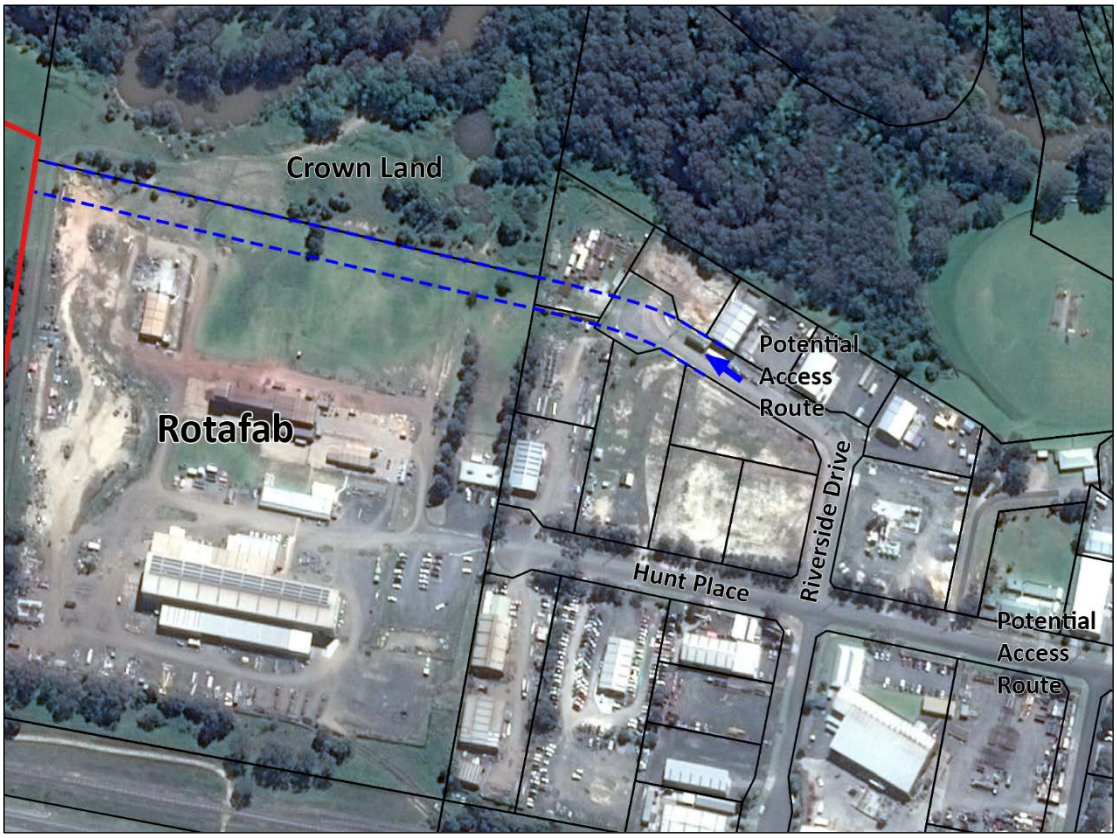


Figure 7: Potential Riverside Drive Extension

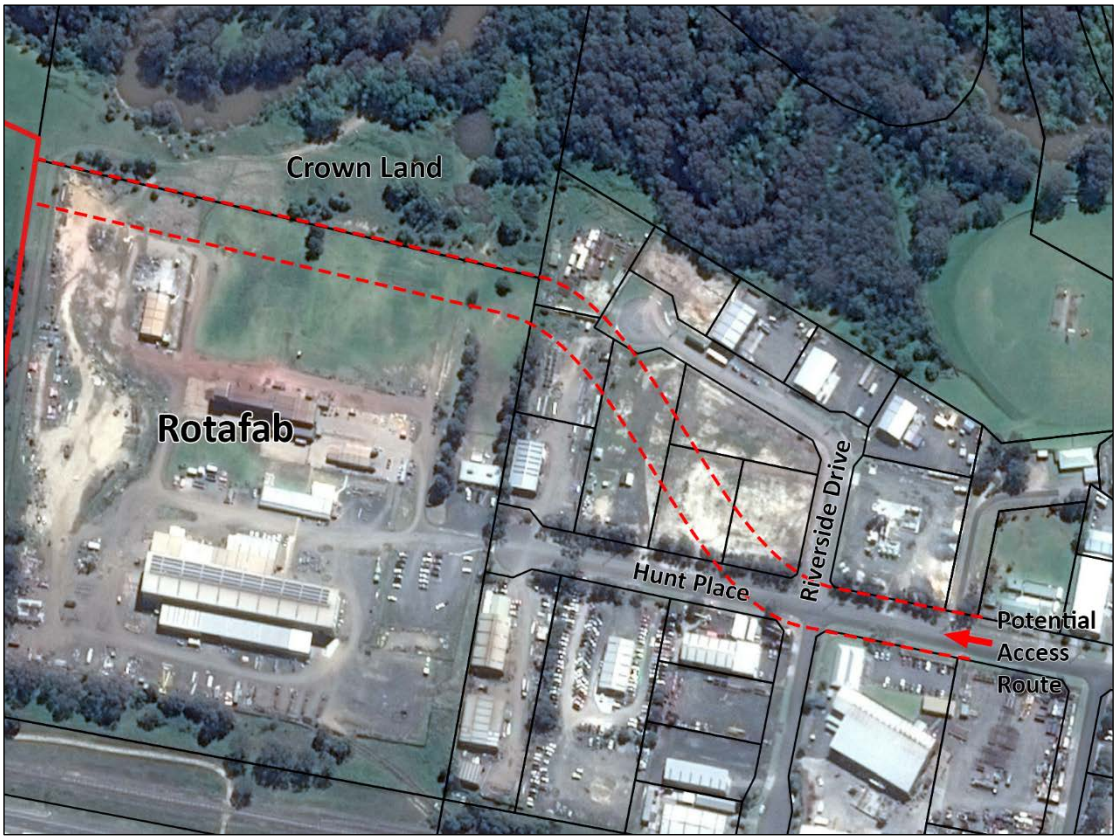


Figure 8: Potential Hunt Place Extension

From a traffic engineering perspective, both of these options are workable, with the following noted:

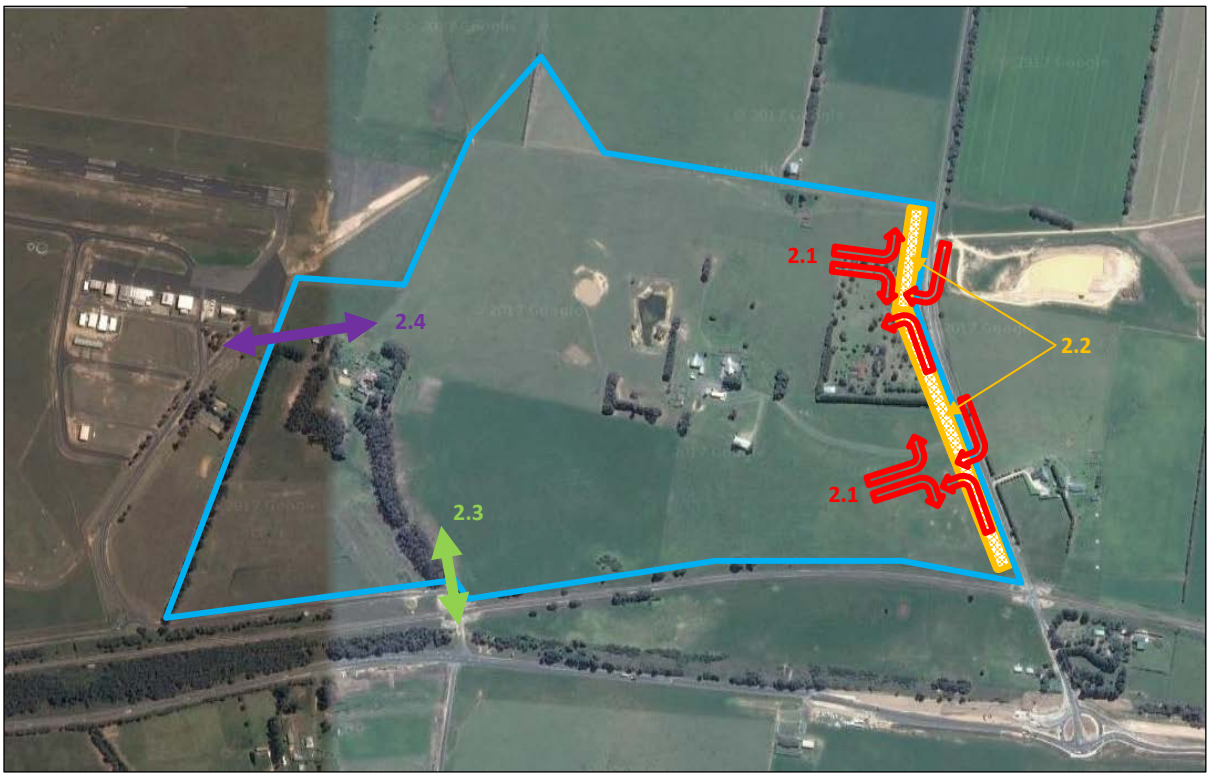
- The Riverside Drive extension requires less new road construction and impacts fewer properties.
- The Riverside Drive extension results in a significant volume of turning traffic at the Hunt Place/Riverside Drive intersection. No capacity issues are anticipated due to the low volumes of traffic in the west and south legs of the intersection.
- The Hunt Place extension results in the northern leg of the Riverside Drive intersection being located on the inside of a curve, with restricted sight distances to the right (west).

The Riverside Drive extension is the preferable option.

6.2 Candidate Area 2: West Sale Aerodrome

6.2.1 Potential Access Options

Four potential access options have been identified for Candidate Area 2. These are shown diagrammatically in Figure 6 and described below.



Source: NearMap

Figure 6: Candidate Area 2 - Potential Access Options

Option 2.1

- Full movement T-intersection(s) on Sale-Heyfield Road.

Option 2.2

- Service road(s) to Sale-Heyfield Road.

Option 2.3

- New road off Williams Drive, north into Site 2.
- Create T-intersection with north-south movement having priority.
- Use existing wide median treatment at Princes Highway/Hopkins Road/Williams Drive, or upgrade to a roundabout?

Option 2.4

- Access via West Sale Aerodrome (Williams Drive).
- Use existing wide median treatment at Princes Highway/Hopkins Road/Williams Drive, or upgrade to a roundabout?

6.2.2 Traffic Generation

Candidate Area 2 has a land area of 55 ha.

The resultant likely traffic volumes generated by Candidate Area 2 are therefore:

- Daily vehicle trips: 8,800 vpd
- Evening peak hour vehicle trips: 1,760 vph

6.2.3 Traffic Distribution

As discussed in Section 6.2.1, access to Candidate Area 2 is potentially possible via Sale-Heyfield Road and Williams Drive. It is assumed that both roads will be utilised for access purposes.

6.2.4 Traffic Volumes

As shown in Figure 2, Princes Highway west of Sale-Heyfield Road carries in the order of 8,900 vpd and Sale-Heyfield Road north of Princes Highway carries in the order of 3,100 vpd. Assuming that the evening peak hour volume is 15% of the daily volume equates to an evening peak hour volume of 1,335 vph on Princes Highway and 465 vph on Sale-Heyfield Road. It is anticipated that these volumes will be roughly evenly split in each direction on both roads.

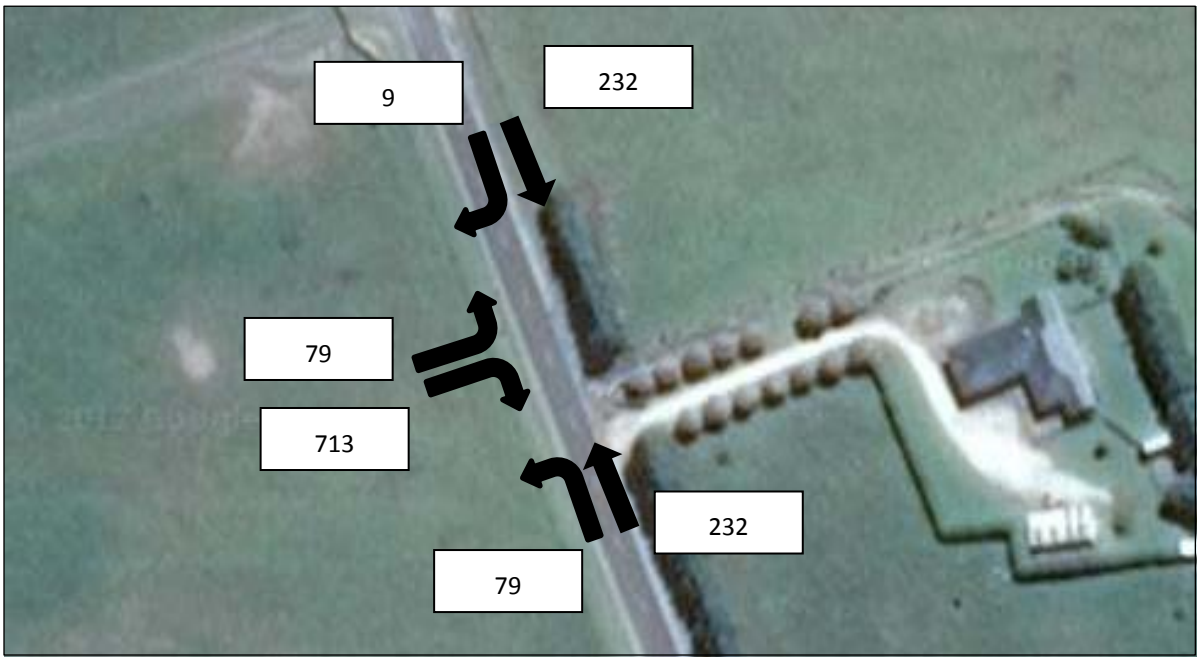
No traffic volume data is available for Williams Drive. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

No traffic volume data is available for Hopkins Road. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

Candidate Area 2 is anticipated to generate 1,760 vph in the evening peak hour. It is assumed that this will comprise 1,560 vph outbound and 180 vph inbound, split 10% to/from north and 90% to/from south on Sale-Heyfield Road and 40% to/from the west and 60% to/from the east on Princes Highway (as detailed in Section 5.6).

For the purposes of this analysis, it is assumed that traffic generated by Candidate Area 2 will be evenly split between access via Sale-Heyfield Road and via Princes Highway (via Williams Drive).

This analysis and assumptions result in the traffic volumes shown in Figures 7 to 9. (Note - these volumes include traffic generated by the candidate area to/from both access points.)

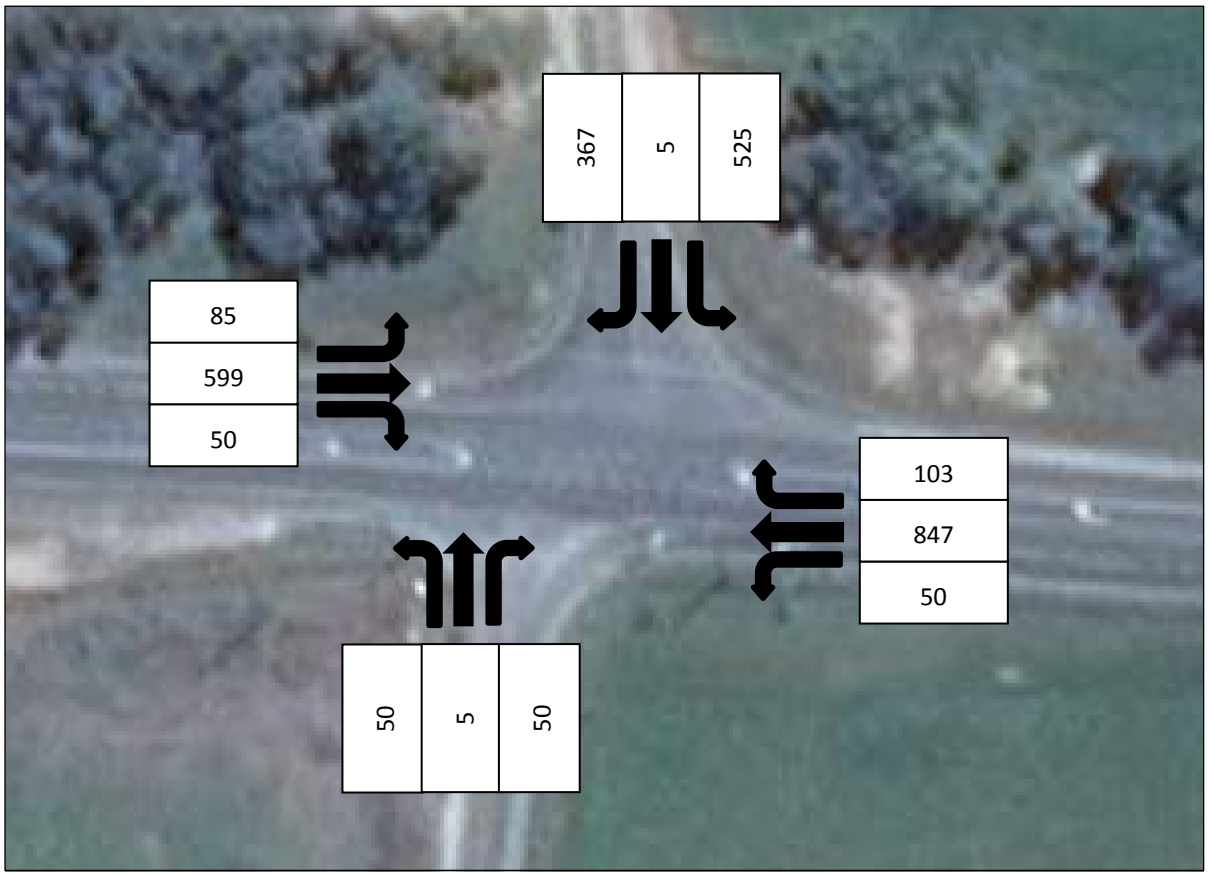


Source: NearMap

Figure 7: Candidate Area 2 Traffic Volumes
Sale-Hayfield Road/Site Access (One Access Point)

Source: NearMap

Figure 8: Candidate Area 2 Traffic Volumes
Princes Highway/Sale-Heyfield Road



Source: NearMap

Figure 9: Candidate Area 2 Traffic Volumes
Princes Highway/Williams Drive

It is noted that this does not allow for any growth in traffic volumes along Princes Highway or Sale-Heyfield Road. Also, it is assumed that Candidate Areas 1 and 3 are not developed.

6.2.5 Traffic Impact

Sale-Heyfield Road/Site Access

The traffic volumes shown in Figure 7 were input into SIDRA to assess the likely performance of a future Sale-Heyfield Road/site access T-intersection. The analysis showed that the site access leg operated at a DoS greater than 1.0, due to the volume of right turn "out" movements. Further analysis was undertaken to ascertain the maximum number of right turn "out" movements to achieve a DoS of 0.90.

The output of the SIDRA analysis (including the reduced right turn "out" volume) for the adopted geometry is attached at Appendix B and is summarised in Table 4.

Table 4: Candidate Area 2 - Sale-Heyfield Road/Site Access SIDRA Analysis

Movement	Degree of Saturation	Average Delay	95th Percentile Queue
Sale-Heyfield Road (South Approach)			
Left	0.05	7.2 sec	0.0m
Through	0.14	0.0 sec	0.0m
Sale-Heyfield Road (North Approach)			
Through	0.14	0.0 sec	0.0m
Right	0.01	8.3 sec	0.2m
Site Access (West Approach)			
Left	0.06	10.5 sec	2.2m
Right	0.90	30.4 sec	119.4m

This analysis demonstrates that:

- Two access points are required via Sale-Heyfield Road, in addition to access via Williams Drive, for Candidate Area 2; and
- The volume of right turn "out" traffic from each site access on Sale-Heyfield Road needs to be restricted to 509 vph.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the assumed T-intersection configuration to accommodate the adopted traffic volumes with two T-intersections on Sale-Heyfield Road.

Princes Highway/Sale-Heyfield Road

The traffic volumes shown in Figure 8 and the existing geometry of the intersection were input into SIDRA to assess the likely performance of the Princes Highway/Sale-Heyfield Road intersection. The analysis showed that an additional lane was required on the northern leg (Sale-Heyfield Road) to achieve acceptable intersection performance.

The output of the SIDRA analysis (including the adopted geometry) for the modified geometry is attached at Appendix C and is summarised in Table 5.

Table 5: Candidate Area 2 - Princes Highway/Sale-Heyfield Road SIDRA Analysis

Movement	Degree of Saturation	Average Delay	95th Percentile Queue
Princes Highway (East Approach)			
Through	0.42	8.7 sec	30.5m
Right	0.42	17.2 sec	26.2m
Sale-Heyfield Road (North Approach)			
Left	0.63	11.6 sec	32.1m
Right	0.61	17.2 sec	33.9m
Princes Highway (West Approach)			
Left	0.44	6.0 sec	31.9m
Through	0.44	6.4 sec	31.9m

The intersection operates with on overall Level of Service B.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the existing Princes Highway/Sale-Heyfield Road roundabout (with a second lane added to the Sale-Heyfield Road approach) to accommodate the adopted traffic volumes.

Princes Highway/Williams Drive

The traffic volumes shown in Figure 9 and the geometry of a roundabout were input into SIDRA to assess the likely performance of the Princes Highway/Williams Drive intersection. The analysis showed that two lanes were required on the northern leg (Williams Drive) to achieve acceptable intersection performance.

The output of the SIDRA analysis (including the adopted geometry) for the modified geometry is attached at Appendix D and is summarised in Table 6.

Table 6: Candidate Area 2 - Princes Highway/Williams Drive SIDRA Analysis

Movement	Degree of Saturation	Average Delay	95th Percentile Queue
Hopkins Road (South Approach)			
Left	0.20	7.4 sec	7.5m
Through	0.20	7.0 sec	7.5m
Right	0.20	14.2 sec	7.5m
Princes Highway (East Approach)			
Left	0.46	7.5 sec	32.2m
Through	0.46	8.1 sec	32.2m
Right	0.46	16.3 sec	28.7m
Williams Drive (North Approach)			
Left	0.50	5.7 sec	23.7m
Through	0.47	6.0 sec	19.9m
Right	0.47	13.2 sec	19.9m
Princes Highway (West Approach)			
Left	0.27	5.8 sec	15.3m
Through	0.27	6.2 sec	15.3m
Right	0.27	13.9 sec	14.5m

The intersection operates with on overall Level of Service A.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is significant spare capacity within the existing Princes Highway/Williams Drive roundabout (with a second lane added to the Williams drive approach) to accommodate the adopted traffic volumes.

Williams Drive

As detailed in Section 6.2.1, access to Candidate Area 2 via Williams Drive is via either or both a new road off Williams Drive directly into the candidate area or West Sale Aerodrome.

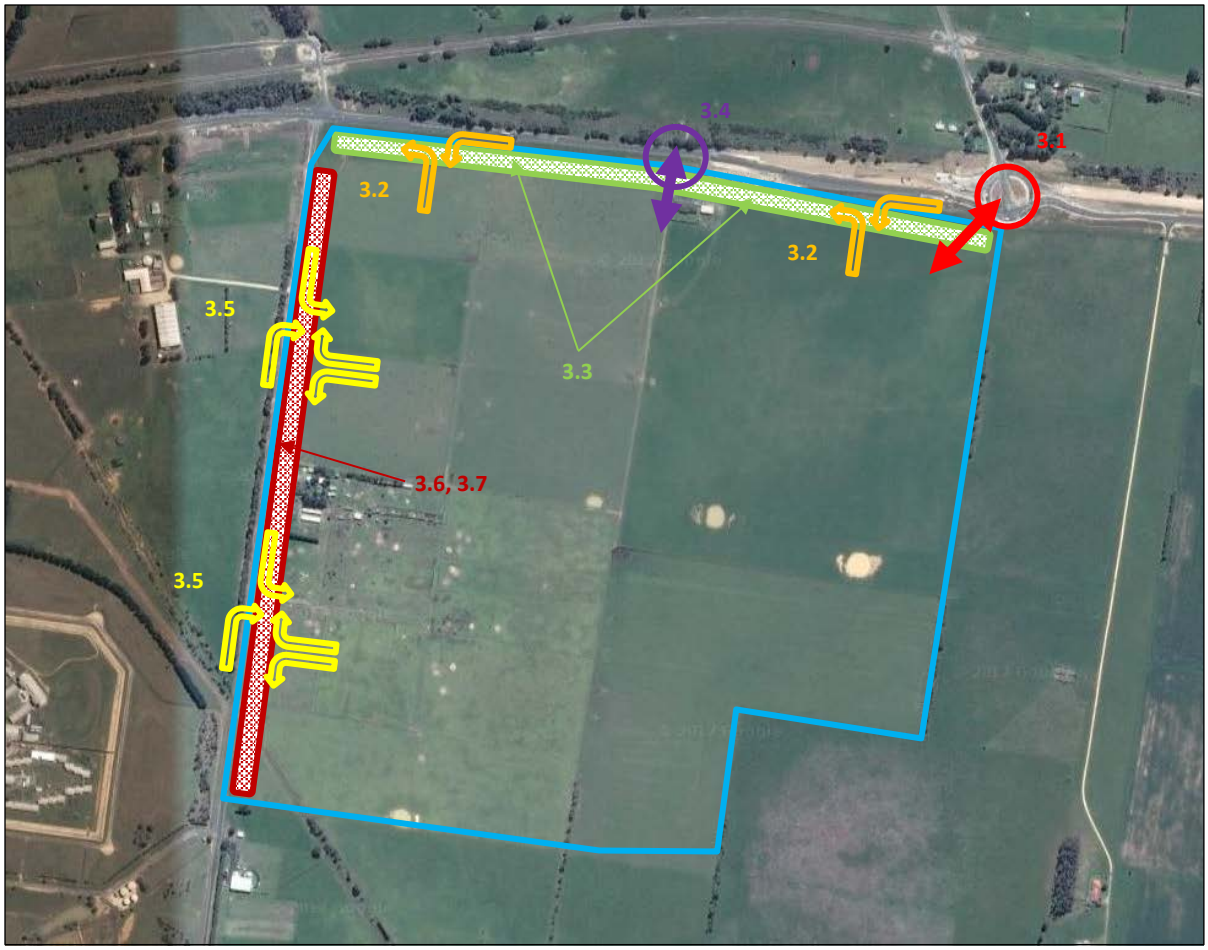
Both will necessitate an upgrade to the railway level crossing from flashing lights to flashing lights and boom gates.

The predicted daily traffic volume on Williams Road at Princes Highway is in the order of 5,500 vpd (comprising 4,400 vpd from Candidate Area 2 and 1,000 vpd existing). A two lane undivided carriageway would be sufficient to accommodate this level of traffic.

6.3 Candidate Area 3: Fulham

6.3.1 Potential Access Options

Seven potential access options have been identified for Candidate Area 3. These are shown diagrammatically in Figure 10 and described below.



Source: NearMap

Figure 10: Candidate 3 - Potential Access Options

Option 3.1

- New access opposite Sale-Heyfield Road.
- Add fourth leg on south side of roundabout on Princes Highway.

Option 3.2

- Left in/left out to Princes Highway.
- One or two accesses?
- Use existing roundabout at Sale-Heyfield Road and existing wide median treatment at Hopkins Road/Williams Drive.
- Location(s) dependent on weaving distances.

Option 3.3

- Service road(s) to Princes Highway.

Option 3.4

- New roundabout on Princes Highway.
- Location to be determined.
  - No sight distance constraints.

Option 3.5

- Full movement T-intersection(s) on Hopkins Road.
- Maintain existing wide median treatment at Princes Highway/Hopkins Road/Williams Road or upgrade to a roundabout?

Option 3.6

- Direct access to Hopkins Road.
- Requires large lots to front Hopkins Road.
- Corner sites to take access off internal road.

Option 3.7

- Service road(s) to Hopkins Road.

6.3.2 Traffic Generation

Candidate Area 3 has a land area of 100 ha.

The resultant likely traffic volumes generated by Candidate Area 3 are therefore:

- Daily vehicle trips: 16,000 vpd
- Evening peak hour vehicle trips: 3,200 vph

6.3.3 Traffic Distribution

All traffic generated by Candidate Area 3 will be generated to or from Princes Highway via the Princes Highway/Sale-Heyfield Road roundabout and/or via the Princes Highway/Hopkins Road.

6.3.4 Traffic Volumes - Single Access Point

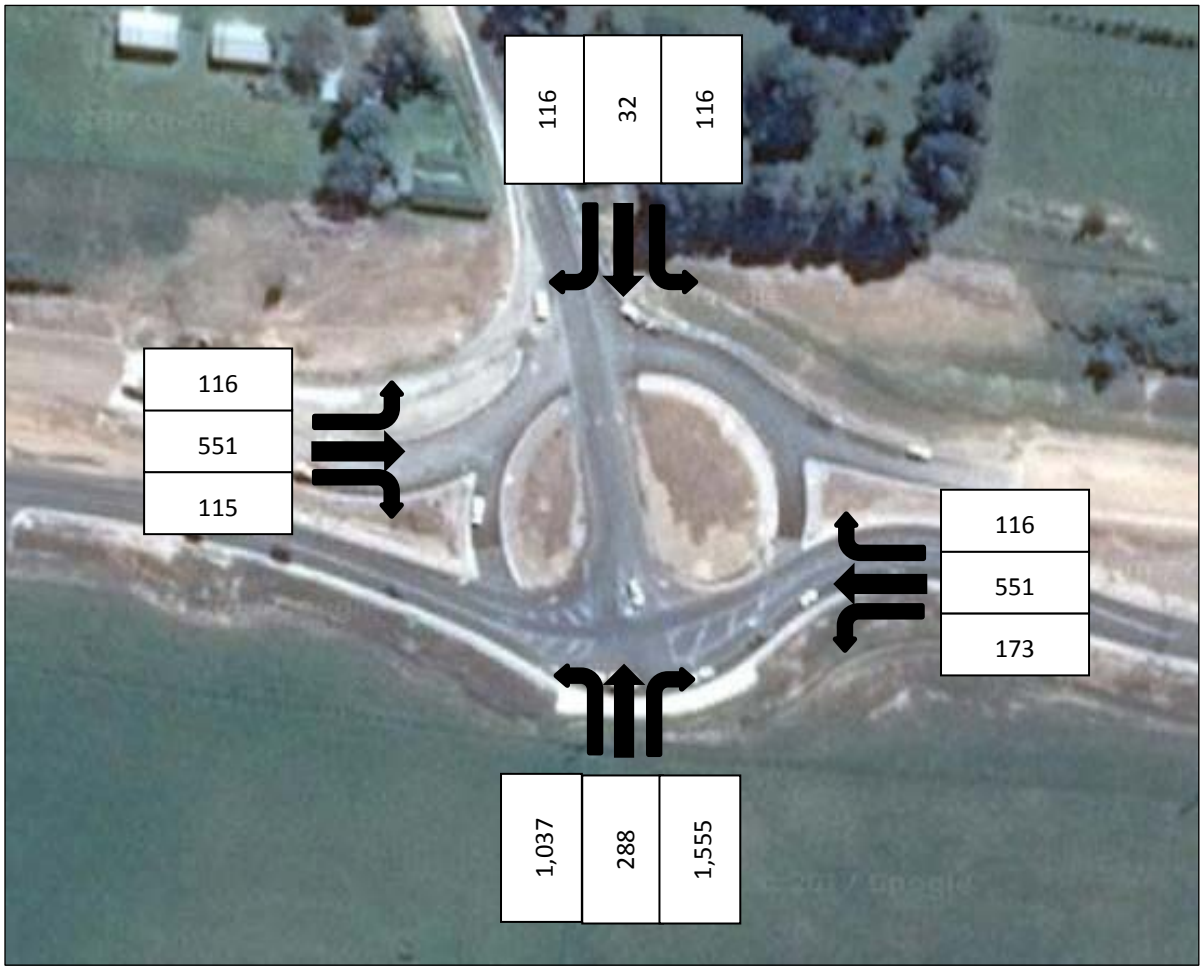
As shown in Figure 2, Princes Highway west of Sale-Heyfield Road carries in the order of 8,900 vpd. Assuming that the evening peak hour volume is 15% of the daily volume equates to an evening peak hour volume of 1,335 vph. It is anticipated that this volume will be roughly evenly split between eastbound and westbound, ie 670 vph in each direction.

No traffic volume data is available for Williams Drive. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

No traffic volume data is available for Hopkins Road. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

Candidate Area 3 is anticipated to generate 3,200 vph in the evening peak hour. It is assumed that this will comprise 2,880 vph outbound and 320 vph inbound, split 10% to/from the north on Sale-Heyfield Road and 90% to Princes Highway, split 40% to/from the west and 60% to/from the east (as detailed in Section 5.6).

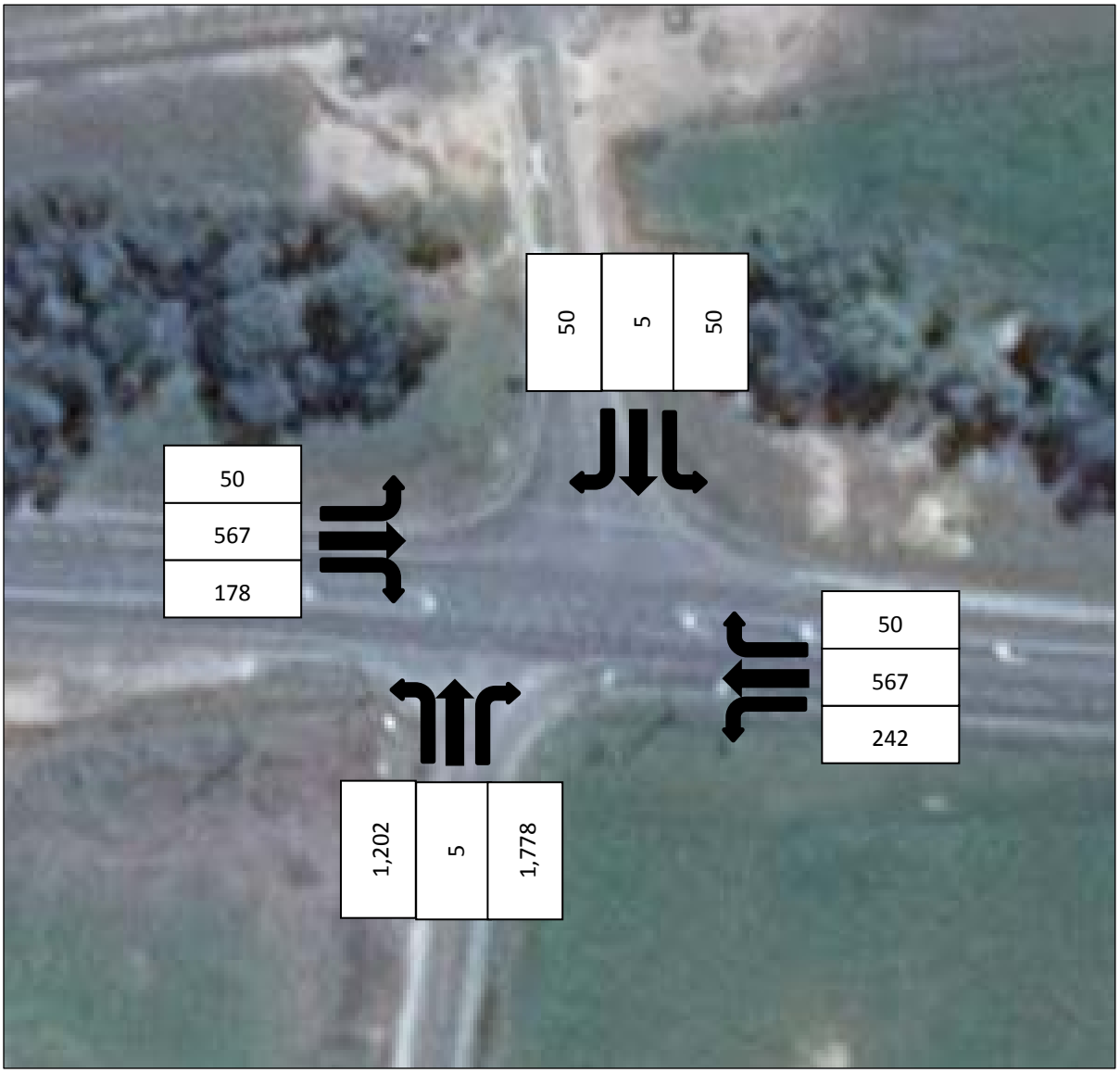
Assuming all traffic generated by Candidate Area 3 is accessed via the Princes Highway/Sale-Heyfield roundabout, this analysis and assumptions result in the traffic volumes shown in Figure 11.



Source: NearMap

Figure 11: Candidate Area 3 Traffic Volumes
Access Only via Princes Highway/Sale-Heyfield Road

Assuming all traffic generated by Candidate Area 3 is accessed via the Princes Highway/Sale-Heyfield roundabout, this analysis and assumptions result in the traffic volumes shown in Figure 12.



Source: NearMap

Figure 12: Candidate Area 3 Traffic Volumes
Access Only via Princes Highway/Hopkins Road

It is noted that this does not allow for any growth in traffic volumes along Princes Highway, Sale-Heyfield Road, Williams Road or Hopkins Road. Also, it is assumed that Candidate Areas 1 and 2 are not developed.

6.3.5 Traffic Impact - Single Access point

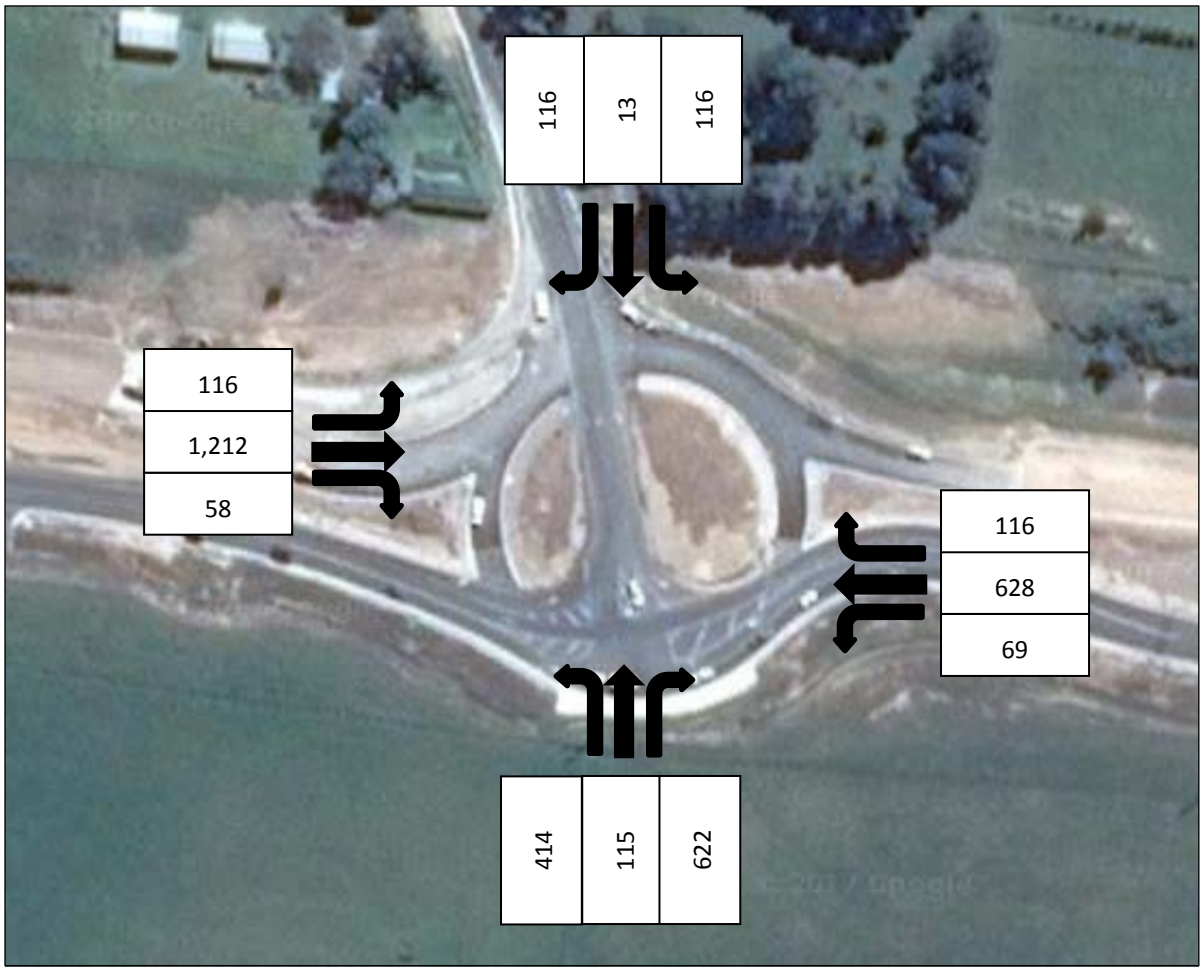
The traffic volumes shown in Figures 11 and 12 were input into SIDRA to assess the likely performance of the Princes Highway/Sale-Heyfield Road and Princes Highway/Hopkins Road intersections. It was apparent that the volume of traffic anticipated to be generated by Candidate Area 3 could not be accommodated by a single access point.

6.3.6 Traffic Volumes - Two Access Points

For the purposes of this further analysis, it is assumed that traffic generated by Candidate Area 3 is equally split between via the Princes Highway/Sale-Heyfield roundabout and the Princes Highway/Hopkins Road intersection.

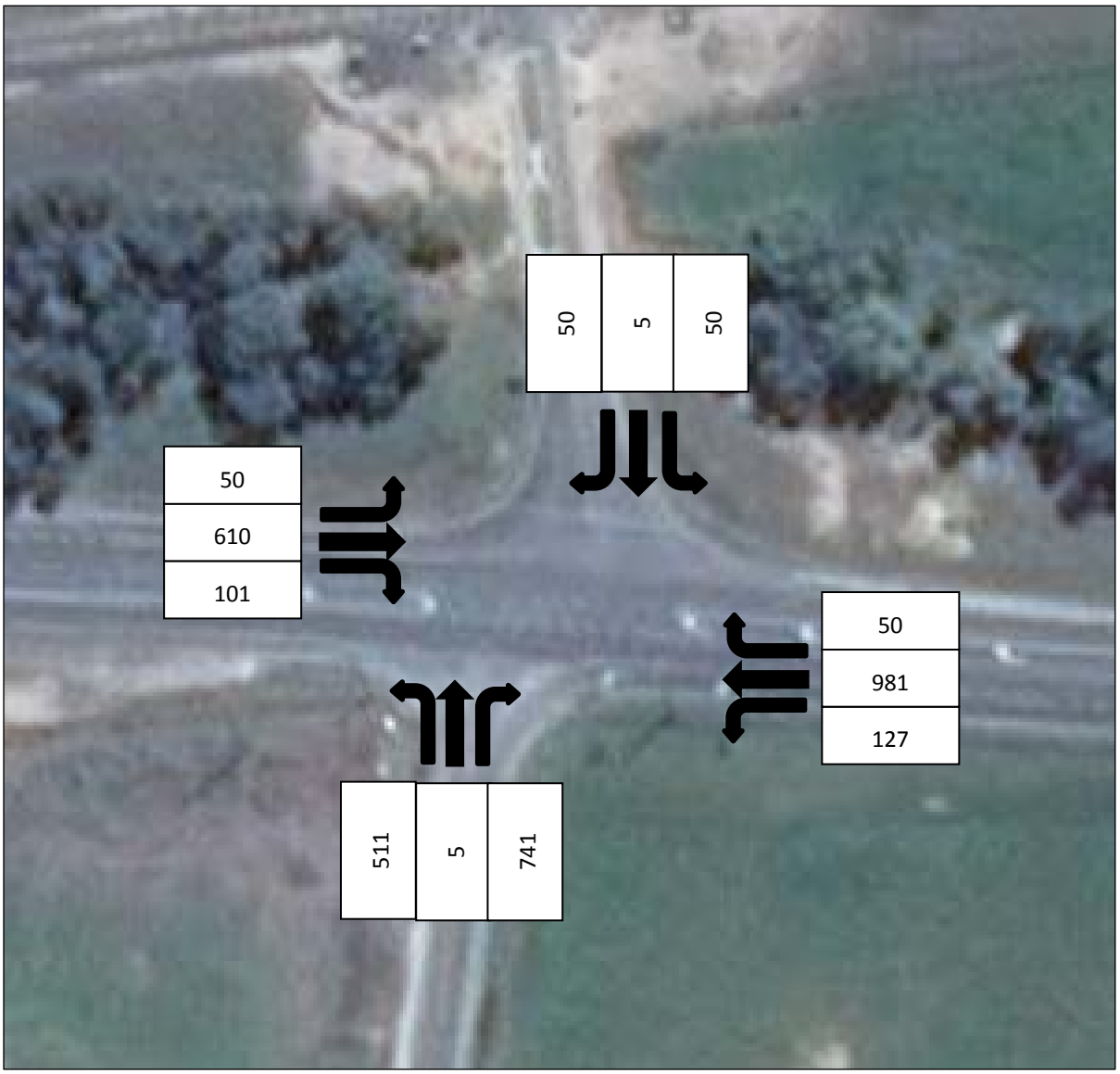
The initial SIDRA analysis resulted in excessive degrees of saturation due to the total volume of traffic generated and the movement of that traffic through the adjacent intersection. An iterative analysis of reduced traffic generated by Candidate Area 3 resulted in satisfactory intersection performance with 80% of the initially projected traffic volume; namely, 2,560 vph in the evening peak period.

This results in the traffic volumes shown in Figures 13 and 14. (Note - these volumes include traffic generated by the candidate area to/from both access points.)



Source: NearMap

Figure 13: Candidate Area 3 Traffic Volumes (Two Access Points)
Princes Highway/Sale-Heyfield Road



Source: NearMap

Figure 14: Candidate Area 3 Traffic Volumes (Two Access Points) Princes Highway/Hopkins Road

Princes Highway/Sale-Heyfield Road

The traffic volumes shown in Figure 11 and a modified geometry of the intersection were input into SIDRA to assess the likely performance of the Princes Highway/Sale-Heyfield Road intersection. The modification comprised a new leg on the southern approach with a right turn lane, a shared through and right turn lane and a separate left turn lane.

The output of the SIDRA analysis (including the adopted geometry) is attached at Appendix E and is summarised in Table 7.

Table 7: Candidate Area 3 - Princes Highway/Sale-Heyfield Road SIDRA Analysis (Two Access Points)

Movement	Degree of Saturation	Average Delay	95th Percentile Queue
Site (South Approach)			
Left	0.30	6.5 sec	12.0m
Through	0.34	7.0 sec	14.7m
Right	0.34	15.0 sec	14.7m
Princes Highway (East Approach)			
Left	0.35	5.8 sec	18.5m
Through	0.35	6.2 sec	18.5m
Right	0.35	14.1 sec	17.7m
Sale-Heyfield Road (North Approach)			
Left	0.65	20.4 sec	35.4m
Through	0.65	20.7 sec	35.4m
Right	0.65	28.2 sec	35.4m
Princes Highway (West Approach)			
Left	0.93	24.8 sec	143.8m
Through	0.93	27.3 sec	143.8m
Right	0.93	37.8 sec	124.5m

The intersection operates with on overall Level of Service B.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is sufficient capacity within the modified Princes Highway/Sale-Heyfield Road roundabout to accommodate the adopted traffic volumes.

Princes Highway/Hopkins Road

The traffic volumes shown in Figure 12 and the geometry of a roundabout were input into SIDRA to assess the likely performance of the Princes Highway/Hopkins Road intersection. The roundabout included two lanes on the south approach (Hopkins Road) (shared right and through and separate left) and a single lane on the north approach (Williams Drive).

The output of the SIDRA analysis (including the adopted geometry) is attached at Appendix F and is summarised in Table 8.

Table 8: Candidate Area 3 - Princes Highway/Hopkins Road SIDRA Analysis (Two Access Points)

Movement	Degree of Saturation	Average Delay	95th Percentile Queue
Hopkins Road (South Approach)			
Left	0.82	16.4 sec	57.3m
Through	0.84	14.5 sec	73.0m
Right	0.84	22.0 sec	73.0m
Princes Highway (East Approach)			
Left	0.42	5.6 sec	29.1m
Through	0.42	6.1 sec	29.1m
Right	0.42	14.1 sec	27.6m
Williams Drive (North Approach)			
Left	0.23	12.1 sec	9.8m
Through	0.23	12.3 sec	9.8m
Right	0.23	19.8 sec	9.8m
Princes Highway (West Approach)			
Left	0.60	14.7 sec	61.6m
Through	0.60	15.9 sec	61.6m
Right	0.60	25.4 sec	50.9m

The intersection operates with on overall Level of Service B.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the adopted geometry of the roundabout to accommodate the adopted traffic volumes.

Hopkins Road

The predicted daily traffic volume on Williams Road at Princes Highway is in the order of 7,500 vpd (comprising 6,400 vpd from Candidate Area 3 and 1,000 vpd existing). A two lane undivided carriageway would be sufficient to accommodate this level of traffic.

6.4 Conclusions - Capacity Analysis

6.4.1 Candidate Area 1: Wurruk

Princes Highway/Hunt Place

- The Princes Highway/Hunt Place roundabout needs to be upgraded to include a second lane added to the Hunt Place approach to accommodate the adopted traffic volumes.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the existing Princes Highway/Hunt Place roundabout (with a second lane added to the Hunt Place approach) to accommodate the adopted traffic volumes.

Hunt Place

- Hunt Place will exceed the indicative daily traffic volume for a Local Access A - Road.
- Hunt Place nonetheless has a cross-section and industrial environment that can accommodate the anticipated volume of traffic.

Riverside Drive

- Riverside Drive will exceed the indicative daily traffic volume for a Local Access B - Road.
- Riverside Drive nonetheless has a cross-section and industrial environment that can accommodate the anticipated volume of traffic.

Extension of Hunt Place or Riverside Drive?

- The extension of Riverside Drive to connect with Candidate Area 1 is preferable from a traffic engineering perspective than the extension of Hunt Place, although both options are workable.

6.4.2 Candidate Area 2: West Sale Aerodrome

- The completed analysis assumed that access to Candidate Area 2 would comprise access via both Sale-Heyfield Road and Princes Highway.

Sale-Heyfield Road Access

- Two access points are required via Sale-Heyfield Road, in addition to access via Williams Drive, for Candidate Area 2.
- The volume of right turn “out” traffic from each site access on Sale-Heyfield Road needs to be restricted to 509 vph to achieve an appropriate level of performance for the assumed T-intersection configuration.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the assumed T-intersection configuration to accommodate the adopted traffic volumes with two T-intersections on Sale-Heyfield Road.

Princes Highway/Sale-Heyfield Road

- The Princes Highway/Sale-Heyfield Road roundabout needs to be upgraded to include a second lane added to the Sale-Heyfield Road approach to achieve acceptable intersection performance.

- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the existing Princes Highway/Sale-Heyfield Road roundabout (with a second lane added to the Sale-Heyfield Road approach) to accommodate the adopted traffic volumes.

Princes Highway/Williams Drive

- The Princes Highway/Williams Drive intersection needs to be upgraded to a roundabout with two lanes on the Williams Drive approach to achieve acceptable intersection performance.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the modified Princes Highway/Williams Drive intersection (roundabout with a second lane added to the Williams Drive approach) to accommodate the adopted traffic volumes.

Williams Drive

- The existing railway level crossing will need to be upgraded from flashing lights to flashing lights and boom gates.
- A two lane undivided carriageway in Williams Drive would be sufficient to accommodate the anticipated volume of traffic.

6.4.3 Candidate Area 3: Fulham

- The completed analysis indicated that:
  - At least two access points (assumed to be via Princes Highway/Hopkins Road and the Princes Highway/Sale-Heyfield Road roundabout) are required to accommodate the traffic anticipated to be generated by Candidate Area 3.
  - The volume of traffic generated by Candidate Area 3 needs to be restricted to 80% of the initially projected traffic volume; namely, 2,560 vph in the evening peak period.

Princes Highway/Sale-Heyfield Road

- The Princes Highway/Sale-Heyfield Road roundabout needs to be upgraded to a four leg roundabout, with the new leg on the southern approach to comprise a right turn lane, a shared through and right turn lane and a separate left turn lane, to achieve acceptable intersection performance.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is sufficient capacity within the modified Princes Highway/Sale-Heyfield Road roundabout to accommodate the adopted traffic volumes.

Princes Highway/Hopkins Road

- The Princes Highway/Hopkins Road intersection needs to be upgraded to a roundabout with two lanes on the Hopkins Road approach and a single lane on the Williams Drive approach to achieve acceptable intersection performance.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the adopted geometry of the roundabout to accommodate the adopted traffic volumes.

Hopkins Road

- A two lane undivided carriageway in Hopkins Road would be sufficient to accommodate the anticipated volume of traffic.

6.5 Qualitative Assessment of Potential Access Options

A qualitative assessment of the potential access options is shown in Table 9.

Table 9: Qualitative Assessment of Potential Access Options

Option	Description	Pro's	Con's	Comments
Candidate Area 1				
1.1	Connection via Riverside Drive	Uses existing roundabout at Princes Highway/Hunt Place Uses existing railway level crossing - upgrade not needed?	Requires land acquisition Potentially through sensitive area adjacent to Thomson River	
1.2	Connection via Hunt Place	Uses existing roundabout at Princes highway/Hunt Place Uses existing railway level crossing - no upgrade required?	Requires land acquisition	
1.3	Access via Princes Highway/ Reid Drive	Uses existing intersection location	Requires new railway level crossing May require land acquisition	Change existing wide median treatment to a roundabout
1.4	New roundabout on Princes Highway		Requires new railway level crossing Creates an additional roundabout on Princes Highway	No sight distance issues Location dependent on spacings to treatments to east and west
1.5	Left in/left out to Princes Highway	Uses existing treatments at Polocross Drive (wide median treatment) and at Reid Drive (roundabout) Some flexibility in location(s) of intersection(s)	Requires new railway level crossing May require wide median treatment at Polocross Drive to be upgraded to a roundabout	Location(s) dictated by weaving distances

Option	Description	Pro's	Con's	Comments
Candidate Area 2				
2.1	T-intersection(s) on Sale-Heyfield Road	Uses existing roundabout at Princes Highway/Sale-Heyfield Road Uses existing railway level crossing - no upgrade required? Flexibility in location(s) of intersection(s)	Bend in Sale-Heyfield Road limits potential location(s)	Must allow for potential road reserve widening for Sale Alternative Truck Route
2.2	Service road(s) to Sale-Heyfield Road	Allows development to front Sale-Heyfield Road Uses existing roundabout at Princes Highway/Sale-Heyfield Road Uses existing railway level crossing - no upgrade required? Flexibility in location(s) of service road(s)	Bend in Sale-Heyfield Road limits potential location(s)	Must allow for potential road reserve widening for Sale Alternative Truck Route
2.3	New road off Williams Drive	Uses existing wide median treatment at Princes Highway/Williams Road /Hopkins Road Uses existing railway level crossing	Upgrade of existing railway level crossing required May require wide median treatment at Princes Highway/ Williams Road/Hopkins Road to be upgraded to a roundabout	New T-intersection with north-south traffic having priority and west leg (existing) giving way
2.4	Access via West Sale Aerodrome	Uses existing wide median treatment at Princes Highway/Williams Road /Hopkins Road Uses existing railway level crossing	Upgrade of existing railway level crossing required May require wide median treatment at Princes Highway/ Williams Road/Hopkins Road to be upgraded to a roundabout Access via aerodrome car park and environs	

Option	Description	Pro's	Con's	Comments
Candidate Area 3				
3.1	Access via Princes Highway/Sale-Heyfield roundabout	Uses existing intersection location	May require land acquisition	
3.2	Left in/left out to Princes Highway	Uses existing treatments at Hopkins Road/Williams Drive (wide median treatment) and at Sale-Heyfield Road (roundabout)	May require wide median treatment at Hopkins Road/Williams Drive to be upgraded to a roundabout	Location(s) dictated by weaving distances No sight distance issues
3.3	Service road(s) to Princes Highway	Allows development to front Princes Highway Utilises existing treatments at Hopkins Road/Williams Drive (wide median treatment) and at Sale-Heyfield Road (roundabout) Flexibility in location(s) of service road(s)	May require wide median treatment at Hopkins Road/Williams Drive to be upgraded to a roundabout	Location(s) dictated by weaving distances No sight distance issues
3.4	New roundabout on Princes Highway		Creates an additional roundabout on Princes Highway	No sight distance issues Location dependent on spacings to treatments to east and west
3.5	T-intersection(s) on Hopkins Road	Uses existing wide median treatment at Princes Highway/Hopkins Road/Williams Drive Flexibility in location(s) of intersection(s)	May require existing wide median treatment at Princes Highway/Hopkins Road/Williams Drive to be upgraded to a roundabout	No sight distance issues
3.6	Direct access to Hopkins Road	Allows development to front Hopkins Road Uses existing wide median treatment at Princes Highway/ Hopkins Road/Williams Drive	Large lots only to front Hopkins Road Corner sites to take access off side road	No sight distance issues

Option	Description	Pro's	Con's	Comments
3.7	Service road(s) to Hopkins Road	Allows development to front Hopkins Road Uses existing wide median treatment at Princes Highway/ Hopkins Road/Williams Drive		No sight distance issues

7 Indicative Costs of Mitigating Works

To assist the comparison of the candidate areas, preliminary indicative costs of the upgrades required as detailed in this report (major intersections and railway level crossings) have been prepared. It is noted that these preliminary indicative costs are not based on any plans, surveys, locations of services and the like, and as such should only be relied upon for a relative comparison of the potential costs of the treatments.

Further, it is noted that, as detailed in Sections 6.1.1, 6.2.1 and 6.3.1, a number of access options exist for the candidate areas including service roads and direct property access (eg on Hopkins Road). These have not been costed.

Table 10 provides a comparison of the relative costs of the required upgrades as detailed in this report.

Table 10: Comparison of Relative Costs of Required Upgrades [1]

	Works	Preliminary Indicative Cost [1]	
		Works	Total
Candidate Area 1	Second lane on north (Hunt Place) approach to Princes Highway/Hunt Place roundabout	$180,000	$1,880,000
	Riverside Drive extension [2]	$1,700,000	
Candidate Area 2	T-intersections on Sale-Heyfield Road (two)	$1,800,000	$4,050,000
	Second lane on north (Sale-Heyfield Road) approach to Princes Highway/Sale-Heyfield Road roundabout	$250,000	
	Upgrade Princes Highway/Williams Drive intersection to a roundabout (with two lanes on northern (Williams Drive) approach)	$1,500,000	
	Upgrade Williams Drive railway level crossing	$500,000	
Candidate Area 3	Add fourth (southern) leg to Princes Highway/Sale-Heyfield Road roundabout [2]	$300,000	$1,800,000
	Upgrade Princes Highway/Hopkins Road intersection to a roundabout	$1,500,000	

(1) It is noted that these preliminary indicative costs are not based on any plans, surveys, locations of services and the like, and as such should only be relied upon for a relative comparison of the potential costs of the treatments.

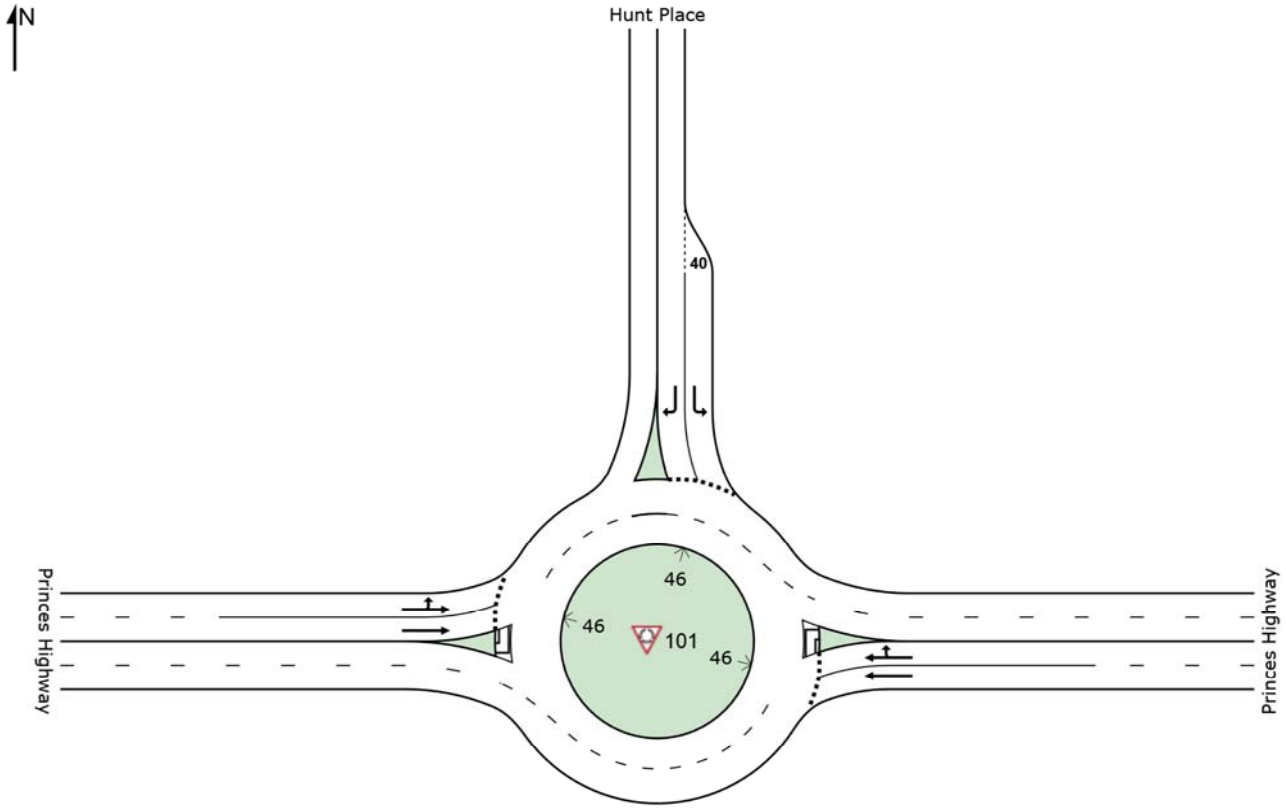
(2) Excludes land acquisition costs.

Appendix A
SIDRA Output
Candidate Area 1 - Princes Highway/Hunt Place

SITE LAYOUT

Site: 101 [Cadidate Area 1 - Princes Highway/Hunt Place Intesection]

Cadidate Area 1 - Princes Highway/Hunt Place Intesection
Roundabout



MOVEMENT SUMMARY

Site: 101 [Cadidate Area 1 - Princes Highway/Hunt Place Intesection]

Cadidate Area 1 - Princes Highway/Hunt Place Intesection
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Princes Highway											
5	T1	505	14.0	0.320	8.4	LOS A	2.7	21.4	0.80	0.67	62.4
6	R2	135	14.0	0.320	16.8	LOS B	2.4	18.6	0.80	0.78	59.1
Approach		640	14.0	0.320	10.2	LOS B	2.7	21.4	0.80	0.70	61.7
North: Hunt Place											
7	L2	817	14.0	0.677	6.3	LOS A	5.6	44.2	0.71	0.82	56.8
9	R2	562	14.0	0.590	13.2	LOS B	4.0	31.6	0.68	0.91	53.7
Approach		1379	14.0	0.677	9.1	LOS A	5.6	44.2	0.69	0.86	55.5
West: Princes Highway											
10	L2	107	14.0	0.209	5.7	LOS A	1.6	12.2	0.38	0.46	60.9
11	T1	505	14.0	0.209	6.0	LOS A	1.6	12.2	0.40	0.46	66.4
Approach		613	14.0	0.209	5.9	LOS A	1.6	12.2	0.39	0.46	65.4
All Vehicles		2632	14.0	0.677	8.6	LOS A	5.6	44.2	0.65	0.73	59.0

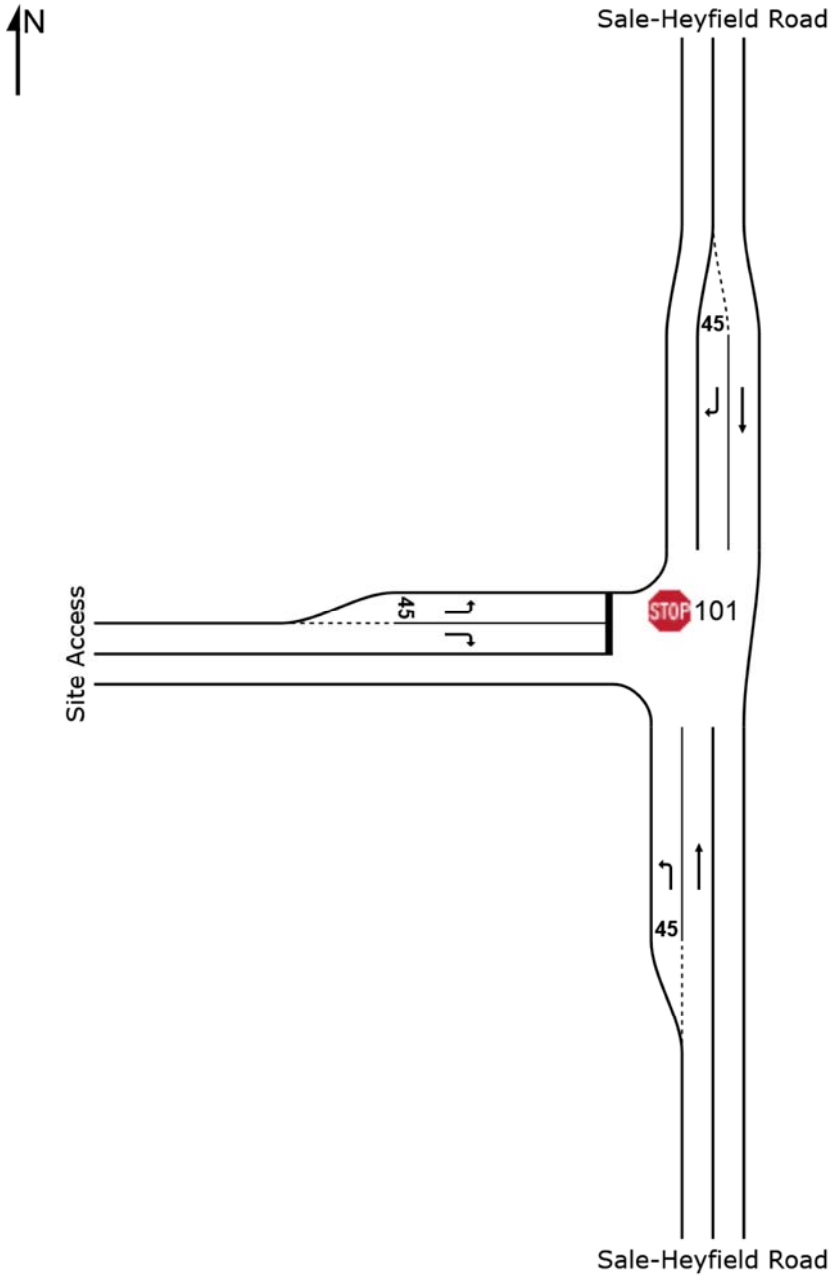
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix B
SIDRA Output
Candidate Area 2 - Sale-Heyfield Road/Site Access

SITE LAYOUT

Site: 101 [Candidate Area 2 - Sale-Heyfield Road/Site Access Intersection]

Candidate Area 2 - Sale-Heyfield Road/Site Access Intersection
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 101 [Candidate Area 2 - Sale-Heyfield Road/Site Access Intersection]

Candidate Area 2 - Sale-Heyfield Road/Site Access Intersection
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Sale-Heyfield Road											
1	L2	83	14.0	0.049	7.2	LOS A	0.0	0.0	0.00	0.63	60.9
2	T1	244	14.0	0.137	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		327	14.0	0.137	1.8	NA	0.0	0.0	0.00	0.16	74.1
North: Sale-Heyfield Road											
8	T1	244	14.0	0.137	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
9	R2	9	14.0	0.011	8.3	LOS A	0.0	0.2	0.32	0.64	59.5
Approach		254	14.0	0.137	0.3	NA	0.0	0.2	0.01	0.02	78.9
West: Site Access											
10	L2	83	14.0	0.064	10.5	LOS B	0.3	2.2	0.37	0.87	58.8
12	R2	536	14.0	0.901	30.4	LOS D	15.2	119.4	0.90	1.64	44.9
Approach		619	14.0	0.901	27.8	LOS D	15.2	119.4	0.83	1.53	46.4
All Vehicles		1200	14.0	0.901	14.9	NA	15.2	119.4	0.43	0.84	57.2

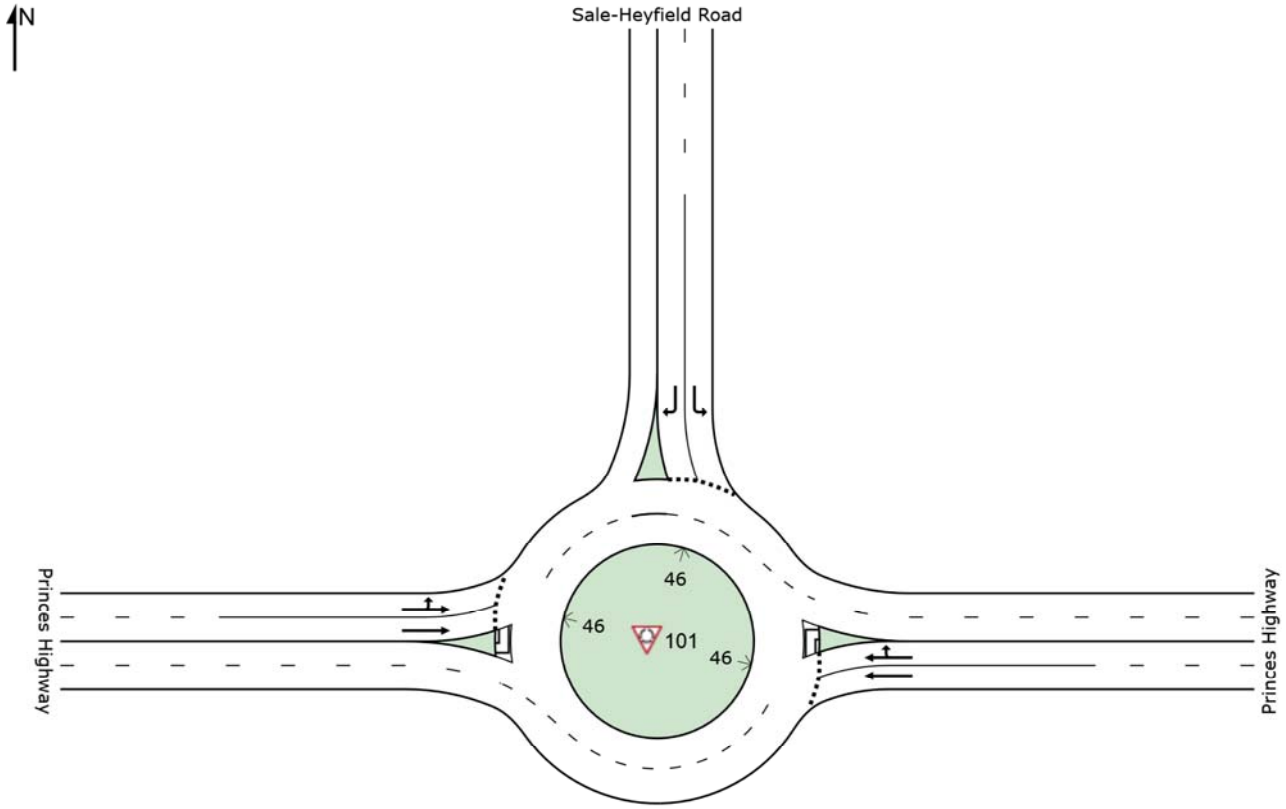
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix C
SIDRA Output
Candidate Area 2 - Princes Highway/Sale-Heyfield Road

SITE LAYOUT

Site: 101 [Cadidate Area 2 - Princes Highway/Sale-Heyfield Road Intesection]

Cadidate Area 2 - Princes Highway/Sale-Heyfield Road Intesection
Roundabout



MOVEMENT SUMMARY

Site: 101 [Cadidate Area 2 - Princes Highway/Sale-Heyfield Road Intesection]

Cadidate Area 2 - Princes Highway/Sale-Heyfield Road Intesection
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Princes Highway											
5	T1	636	14.0	0.420	8.7	LOS A	3.9	30.5	0.87	0.70	61.9
6	R2	172	14.0	0.420	17.2	LOS B	3.3	26.2	0.87	0.81	59.9
Approach		807	14.0	0.420	10.5	LOS B	3.9	30.5	0.87	0.72	61.5
North: Sale-Heyfield Road											
7	L2	422	14.0	0.629	11.6	LOS B	4.1	32.1	0.82	0.98	59.6
9	R2	573	14.0	0.610	17.2	LOS B	4.3	33.9	0.81	1.00	57.8
Approach		995	14.0	0.629	14.8	LOS B	4.3	33.9	0.81	0.99	58.5
West: Princes Highway											
10	L2	156	14.0	0.437	6.0	LOS A	4.1	31.9	0.53	0.50	62.7
11	T1	1080	14.0	0.437	6.4	LOS A	4.1	31.9	0.55	0.51	65.2
Approach		1236	14.0	0.437	6.4	LOS A	4.1	31.9	0.55	0.50	64.8
All Vehicles		3038	14.0	0.629	10.2	LOS B	4.3	33.9	0.72	0.72	61.7

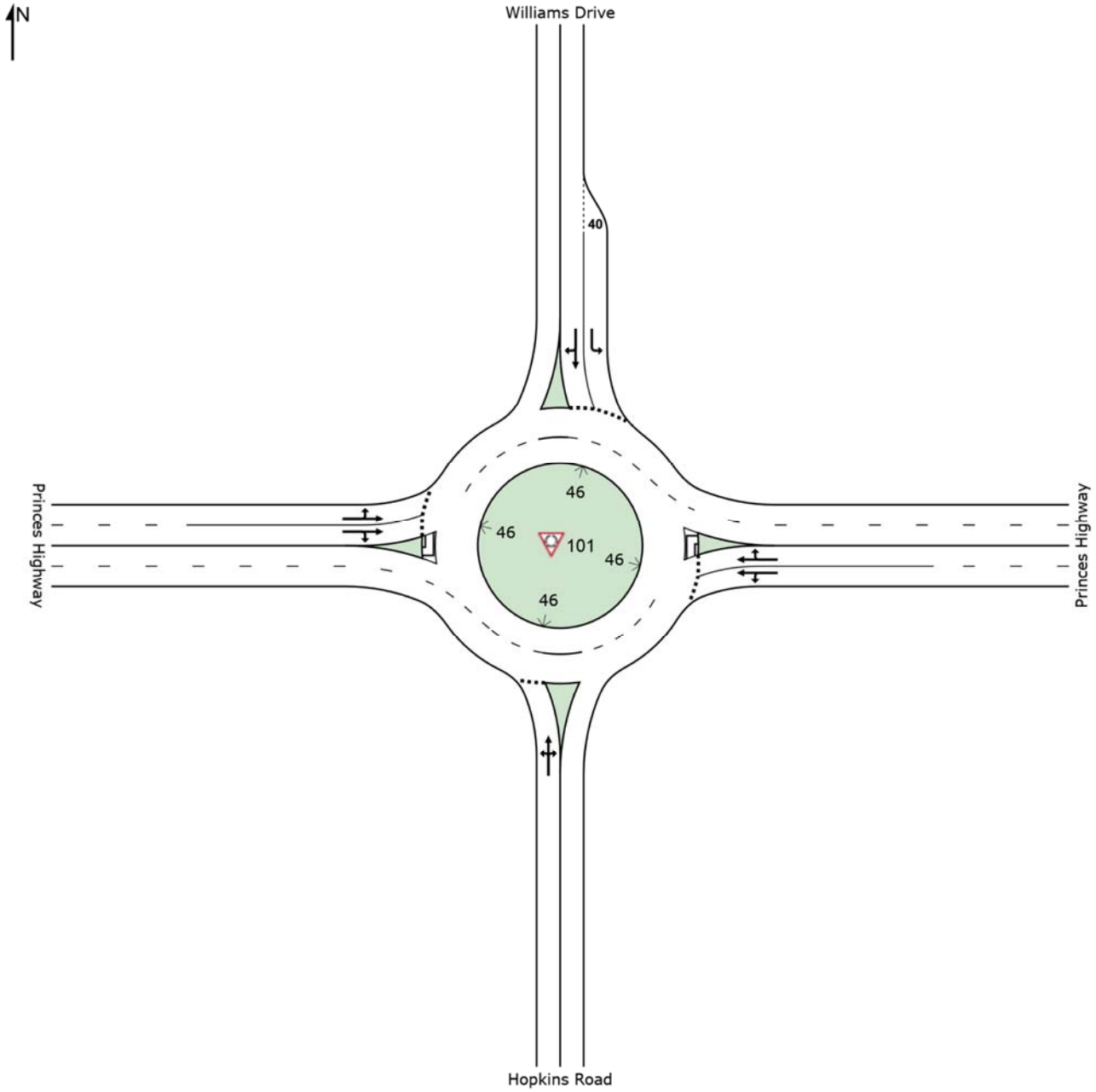
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix D
SIDRA Output
Candidate Area 2 - Princes Highway/Williams Drive

SITE LAYOUT

Site: 101 [Cadidate Area 2 - Princes Highway/Williams Drive Intesection]

Cadidate Area 2 - Princes Highway/Williams Drive Intesection
Roundabout



MOVEMENT SUMMARY

Site: 101 [Cadidate Area 2 - Princes Highway/Williams Drive Intesection]

Cadidate Area 2 - Princes Highway/Williams Drive Intesection
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hopkins Road											
1	L2	53	14.0	0.195	7.4	LOS A	1.0	7.5	0.77	0.88	53.8
2	T1	5	14.0	0.195	7.0	LOS A	1.0	7.5	0.77	0.88	53.9
3	R2	53	14.0	0.195	14.2	LOS B	1.0	7.5	0.77	0.88	55.6
Approach		111	14.0	0.195	10.6	LOS B	1.0	7.5	0.77	0.88	54.7
East: Princes Highway											
4	L2	53	14.0	0.464	7.5	LOS A	4.1	32.2	0.76	0.61	58.3
5	T1	892	14.0	0.464	8.1	LOS A	4.1	32.2	0.77	0.65	62.9
6	R2	108	14.0	0.464	16.3	LOS B	3.7	28.7	0.78	0.72	60.5
Approach		1053	14.0	0.464	8.9	LOS A	4.1	32.2	0.77	0.66	62.4
North: Williams Drive											
7	L2	553	14.0	0.501	5.7	LOS A	3.0	23.7	0.67	0.72	57.0
8	T1	5	14.0	0.466	6.0	LOS A	2.5	19.9	0.67	0.90	52.3
9	R2	386	14.0	0.466	13.2	LOS B	2.5	19.9	0.67	0.90	53.8
Approach		944	14.0	0.501	8.7	LOS A	3.0	23.7	0.67	0.80	55.6
West: Princes Highway											
10	L2	89	14.0	0.267	5.8	LOS A	1.9	15.3	0.41	0.48	60.7
11	T1	631	14.0	0.267	6.2	LOS A	1.9	15.3	0.43	0.50	65.7
12	R2	53	14.0	0.267	13.9	LOS B	1.9	14.5	0.45	0.53	63.4
Approach		773	14.0	0.267	6.7	LOS A	1.9	15.3	0.43	0.50	65.0
All Vehicles		2880	14.0	0.501	8.3	LOS A	4.1	32.2	0.65	0.67	60.3

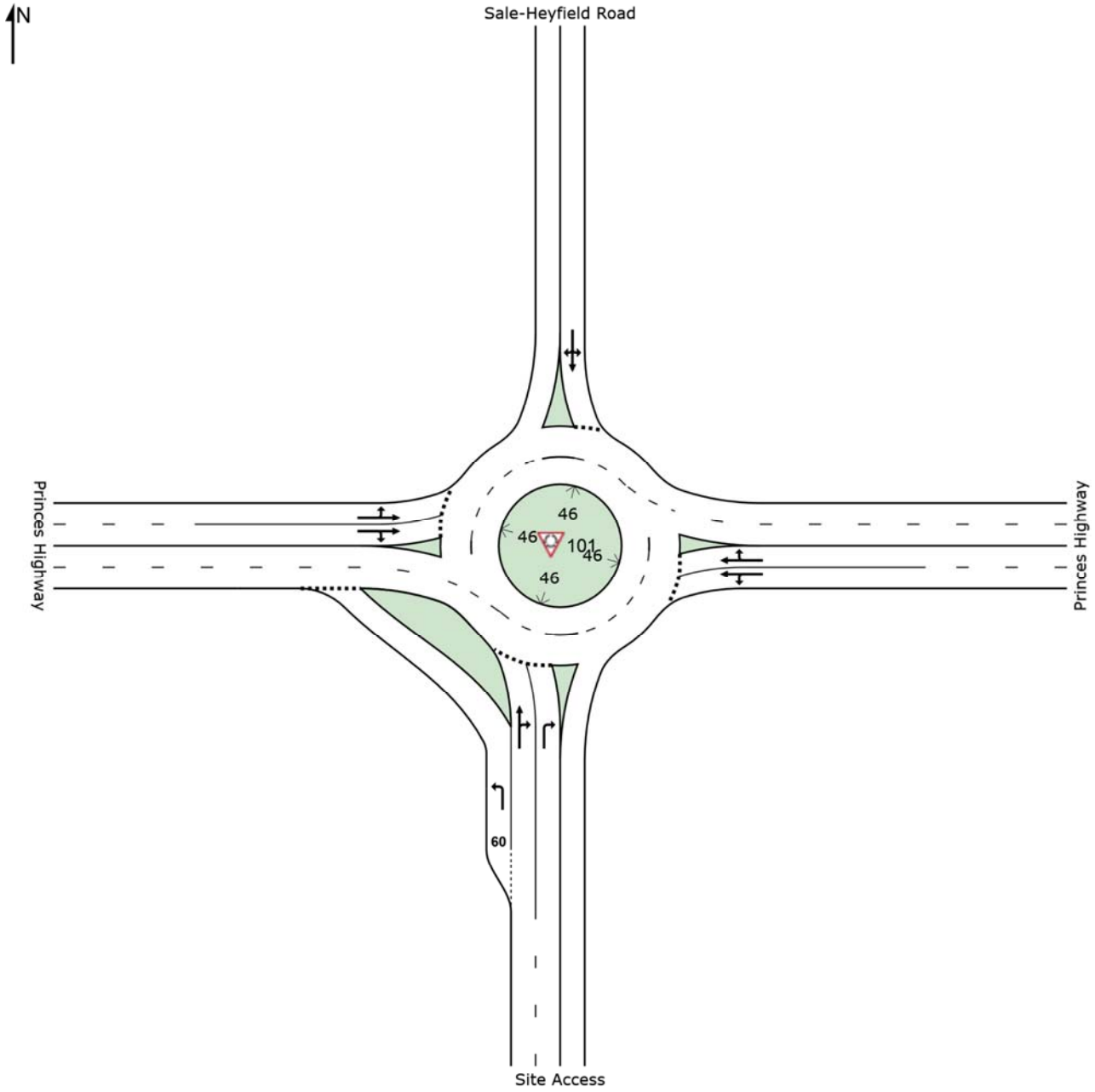
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix E
SIDRA Output
Candidate Area 3 - Princes Highway/Sale-Heyfield Road

SITE LAYOUT

Site: 101 [Cadidate Area 3 - Princes Highway/Site Access Intesection (Two Access Points)]

Cadidate Area 3 - Princes Highway/Site Access Intesection (Two Access Points)
Roundabout



MOVEMENT SUMMARY

Site: 101 [Cadidate Area 3 - Princes Highway/Site Access Intesection (Two Access Points)]

Cadidate Area 3 - Princes Highway/Site Access Intesection (Two Access Points)
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Site Access											
1	L2	436	14.0	0.300	6.5	LOS A	1.5	12.0	0.58	0.62	63.2
2	T1	121	14.0	0.337	7.0	LOS A	1.9	14.7	0.65	0.77	60.6
3	R2	655	14.0	0.337	15.0	LOS B	1.9	14.7	0.65	0.80	59.5
Approach		1212	14.0	0.337	11.1	LOS B	1.9	14.7	0.63	0.73	60.8
East: Princes Highway											
4	L2	73	14.0	0.345	5.8	LOS A	2.4	18.5	0.46	0.48	59.7
5	T1	661	14.0	0.345	6.2	LOS A	2.4	18.5	0.47	0.52	64.7
6	R2	122	14.0	0.345	14.1	LOS B	2.3	17.7	0.48	0.58	63.7
Approach		856	14.0	0.345	7.2	LOS A	2.4	18.5	0.47	0.53	64.1
North: Sale-Heyfield Road											
7	L2	122	14.0	0.650	20.4	LOS C	4.5	35.4	0.94	1.10	50.1
8	T1	14	14.0	0.650	20.7	LOS C	4.5	35.4	0.94	1.10	50.2
9	R2	122	14.0	0.650	28.2	LOS C	4.5	35.4	0.94	1.10	51.7
Approach		258	14.0	0.650	24.1	LOS C	4.5	35.4	0.94	1.10	50.8
West: Princes Highway											
10	L2	122	14.0	0.932	24.8	LOS C	18.3	143.8	1.00	1.47	49.6
11	T1	1276	14.0	0.932	27.3	LOS C	18.3	143.8	1.00	1.47	49.5
12	R2	61	14.0	0.932	37.8	LOS D	15.9	124.5	1.00	1.48	46.4
Approach		1459	14.0	0.932	27.5	LOS C	18.3	143.8	1.00	1.47	49.3
All Vehicles		3784	14.0	0.932	17.4	LOS B	18.3	143.8	0.76	1.00	55.7

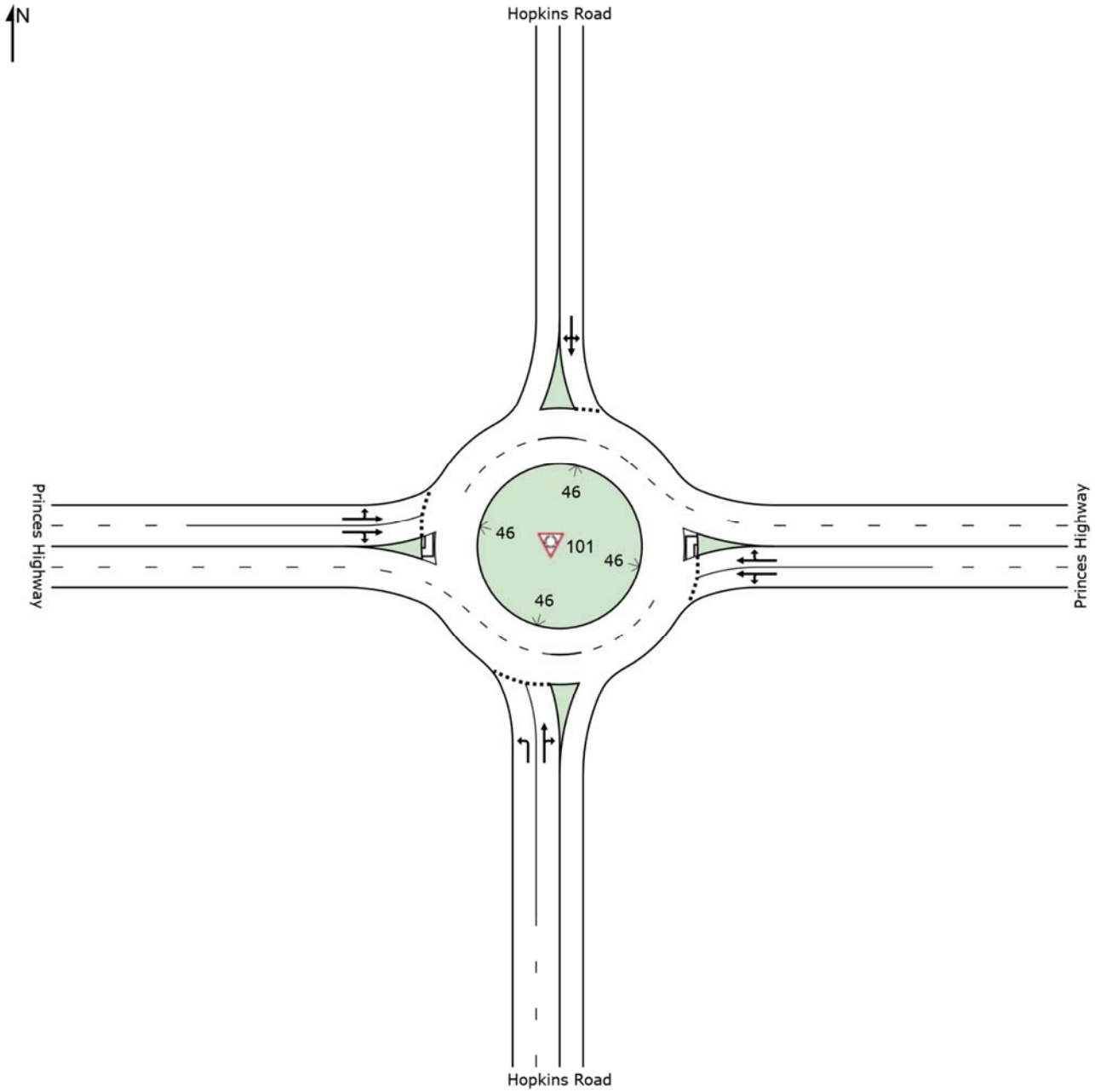
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix F
SIDRA Output
Candidate Area 3 - Princes Highway/Hopkins Road

SITE LAYOUT

Site: 101 [Cadidate Area 3 - Princes Highway/Hopkins Road Intersection (Two Access Points)]

Cadidate Area 3 - Princes Highway/Hopkins Road Intersection (Two Access Points)
Roundabout



MOVEMENT SUMMARY

Site: 101 [Cadidate Area 3 - Princes Highway/Hopkins Road Intersection (Two Access Points)]

Cadidate Area 3 - Princes Highway/Hopkins Road Intersection (Two Access Points)
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hopkins Road											
1	L2	538	14.0	0.815	16.4	LOS B	7.3	57.3	0.90	1.14	55.3
2	T1	5	14.0	0.842	14.5	LOS B	9.3	73.0	0.92	1.18	54.3
3	R2	780	14.0	0.842	22.0	LOS C	9.3	73.0	0.92	1.18	54.1
Approach		1323	14.0	0.842	19.7	LOS B	9.3	73.0	0.91	1.16	54.6
East: Princes Highway											
4	L2	134	14.0	0.424	5.6	LOS A	3.7	29.1	0.49	0.47	59.4
5	T1	1033	14.0	0.424	6.1	LOS A	3.7	29.1	0.51	0.50	64.8
6	R2	53	14.0	0.424	14.1	LOS B	3.5	27.6	0.53	0.53	64.5
Approach		1219	14.0	0.424	6.4	LOS A	3.7	29.1	0.50	0.50	64.1
North: Hopkins Road											
7	L2	53	14.0	0.231	12.1	LOS B	1.3	9.8	0.85	0.94	56.3
8	T1	5	14.0	0.231	12.4	LOS B	1.3	9.8	0.85	0.94	56.3
9	R2	53	14.0	0.231	19.9	LOS B	1.3	9.8	0.85	0.94	58.2
Approach		111	14.0	0.231	15.8	LOS B	1.3	9.8	0.85	0.94	57.2
West: Princes Highway											
10	L2	53	14.0	0.604	14.7	LOS B	7.9	61.6	1.00	0.98	57.1
11	T1	642	14.0	0.604	15.9	LOS B	7.9	61.6	1.00	1.02	57.2
12	R2	106	14.0	0.604	25.4	LOS C	6.5	50.9	1.00	1.10	52.1
Approach		801	14.0	0.604	17.1	LOS B	7.9	61.6	1.00	1.03	56.4
All Vehicles		3454	14.0	0.842	14.3	LOS B	9.3	73.0	0.79	0.89	58.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX C CULTURAL HERITAGE REPORT

APPENDIX D BIODIVERSITY REPORT

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