asongroup

Prepared for

ALTIS PROPERTY PARTNERS

Traffic Impact Assessment Report

Mamre West Land Investigation Area, Planning Proposal
Mamre Road, Western Sydney Priority Growth Area

Ref: 0124r03v3
23/02/2016

Info@asongroup.com.au | +61 2 9083 6601 | Suite 1404, Level 14, 101 Grafton Street, Bondi Junction, NSW 2022

Table of Contents

1 Introduction

1.1 Study Objectives

Ason Group has been engaged by Altis Property Partners to prepare a Traffic Impact Assessment (**TIA**) relating to a Planning Proposal (the **Proposal**) to rezone land for IN1 use. The land is located within Orchard Hills to the west of Mamre Road and within the study area referred to as the Mamre West Land Investigation Area (the **Precinct**). A Location Plan is presented in **Figure 1**, which provides an appreciation of the Precinct and its location within the new Western Sydney Priority Growth Area.

The Precinct consists largely of 3 areas:

- Stage 1 flood-free area to the south (STG1 – the **Site** and the land that is the subject of this Planning Proposal and which includes the **Altis site**).
- Stage 2 flood-free area to the north (STG2 – also referred to as the *Potential Stage 2 Area*)
- The remaining area of the Precinct that is flood prone.

STG1 and STG2 – which are 47.8 hectares and 39.6 hectares in site area respectively, are presented on the Precinct Plan at **Figure 2** and represent the 87.4 hectares of developable (flood-free) area within the Precinct.

It is noteworthy that earlier assessments also divided the 87.4 hectares of developable land into 2 'parcels'; the 43.8 hectare Altis site in the south (originally considered the Stage 1 Area) and the 43.6 hectares of remaining developable land in the north (referred to as **Mandalong North**). These areas are shown on the Indicative Site Plan at **Figure 3** within the context of the current STG1 and STG2 study areas.

This report provides input to the *Land Use and Infrastructure Delivery Plan, Mamre West Land Investigation Area* prepared by Urbis and submitted to the Department of Planning & Environment (**DPE**) as part of the precinct planning process. Importantly, this assessment investigates the Traffic and Transport implications of rezoning the Precinct. Furthermore, this assessment responds to specific issues raised by the NSW Roads & Maritime Services (**RMS**) during pre-lodgement consultation.

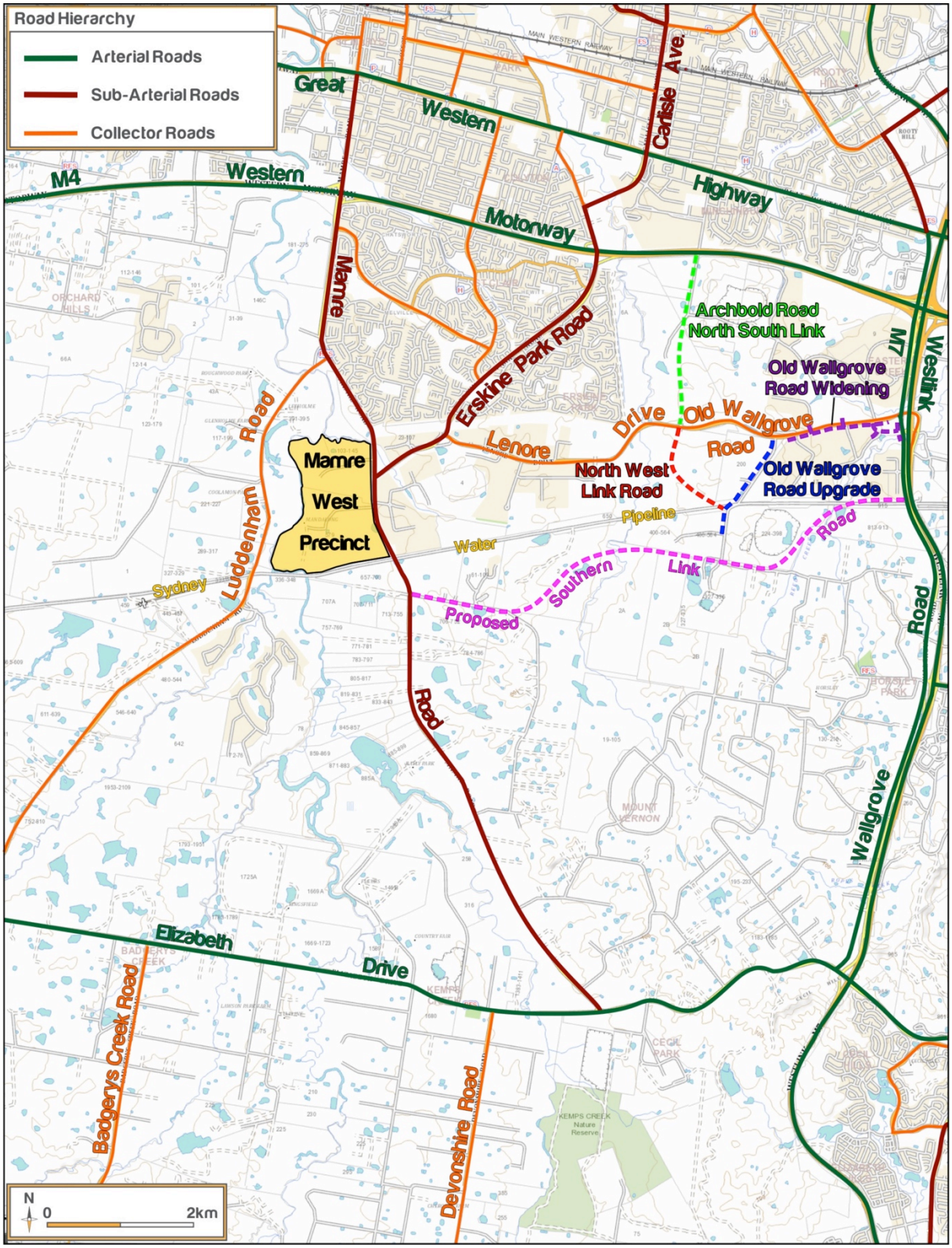


Figure 1: Location Plan and Road Hierarchy

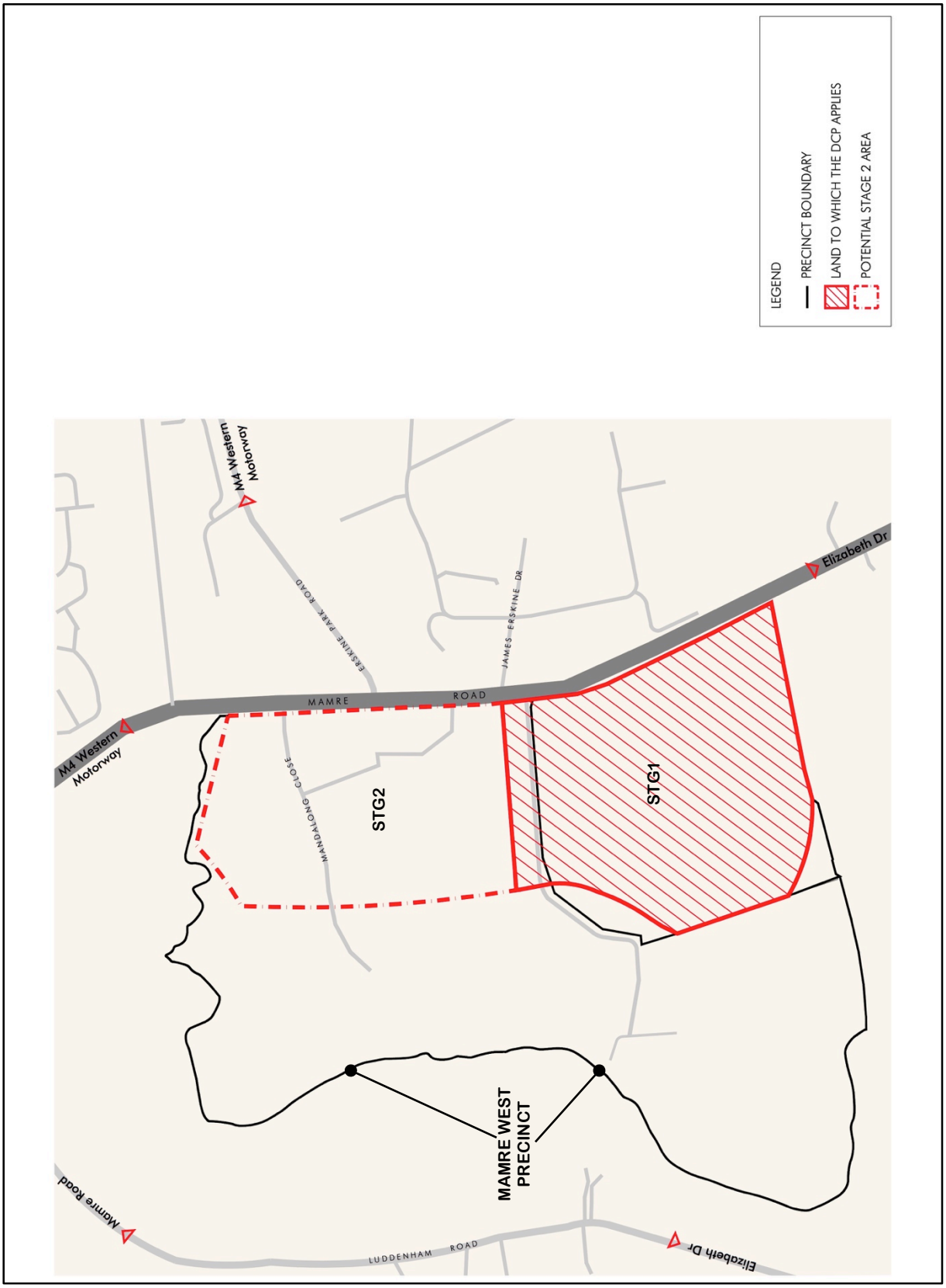


Figure 2: Precinct Plan

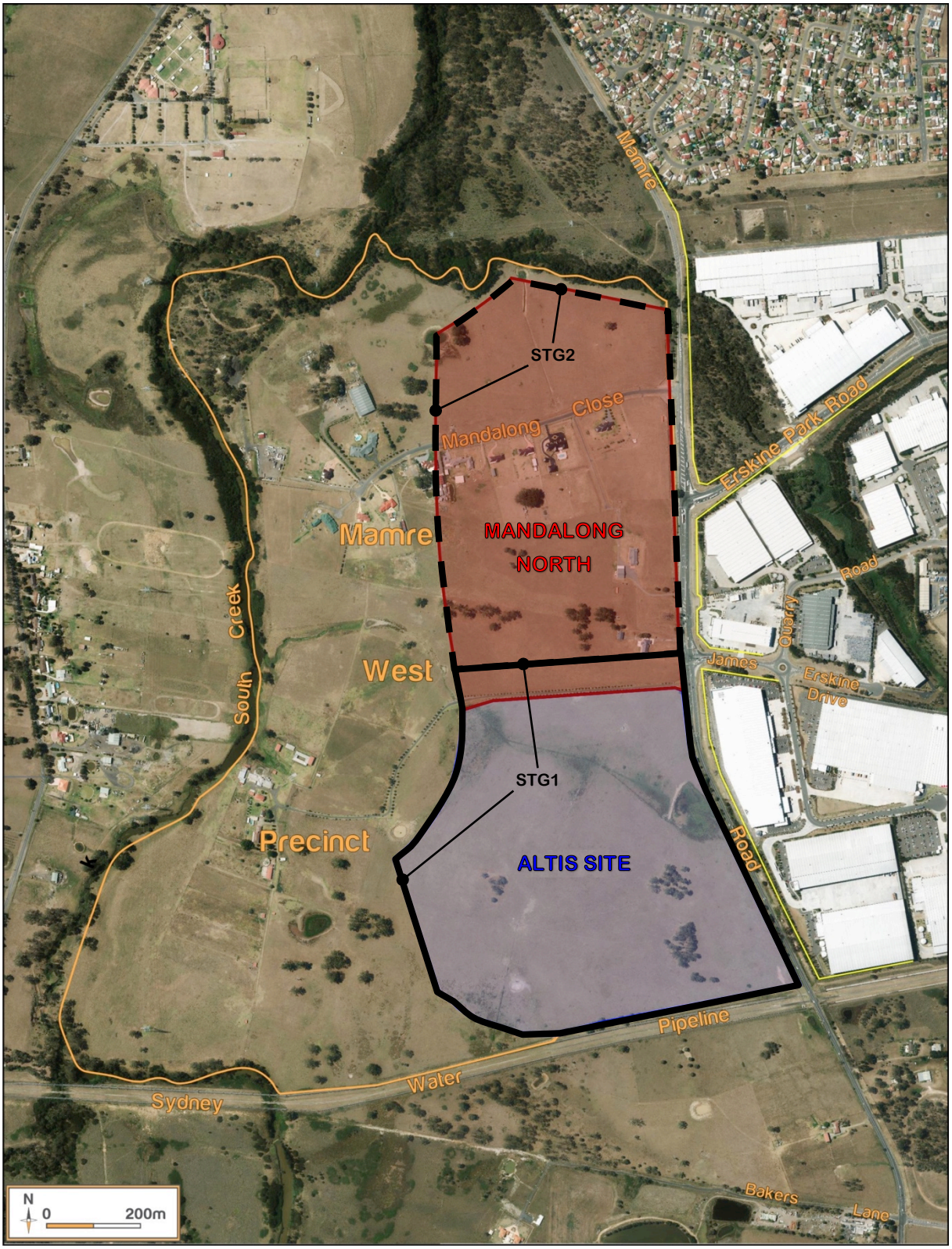


Figure 3: Indicative Site Plan

1.2 RMS, DPE & Council Consultation

A number of pre-lodgement discussions and meetings with the RMS have been undertaken with a view to cooperatively developing an Access Strategy that accommodated the requirements of Altis, RMS, DPE, Council and the Precinct. In this regard, an initial meeting was held at RMS on 23 June 2015 with the Developer, their consultants and DPE to discuss the Precinct Planning Package requirements, specifically:

- Any RMS planned upgrades to Mamre Road – RMS noted that the road is flagged for upgrade (potentially dual carriageway); however, formal planning was yet to commence and funding was not secured.
- Potential Road Widening / Acquisition requirements to Mamre Road – RMS noted that the existing 40 metre road reserve would be sufficient to cater for the development.
- Precinct Upgrades (Mandalong Close) – The Developer noted the existing road reserve of Mandalong Close is capable of becoming an industrial road (20.6 metres).

At the meeting the proposal for a new signalised T-intersection on Mamre Road providing access to the Altis site was tabled. RMS raised no issue in relation to the location of the proposed intersection, approximately 500 metres south of the existing intersection with James Erskine Drive.

A further meeting was held with RMS on 30 September 2015 to discuss access, at which separate signalised access intersections were tabled for Mandalong North (in the location of the existing Mandalong Close intersection with Mamre Road) and for the Altis site in the same location 500 metres south of James Erskine Drive. At this meeting, RMS advised that Mamre Road was earmarked for classification as a Principal Arterial Road and that it's main role would be to cater for 'through traffic' as opposed to provide access to development.

In this regard, RMS advised that it would seek an access arrangement along this section of Mamre Road that would be optimal in terms of reducing delays (particularly at intersections), with a view to promoting the free-flow of through traffic across the local network and ideally achieve an 80 km/h speed environment for Mamre Road.

To achieve this, it was the view of RMS that reducing the number of intersections would reduce the amount of delay experienced by through traffic. Accordingly, RMS recommended that the proposed Altis site intersection be designed to provide for the entire Precinct, thereby eliminating the need for a signalised intersection at Mandalong Close. RMS further recommended that the Planning Proposal area be expanded beyond the Altis site to cover the entire Precinct. It is however noteworthy that RMS again raised no issue with regard to the location of the proposed Altis site Access Road intersection.

At a subsequent meeting of RMS with DPE (understood to have occurred in the first week of October 2015), RMS recommended that access to the Precinct, via a new western connection to the existing signalised T-intersection of Mamre Road with James Erskine Drive, should be investigated.

In response, a TIA report was submitted by Ason Group (dated 4 November 2015), which investigated the following 2 access options:

- Option 1 – via a new signalised T-intersection on Mamre Road located approximately 500 metres south of the existing intersection with James Erskine Drive. All major intersection works on land under the control of Altis (i.e. the Altis site).
- Option 2 – via a new western connection to the existing signalised T-intersection of Mamre Road with James Erskine Drive. All major intersection works on land under third party ownership to the north of the Altis site.

The TIA report concluded that both Option 1 and Option 2 would operate satisfactorily in terms of network performance following development of the non-flood affected areas of the Precinct. Furthermore, the analysis demonstrated that the Option 1 arrangement would result in fewer delays to through traffic on Mamre Road compared with Option 2. The TIA report assessed IN1 development of the 87.4 hectares of developable land in the Precinct.

Following submission of the report, further meetings were held with RMS and DPE on 12 and 17 November 2015 (with Penrith City Council attending the second meeting) to discuss the findings of the report and agree an Access Strategy for the entire Precinct. As a result of those discussions, an Access Strategy that consists generally of the following components was 'conditionally' agreed with RMS.

- Ultimate Development of the Precinct for IN1 industrial use:
  - Primary Access to the Precinct to be provided via a new western connection to the existing signalised T-intersection of Mamre Road with James Erskine Drive (Option 2 arrangement).
  - Secondary Access to the Precinct to be provided via a left-in / left-out priority controlled intersection with Mamre Road located approximately 500 metres south of the existing intersection with James Erskine Drive.
  - Internal industrial collector link roads connecting:
    - The Altis site to Mandalong North (and onwards to the primary signalised access intersection),

- Mandalong Close (and adjacent Lots directly accessed from Mandalong Close) to the southern developable areas of Mandalong North (and onwards to the primary signalised access intersection).

- Mandalong Close intersection with Mamre Road to be closed to traffic or (as a minimum) reduced to a left-in / left-out priority controlled intersection.

- Interim Development of (part of) the Altis site:

  - Interim Access to the Altis site to be provided via a new 'seagull' priority controlled intersection with Mamre Road located approximately 500 metres south of the existing intersection with James Erskine Drive.

  - Internal industrial collector link road corridor to be 'protected' by way of Precinct DCP controls.

  - Interim seagull intersection to be reduced to a left-in / left-out priority controlled intersection in accordance with the Access Strategy for the Precinct, following delivery of (and connection to) the proposed 4-way signalised primary access intersection at James Erskine Drive.

As mentioned, Option 2 requires land that is under third party ownership. It is therefore important to note that Altis – as the main proponent and major stakeholder – agreed to proceed with the Planning Proposal on the basis of the preferred RMS Option 2, in spite of the earlier traffic assessments demonstrating that the Option 1 arrangement, on land entirely within Altis' control, would operate satisfactorily and would result in fewer delays to through traffic on Mamre Road. This agreement; however, was on the understanding that RMS and/or other authorities would provide the necessary mechanisms to gain control of the third party land so that Altis could (if required) bring forward the construction of the RMS preferred intersection and relevant road connections between the intersection and the Altis site.

Following this meeting, it was agreed to extend the Stage 1 Area boundary north from the original Altis site area. The result was the STG1 area that is the subject of this Planning Proposal. The key aspect of the Stage 1 realignment is that it incorporates lands to the north of the Altis site that are required for the delivery of the proposed 4-way signalised primary access intersection at James Erskine Drive preferred by RMS.

In addition, discussions have been ongoing in relation to the STG2 area, in particular, appropriate future land uses that could interface between the IN1 uses at STG1 and the existing/retained rural land uses generally fronting Mandalong Close. Accordingly, the current Planning Proposal no longer includes the STG2 area and therefore any future rezoning of that area would be the subject of a separate Planning Proposal.

In recognition of RMS's requirement that the entire potential developable land be assessed, this TIA report retains the scope of the earlier assessments that considered full development of the Precinct, again adopting the IN1 use. Furthermore, the conditionally agreed Access Strategy has been retained noting that it remains achievable within the revised boundaries for STG1 and STG2.

The objective of this report is to document the traffic impact analysis work that has been undertaken to support the Planning Proposal for the subject STG1 site and – in particular – the analysis of the entire Precinct that informed the process that resulted in the conditionally agreed Access Strategy summarised above. This report consists generally of a revision to the earlier Ason TIA report, retaining much of the traffic analysis presented in that report. This includes the analysis of both access options; however, adopting Option 2 of the agreed Access Strategy.

Scope of Works

As part of this TIA study, Ason Group has:

- Undertaken a detailed review of the proposed future road network(s), which provide access to the sub-regional and regional road network.
- Commissioned and reviewed traffic data for key intersections.
- Undertaken a detailed assessment of the traffic generation and distribution characteristics of the Precinct.
- Undertaken detailed assessment of internal access and sustainable parking provisions.
- Reviewed the key development controls, and traffic and transport guidelines and assessment criteria, pertinent to the Site and the Proposal, including:
    - Penrith City Council Development Control Plan 2014 (**DCP 2014**)
    - RMS (formerly RTA) *Guide to Traffic Generating Developments* (**RMS Guide**)
    - RMS Technical Direction 2013/04a – *Guide to Traffic Generating Developments; Updated traffic surveys* (**RMS Guide Update**)
    - Austroads *Guide to Road Design Part 3 Road Geometry* (**Austroads GRD3**)
    - Austroads *Guide to Road Design Part 4A Unsignalised and Signalised Intersections* (**Austroads GRD4A**)
    - Australian Standard 2890.1: Parking Facilities – Off-street Car Parking (AS2890.1)
    - Australian Standard 2890.2: Parking Facilities – Off-street Commercial Vehicle Facilities (AS2890.2)
    - Australian Standard 2890.6: Parking Facilities – Off-street Parking for People with Disabilities (AS2890.6)
- Undertaken extensive consultation with RMS, DPE and Penrith Council.

2 Existing Conditions

2.1 Site Location

The broader Precinct comprises some 180 hectares of land generally bordered by Mamre Road to the east, South Creek to the north, the Sydney Water Warragamba Pipeline to the south and rural land to the west. The Precinct is divided by the Mandalong Stud access road which runs east-west through the Precinct, with the Altis site comprising some 43.8 hectares of land to the south of the access road, and Mandalong North some 43.6 hectares north of the access road. Figure 3 presents an indicative site plan of the Precinct.

2.2 Road Network

With reference to Figure 1, the key local roads influenced by the application include:

- Mamre Road – an arterial road servicing traffic between the Great Western Highway and M4 to the north and Elizabeth Drive to the south. In the vicinity of the Precinct, Mamre Road generally provides two lanes for two way traffic, with additional through movement and turning infrastructure at key intersections, and specifically at Erskine Park Road and James Erskine Drive. Mamre Road has a posted speed limit of 80km/h.
- Erskine Park Road – a sub-arterial road servicing traffic between the Great Western Highway and M4 to the north, and Mamre Road to the south-west, as well as linking Lenore Drive (Erskine Park Link Road) to the M7 to the east. Erskine Park Road provides four lanes for two-way traffic north-east from the intersection of Mamre Road. Erskine Park Road has a posted speed limit of 70km/h.
- James Erskine Drive – a local industrial access road, providing access for the Erskine Park Industrial Precinct (EPI Precinct) which lies to the east of Mamre Road adjacent to the Precinct. James Erskine Drive provides four lanes for two-way traffic and provides additional turning infrastructure on the approach to Mamre Road. On-street parking is permitted; however, demand for this parking is low and therefore rarely used.

2.3 Key Intersections

The key intersections in the vicinity of the Site are shown below and provide an understanding of the existing road geometry and alignment.

2.3.1 Intersection Mamre Road & Erskine Park Road

Figure 4: Intersection of Mamre Road and Erskine Park Road

It can be seen from **Figure 4** that Erskine Park Road forms a signalised T-intersection with Mamre Road. Erskine Park Road carries 2 lanes of traffic in either direction while Mamre Road generally carries a single lane of traffic. However, Mamre Road widens at this intersection to provide 2 dedicated northbound right-turn lanes into Erskine Park Road and 2 southbound through lanes for a short distance.

2.3.2 Intersection Mamre Road & James Erskine Drive

Figure 5: Intersection of Mamre Road and James Erskine Drive

James Erskine Drive forms a signalised T-intersection with Mamre Road and carries 2 lanes of traffic in either direction as shown in **Figure 5**. Mamre Road widens at this intersection to provide a dedicated right-turn bay for northbound traffic and a priority-controlled slip lane for southbound traffic from James Erskine Drive.

2.4 Public Transport

2.4.1 Bus Services

The existing bus services within the vicinity of the Site are shown in **Figure 6**. It is evident that the Site is not directly serviced by public transport operations at this time. Notwithstanding, the opportunities for future connections have been identified and are discussed further below.

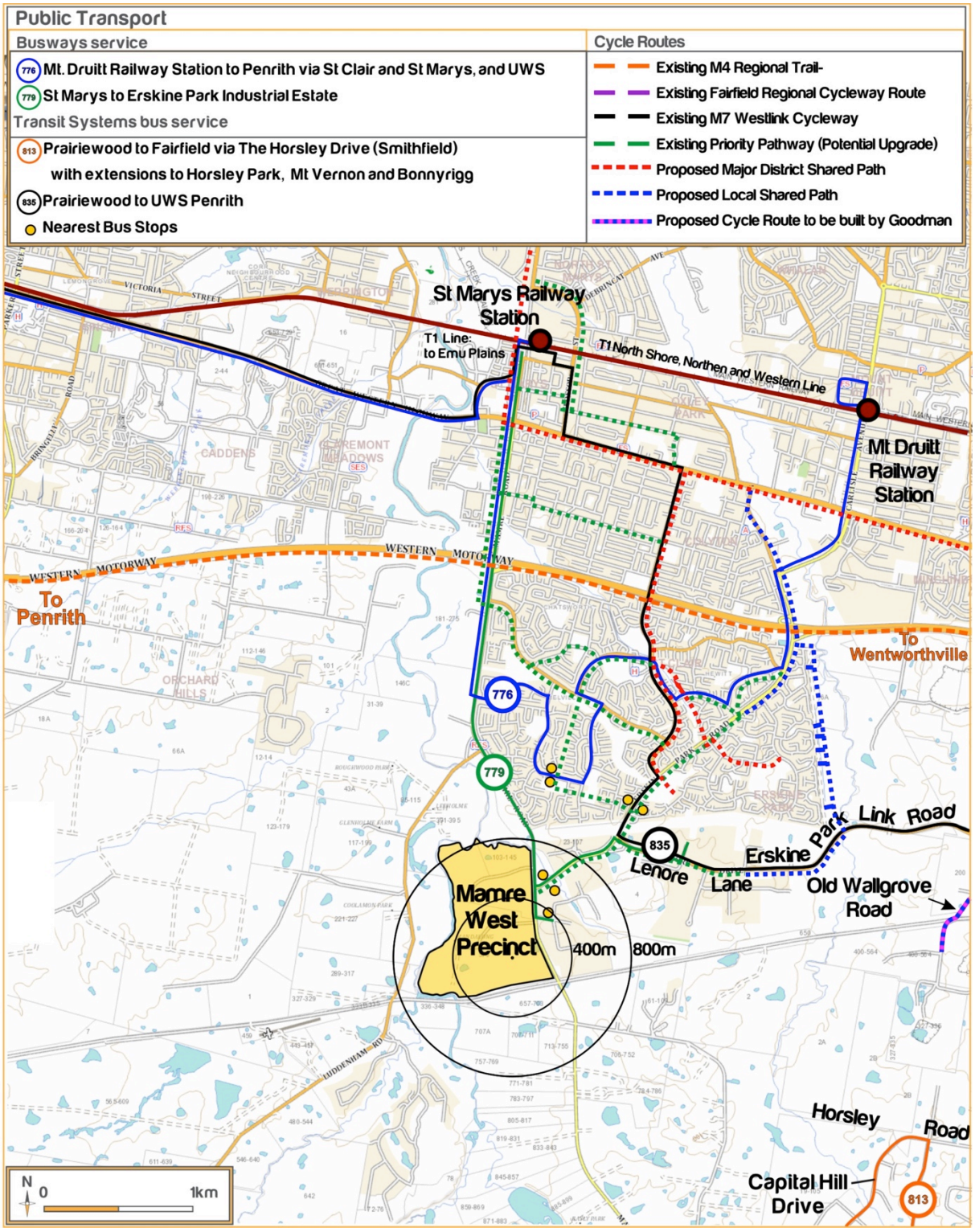


Figure 6: Public Transport Services & Cycling Routes

2.4.2 Future Bus Service Opportunities

While it is apparent that the Site will be well served by a future road network, it is nonetheless important that people have the opportunity to use public transport, which requires significant improved connectivity to the broader area in the first instance. This could be possible through an extension of the 779 bus route and include stops within the internal road network of the Proposal. The mentioned route provides a key connection to the St Mary's railway station and to the broader transport network.

The planning of bus services in Sydney is governed by the NSW Service Planning Guidelines, which aims to establish Strategic Transport Corridors and a hierarchy of bus route types that:

- link to regional centres (such as Penrith and Mt Druitt).
- pass through patronage generators such as district centres, TAFE colleges, hospitals and universities.
- connect with other transport modes (trains, ferries and other buses).
- are multifunctional (serving journeys to work, education, shopping and recreation).
- are direct and frequent.
- meet the network planning principles.

It is also the case that the establishment of public transport services as early as possible in the development stages of the area is important to achieve a culture of public transport use from the outset. To make public transport a viable choice in the study area, the services should ideally:

- integrate with existing bus services in the area.
- connect to regional centres of Penrith, Mt Druitt and Blacktown.
- in the long term connect to areas such as Leppington in the South West Growth Centre, Prairiewood and the Liverpool to Parramatta T-Way.

2.5 Cycling

There are existing opportunities and infrastructure for cyclists to access the Site via Mamre Road. Bicycle lanes are provided along Erskine Park Road and sections of Mamre Road, in addition to carriageway shoulders that could also be utilised by cyclists. Notwithstanding, there are opportunities to improve cycling infrastructure through the provision of shared paths along Mamre Road fronting the Site that could be connected to paths along Erskine Park Road.

3 Adopted Development Yields

3.1 Mamre West Precinct

In accordance with the preference of RMS, the following considers the Precinct in its entirety, in other words, the traffic implications of (potential) development across all 87.4 hectares of developable land within the Precinct. For the purpose of this conservative assessment, IN1 type land uses have been adopted for STG2. This remains consistent with development assumptions adopted by earlier assessments of the Proposal. In this regard, these earlier assessments were based upon indicative development assumptions for the Altis site and Mandalong North. The following summarises relevant development yield assumptions:

The Altis site:

- 43.78 Ha - Non-flood affected area
- 41.58 Ha - Net site area (assuming 2.2 Ha for road infrastructure)
- 260,000 m^2 of total building Gross Floor Area (GFA), consisting of:
  - 247,000 m^2 of Warehouse GFA
  - 13,000 m^2 of Office GFA

Mandalong North:

- 43.62 Ha - Non-flood affected area (allowing for development within the floodplain).
- 40.52 Ha - Net site area (assuming 3.1 Ha for road infrastructure)
- 245,000 m^2 of total building GFA, consisting of:
  - 232,750 m^2 of Warehouse GFA
  - 12,250 m^2 of Office GFA

The Precinct:

- 505,000 m^2 of total building GFA, consisting of:
  - 479,750 m^2 of Warehouse GFA
  - 25,250 m^2 of Office GFA

With regard to the specifics of this Planning Proposal, it is noteworthy that STG1 – with a site area of 47.8 hectares – comprises 54.7% of the developable area within the Precinct. Therefore, it can be expected that STG1 could provide approximately 276,000 m^2 of building GFA. Furthermore, should STG2 be developed for IN1, it would provide in the order of 229,000 m^2 of building GFA.

3.2 James Erskine Drive Precinct, Undeveloped Lots

In order to appropriately assess the future performance of the study road network, an assessment of the likely traffic generation of the undeveloped (or to be redeveloped) Lots within the James Erskine Drive (**JED**) Precinct has been undertaken. In this regard, from a review of available data, the following Lots are of significance, which provide a combined net site area of 34.2 hectares:

- Lot 1 DP1140063 3.5 Ha
- Lot 1024 DP1175670 2.2 Ha
- Lot 4 DP1094504 21.9 Ha
- Lot 103 DP1143935 6.6 Ha

From the development areas adopted for the Precinct, it can be assumed that 6,150 m^2 of building GFA can be developed per net hectare of developable site area. Furthermore, this GFA is generally divided into 95% warehouse GFA and 5% ancillary office GFA. By applying these assumptions to the 34.2 hectares of net developable land, the following yield of future development at the JED Precinct has been adopted:

- 34.20 Ha - Net site area
- 210,000 m^2 of total building GFA, consisting of:
  - 200,000 m^2 of Warehouse GFA
  - 10,000 m^2 of Office GFA

4 Traffic Impact Assessment

4.1 Traffic Analysis Objectives

The main objectives of the following analysis is to assess the performance of the 2 access options, which are:

- Alternative Option 1 – Access to the entire Precinct to be provided via a new signalised T-intersection with Mamre Road at a location approximately 500 metres south of the existing intersection with James Erskine Park Drive.
- Agreed Option 2 – Access to the entire Precinct to be provided via a new western approach to the existing signalised intersection of Mamre Road with James Erskine Drive.

The following analysis focuses initially on the assessment of Option 1 and subsequently modifies the analysis for the purpose of assessing Option 2.

4.2 Traffic Generation

4.2.1 Mamre West Precinct

The recent RMS Guide Update provides surveys of industrial precincts across Sydney, including specific data that relates to development within the adjacent Erskine Park Industrial Area and therefore provides the most appropriate rate for assessment. The RMS Guide Update provides the following rates:

- 0.134 trips per 100 m^2 GFA (total building, warehouse + office) during the morning peak hour
- 0.139 trips per 100 m^2 GFA during the evening peak hour

Table 1 summarises the application of these rates to the adopted Precinct development yields.

Table 1: Forecast Traffic Generation

Site	Area (m^2)	AM Trip Rate (trips / 100 m^2)	AM Trips	PM Trip Rate (trips / 100 m^2)	PM Trips
STG1	276,000	0.134	370	0.139	384
STG2	229,000	0.134	307	0.139	318
The Precinct	505,000	0.134	677	0.139	702

With reference to the RMS Guide Update and the surveys of the similar existing development accessing Mamre Road, it is estimated that:

- 75% of trips during the morning peak hour will be arrival trips (25% departure)
- 25% of trips during the evening peak hour will be arrival trips (75% departure)
- 20% of peak hour trips would be heavy vehicle trips

4.2.2 Undeveloped James Erskine Drive Lots

Application of the same traffic generation assumptions to the adopted development potential remaining within the JED Precinct, results in the traffic generation volumes presented in **Table 2**.

Table 2: Undeveloped JED Precinct, Traffic Generation

Site	Area (m^2)	AM Trip Rate (trips / 100 m^2)	AM Trips	PM Trip Rate (trips / 100 m^2)	PM Trips
JED Precinct	210,000	0.134	281	0.139	292

These forecast trips have been used to determine the future 2026 Baseline traffic volumes on the study road network (see Section 4.4).

4.3 Trip Distribution and Assignment

Trip Distribution assumptions have been based upon forecast traffic volume data contained within the *Western Sydney Employment Area, Southern Link Road Network, Strategic Transport Assessment* – Final Report prepared by Aecom and dated 18 April 2011 (the **Aecom Report**). The EMME/2 sub-regional modelling that informed the Aecom Report provides future 2031 traffic volumes and assignments that account for growth across the broader WSEA (including within the JED Precinct) and the provision of key new road links, in particular the Southern Link Road that is the subject of the report. An output of the 2031 EMME/2 modelling has been extracted from the Aecom Report and is attached at **Appendix A**.

With regard to the Precinct, 5 zones on the wider road network can be identified from the EMME/2 output that are of relevance. These can be summarised as follows:

- Zone 1 – Mamre Road, north of the intersection with Erskine Park Road
- Zone 2 – Erskine Park Road, north of the intersection with Erskine Park Link Road
- Zone 3 – Erskine Park Link Road, east of the intersection with Erskine Park Road

- Zone 4 – Southern Link Road, east of the future (potential) intersection with Mamre Road
- Zone 5 – Mamre Road, south of the future intersection with the Southern Link Road

Based on the traffic volume patterns presented on the EMME/2 output, the following trip distribution assumptions have been adopted:

- 25% from/to Zone 1
- 22% from/to Zone 2
- 15% from/to Zone 3
- 17% from/to Zone 4
- 21% from/to Zone 5

Having consideration for the extent of the study road network, the wider distribution assumptions can be further expressed as follows for the local study road network:

- 25% from/to Mamre Road, north of the intersection with Erskine Park Road
- 37% from/to Erskine Park Road, northeast of the intersection with Mamre Road
- 38% from/to Mamre Road, south of the Site.

The forecast peak hour trip assignment – based on the application of the distribution assumptions above to the earlier traffic generation forecasts for the Precinct – is presented in **Figure 7**.

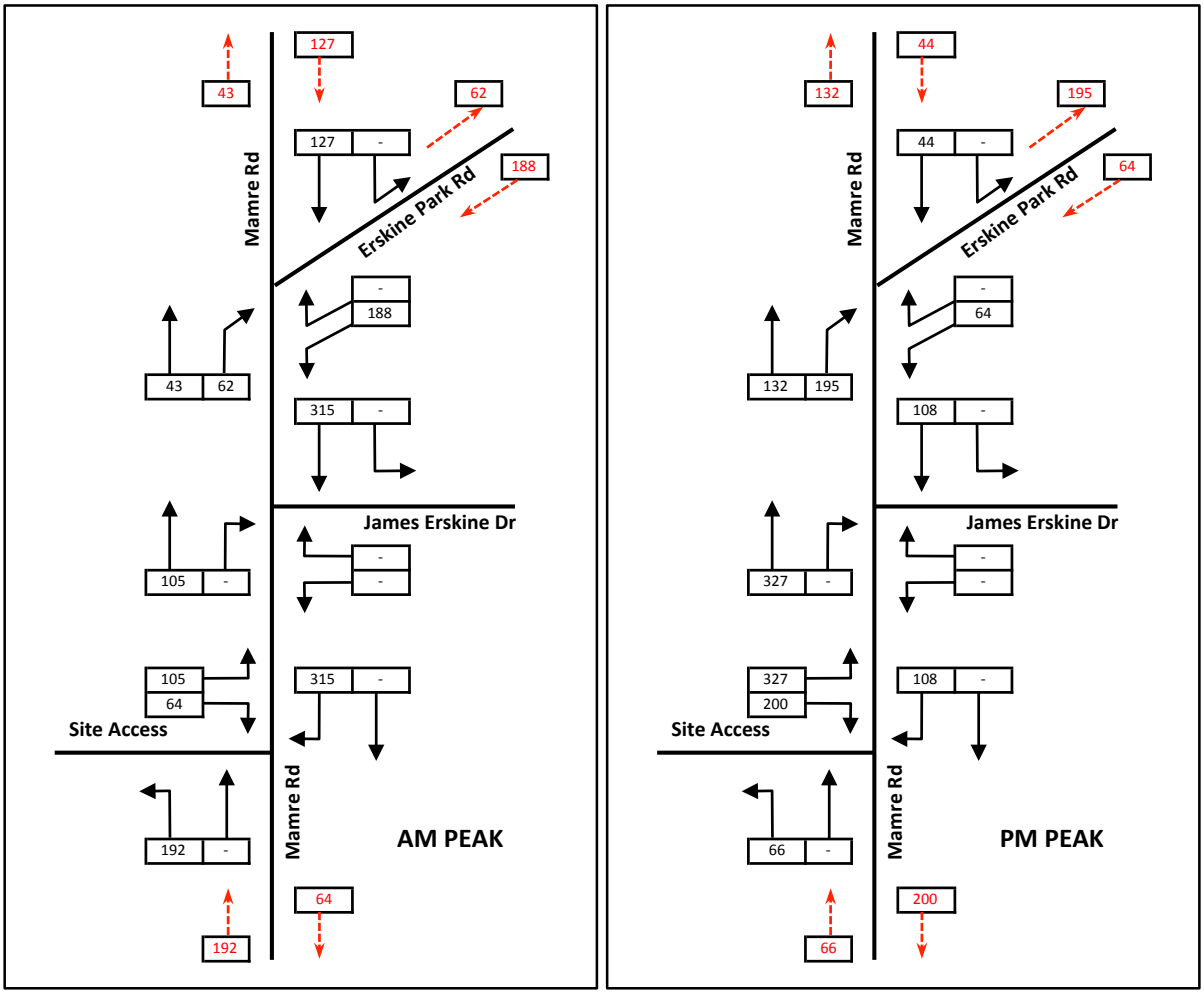


Figure 7: Precinct Forecast Traffic Volumes (Alternative Option 1)

4.4 2026 Baseline Traffic Volumes

4.4.1 Existing 2015 Traffic Volumes

In accordance with RMS requirements, a future design year of 2026 has been adopted, which is the year of opening (2016) plus 10 years background traffic growth. In order to determine existing 2015 traffic volumes – upon which to base future traffic volumes – the following traffic surveys were undertaken:

- Morning and evening peak period traffic surveys at the Mamre Road intersections with Erskine Park Road and James Erskine Drive.
- 24-hour, 7-day midblock volume (tube) counts of Mamre Road, at a location approximately 500 metres south of the James Erskine Drive intersection (potential location of the future access road for the Precinct under Alternative Option 1).

The traffic survey data indicated the following:

- The morning peak 1-hour period was between 8.00 – 9.00AM
- The morning peak 2-hour period was between 7.15 –9.15AM
- The evening peak 1-hour period was between 3.00 – 4.00PM
- The evening peak 2-hour period was between 3.00 – 5.00PM

The existing 2015 traffic volumes on the study road network – derived from the traffic surveys – are presented in **Figure 8**. It is noteworthy that with regard to James Erskine Drive, the surveys indicated the following peak hour traffic volumes:

- 482 trips during the morning peak hour (355 in, 127 out)
- 520 trips during the evening peak hour (155 in, 365 out)

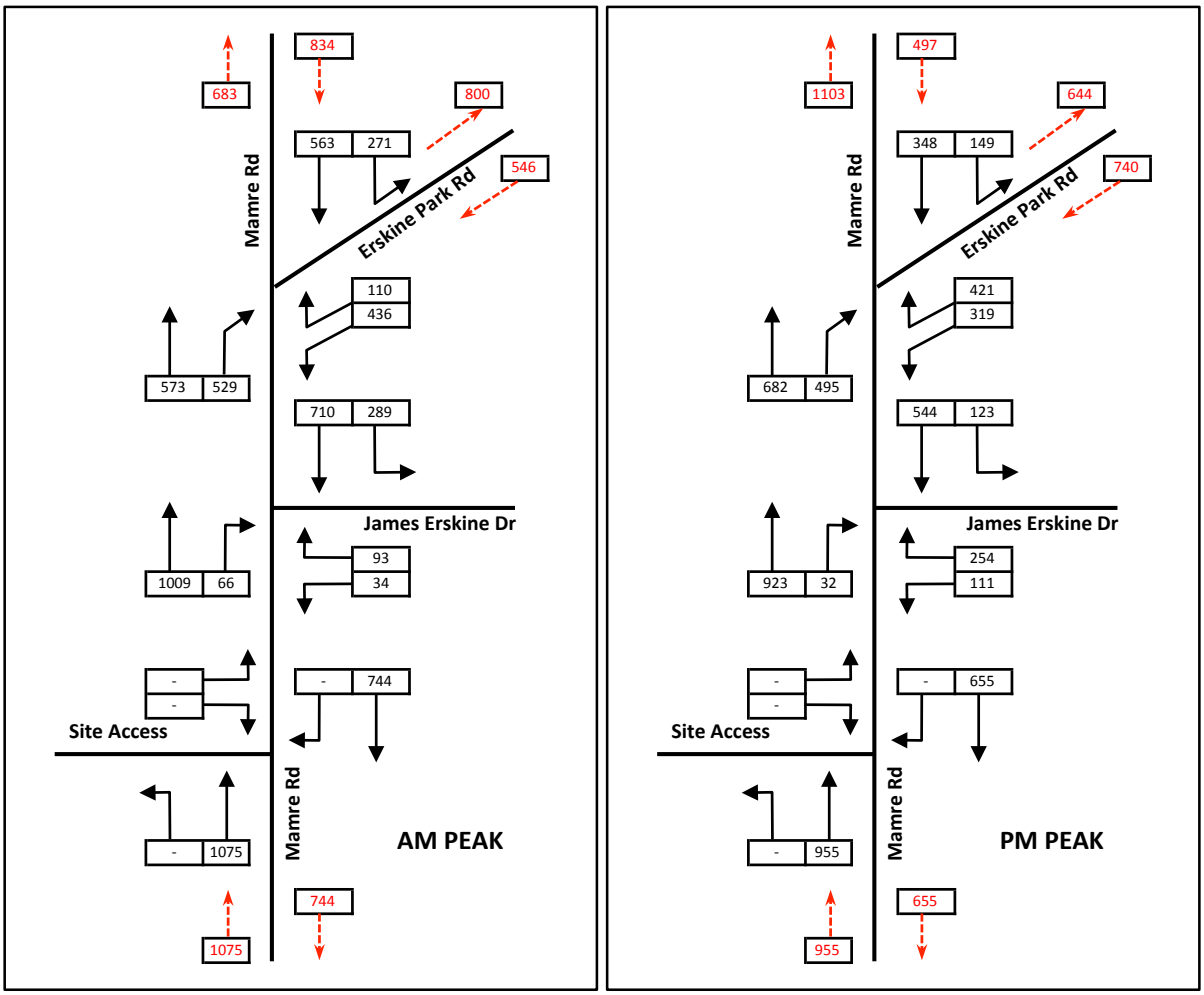


Figure 8: 2015 Surveyed Traffic Volumes

4.4.2 2015 to 2026 Traffic Growth

4.4.2.1 Background Traffic Growth

Background traffic growth on the study road network to 2026 falls generally into the following 2 categories:

1. Further development within the JED Precinct
2. Through traffic growth

4.4.2.2 Future JED Precinct Traffic

Based on the traffic generation analysis and survey data above, Table 3 summarises the future traffic volumes expected for James Erskine Drive following development of all Lots within the Precinct.

Table 3: James Erskine Drive, Future Traffic Volumes

Scenario	AM Arrival	AM Departure	AM Total	PM Arrival	PM Departure	PM Total
Existing	355	127	482	155	365	520
Undeveloped	211	70	281	73	219	292
Future Total	**566**	**197**	**763**	**228**	**584**	**812**

For the purpose of this assessment, the existing surveyed traffic volumes have been 'removed' from the 2015 study network flows (based on current distribution patterns) and then the future total traffic volumes have been 'added' to the study network based on the traffic distribution assumptions adopted for the Precinct development traffic. In doing this, the distribution accounts for future modifications to the wider road network, such as the Southern Link Road, and is consistent with the distribution presented in the EMME/2 modelling output, which also recognises that the EMME/2 modelling accounts for development within the JED Precinct.

4.4.2.3 Through Traffic Growth

Assumptions on through traffic growth have been based upon the EMME/2 modelling data from the Aecom Report attached at Appendix A. In this regard, **Table 4** presents the model's forecast 2031 two-way traffic volumes (peak 2-hour) on Mamre Road south of the James Erskine Drive intersection (i.e. adjacent to the proposed location of the Site access road intersection under Alternative Option 1).

Table 4: Through Traffic Growth on Mamre Road, South of James Erskine Drive Intersection

Scenario	Morning Peak Hour			Evening Peak Hour		
	Northbound	Southbound	Two-Way	Northbound	Southbound	Two-Way
[a] 2031 (2 hours)	2,041	4,150	6,191	4,358	1,955	6,313
[b] 2031 (peak hour) **[=a÷2]**	1,021	2,075	3,096	2,179	978	3,157
[c] 2015 + Full JED	1,224	785	2,009	1,010	766	1,776
[d] 16-Years Growth **[=b-c]**	(-) 203	1,290	1,087	1,169	212	1,381
[e] 11-Years Growth **[=d*11÷16]**	(-) 140	887	747	804	146	950
2026 [c+e]	**1,084**	**1,672**	**2,756**	**1,814**	**912**	**2,726**

Table 4 also presents and/or calculates the following:

- The 2015 traffic flows in this location based on the survey data and including full development of the JED Precinct.
- The growth (or change) in flows anticipated across the 16 years to 2031.
- The proportion of that growth to occur across the 11 years to 2026 (on a pro-rata basis).
- The assumed 2026 flows on Mamre Road south of the intersection with James Erskine Drive.

It is noted that the modelling indicates that during the morning peak hour, northbound traffic volumes on Mamre Road in this location are expected to decrease. It is assumed that this would most likely be due to the proposed Southern Link Road providing an alternative and more direct route for northbound traffic that currently uses the Mamre Road / Erskine Park Road corridor. In any event, the minor reduction in these northbound flows would have limited implications, any of which would be overshadowed by the impacts relating to the significant increase in southbound traffic that is forecast.

Table 5 provides the same assessment for Mamre Road north of the Erskine Park Road intersection.

Table 5: Through Traffic Growth on Mamre Road, North of Erskine Park Road Intersection

Scenario	Morning Peak Hour			Evening Peak Hour		
	Northbound	Southbound	Two-Way	Northbound	Southbound	Two-Way
2031 (2 hours)	1,519	5,167	6,686	5,599	1,462	7,061
2031 (peak hour)	760	2,584	3,344	2,800	731	3,531
2015 + Full JED	610	1,335	1,945	1,590	565	2,155
16-Years Growth	150	1,249	1,399	1,210	166	1,376
11-Years Growth	103	859	962	832	114	946
2026	**713**	**2,194**	**2,907**	**2,422**	**679**	**3,101**

Based on the analysis above, 2026 Baseline traffic volumes for the study road network have been developed and are presented on **Figure 9**.

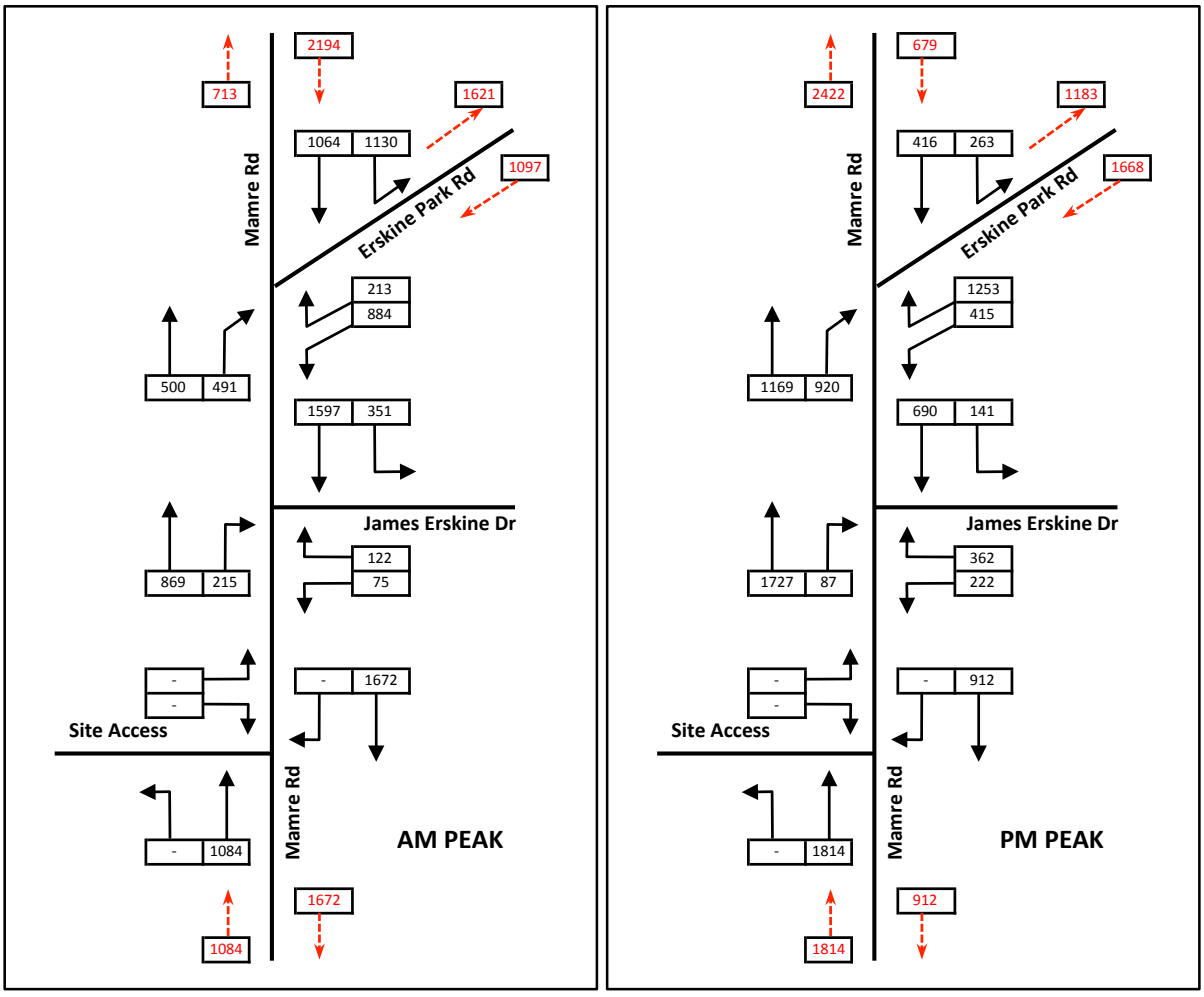


Figure 9: 2026 Baseline Traffic Volumes

4.5 'Baseline + Development' Traffic Volumes

By combining the 2026 Baseline flows (Figure 9) with the Precinct development traffic flows (Figure 7) the future 2026 'with Development' traffic volumes have been calculated and are presented in **Figure 10** for Alternative Option 1.

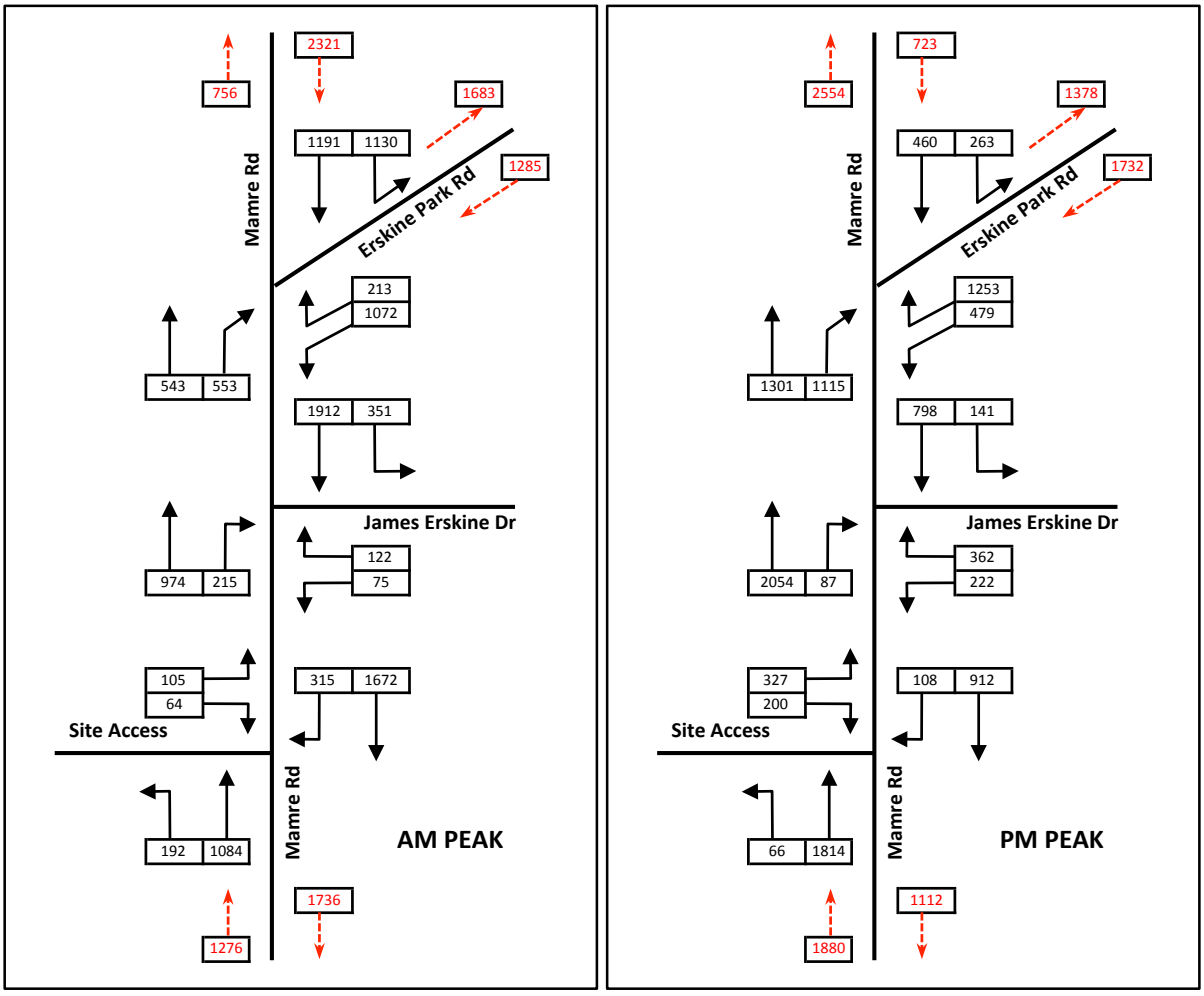


Figure 10: 2026 Baseline + Development Traffic Volumes (Alternative Option 1)

4.6 Alternative Access Arrangement (Option 1) Network Performance

4.6.1 SIDRA Analysis Objectives

SIDRA Intersection modelling has been undertaken to assess the traffic impacts of the Proposal on the study network under the Alternative Option 1 arrangement. In this regard, the objectives of the analysis is two-fold, consisting of:

- Preliminary analysis to develop indicative road network upgrades to accommodate forecast traffic volumes.

- Standard network performance testing to assess the ability of the upgraded study network to accommodate the Precinct development traffic.

4.6.2 Alternative Option 1 Road Network Upgrades

Firstly, **Table 6** presents the additional traffic movements that are forecast to be travelling through the 2 existing key Mamre Road intersections with Erskine Park Road and James Erskine Drive by 2026.

Table 6: Additional Traffic Volumes Through Key Existing Intersections

Scenario	AM Peak Hour			PM Peak Hour		
	Total Movements	Additional Movements	Associated % Increase	Total Movements	Additional Movements	Associated % Increase
2015 Existing	4,683	-	-	4,401	-	-
2026 Base + Dev.	***8,351***	***3,668***	***78.3%***	***8,535***	***4,134***	***93.9%***
+ 11-Yrs Growth	-	2,828	77.1%	-	3,264	78.9%
+ STG1	-	460	12.5%	-	478	11.6%
+ STG2	-	380	10.4%	-	396	9.6%

Note: 1 additional vehicle travelling through both intersections is recorded as 2 additional movements

Table 6 demonstrates that under the 2026 Baseline + Development scenario, the key existing intersections would experience 3,668 additional movements during the morning peak hour – a 78.3% increase in traffic compared with current 2015 flows – and 4,134 additional movements during the evening peak hour, a 93.9% increase. Importantly, Table 6 also demonstrates that the majority of these additional trips (77-79%) are attributed to background traffic growth, with only 11-13% attributed to the development of the STG1 and 9-11% attributed to STG2.

As expected – having regard for the significant increase in traffic volumes presented above – preliminary SIDRA analysis indicated that the 2 existing key Mamre Road intersections with Erskine Park Road and James Erskine Drive would be unable to accommodate the additional traffic volumes forecast on the network under the future 2026 Baseline + Development scenario.

Based on the preliminary SIDRA analysis, **Figure 11** and **Figure 12** present indicative layouts for potential upgrades of the 2 key existing intersections. In addition, **Figure 13** presents an indicative layout for the proposed access intersection under Alternative Option 1. It is important to note that these upgrades are indicative only and based on the 2031 traffic forecasts presented in the 2011 Aecom Report; however, it is generally agreed that these forecasts no longer reflect current traffic estimates for the area and Mamre Road in particular. The eventual upgrades will be determined by the Mamre Road Upgrade study being undertaken by RMS, which includes updating the strategic EMME/2 modelling that informed the 2031 traffic forecasts in the Aecom Report.

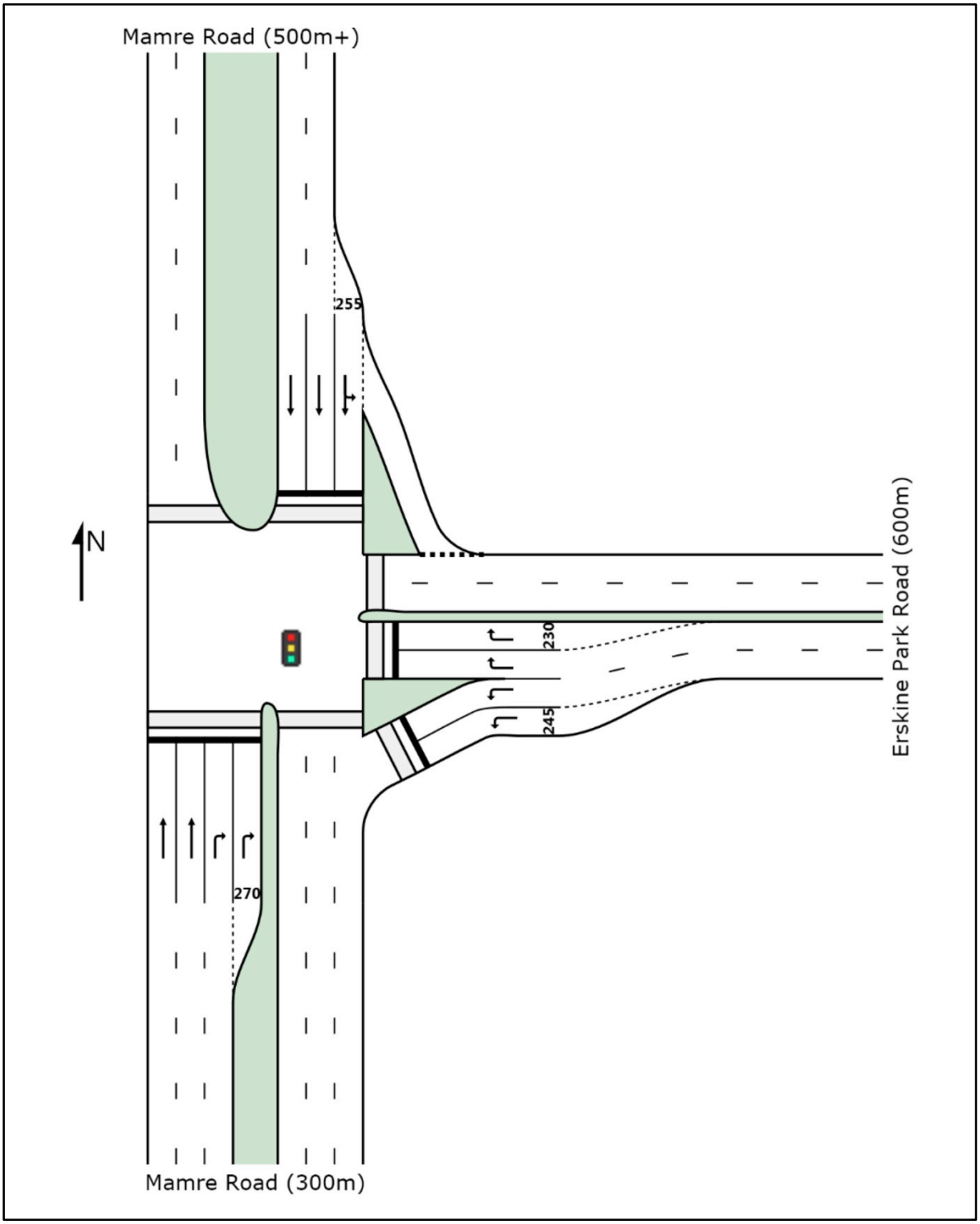


Figure 11: Upgraded Intersection of Mamre Road with Erskine Park Road

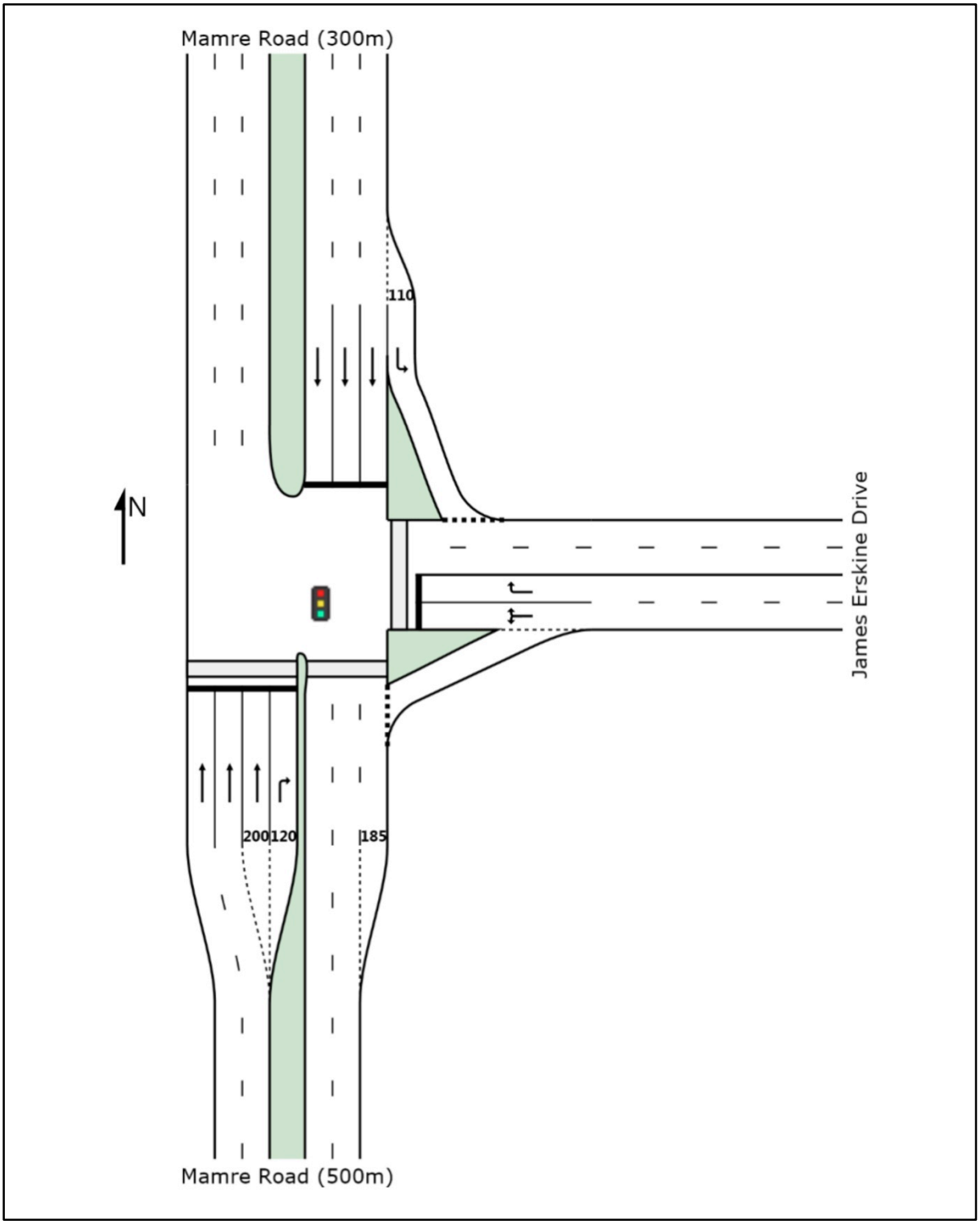


Figure 12: Upgraded Intersection of Mamre Road with James Erskine Drive

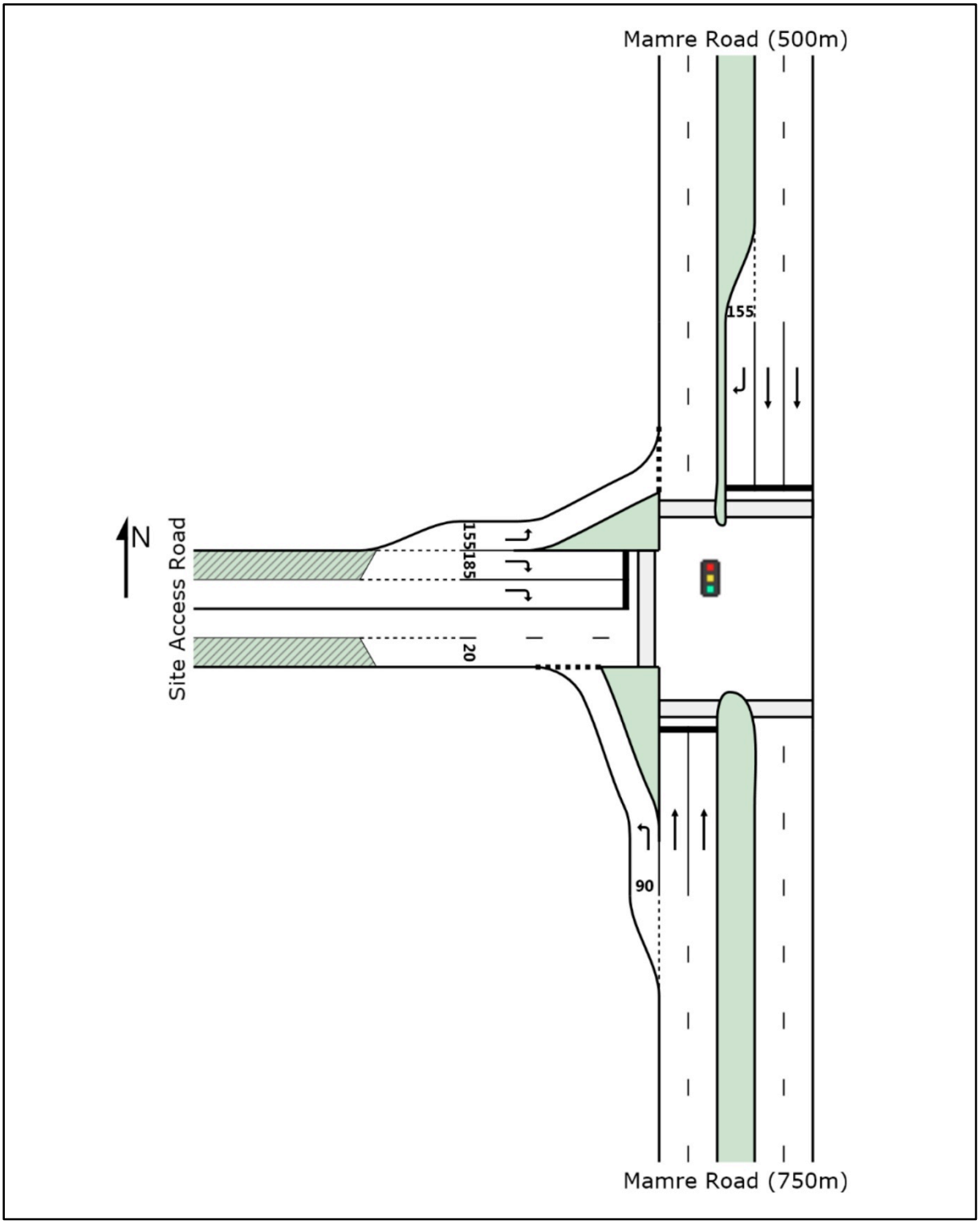


Figure 13: Proposed Intersection of Mamre Road with the Site Access Road (Option 1)

These indicative intersection layouts have been adopted for the following performance testing.

4.6.3 Alternative Option 1 Standard Performance Testing

The performance of the key intersections were analysed using the SIDRA Intersection 6.1 Network modelling program, with the 3 intersections under Alternative Option 1 modelled as a linear coordinated network. In this regard, SIDRA modelling outputs a range of performance measures, in particular:

- Degree of Saturation (DOS) – The DOS is used to measure the performance of intersections where a value of 1.0 represents an intersection at theoretical capacity. As the performance of an intersection approaches DOS of 1.0, queue lengths and delays increase rapidly. It is usual to attempt to keep DOS to less than 0.9, with satisfactory intersection operation generally achieved with a DOS below 0.8.
- Average Vehicle Delay (AVD) – The AVD (or average delay per vehicle in seconds) for intersections also provides a measure of the operational performance of an intersection and is used to determine an intersection's Level of Service (see below). For signalised intersections, the AVD reported relates to the average of all vehicle movements through the intersection. For priority (Give Way, Stop & Roundabout controlled) intersections, the AVD reported is that for the movement with the highest AVD.
- Level of Service (LOS) – This is a comparative measure that provides an indication of the operating performance, based on AVD.

Table 7 provides a recommended baseline for assessment as per the RMS Guide:

Table 7: Level of Service Criteria for Intersections

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	More than 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode or major treatment.

Table 8 presents the results of the SIDRA analysis of the 3 key intersections under the 2026 Baseline + Development traffic scenario. It is noteworthy that all SIDRA modelling (for Alternative Option 1 and Agreed Option 2) has been based on a 140-second cycle time.

Table 8: Alternative Option 1 SIDRA Results

Intersection	Period	Degree of Saturation (DOS)	Average Vehicle Delay (AVD)	Level of Service (LOS)
Mamre Rd x Erskine Park Rd	AM	0.917	38.7	C
	PM	0.892	36.5	C
Mamre Rd x James Erskine Dr	AM	0.735	19.4	B
	PM	0.872	18.6	B
Mamre Rd x Site Access Rd	AM	0.699	16.8	B
	PM	0.806	21.0	B

The SIDRA analysis results indicate that the upgraded network under Alternative Option 1 would satisfactorily accommodate the forecast 2026 Baseline + Development traffic volumes with the intersections operating at LOS C or better. Detailed SIDRA outputs are attached to this report at **Appendix B**, which show that all short lanes (in particular right-turn lanes) have been satisfactorily designed to accommodate forecast 95th-percentile queues.

4.7 Agreed Access Arrangement (Option 2) Network Performance

4.7.1 Agreed Option 2 Future Traffic Volumes

Figure 14 presents the 2026 Baseline + Development traffic volumes under the Agreed Option 2 scenario whereby access to the Precinct is provided via a new 4-way intersection at the existing T-junction signalised intersection of Mamre Road with James Erskine Drive.

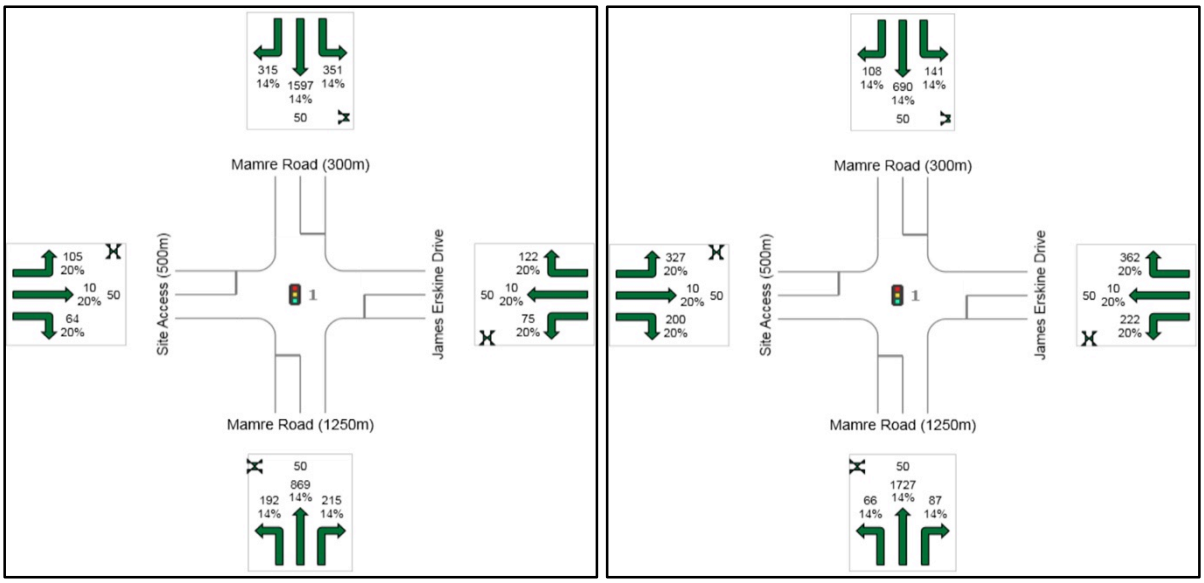


Figure 14: 2026 Baseline + Development Traffic at the Proposed 4-Way Intersection (Option 2)

Traffic volumes at Mamre Road with Erskine Park Road are the same under Agreed Option 2 as they are under Alternative Option 1.

4.7.2 Proposed Signalised Intersection

Based on preliminary SIDRA analysis, **Figure 15** presents an indicative layout for the proposed access intersection under Agreed Option 2. It is noteworthy that the upgrades to the Mamre Road intersection with Erskine Park Road are consistent with those developed under Alternative Option 1.

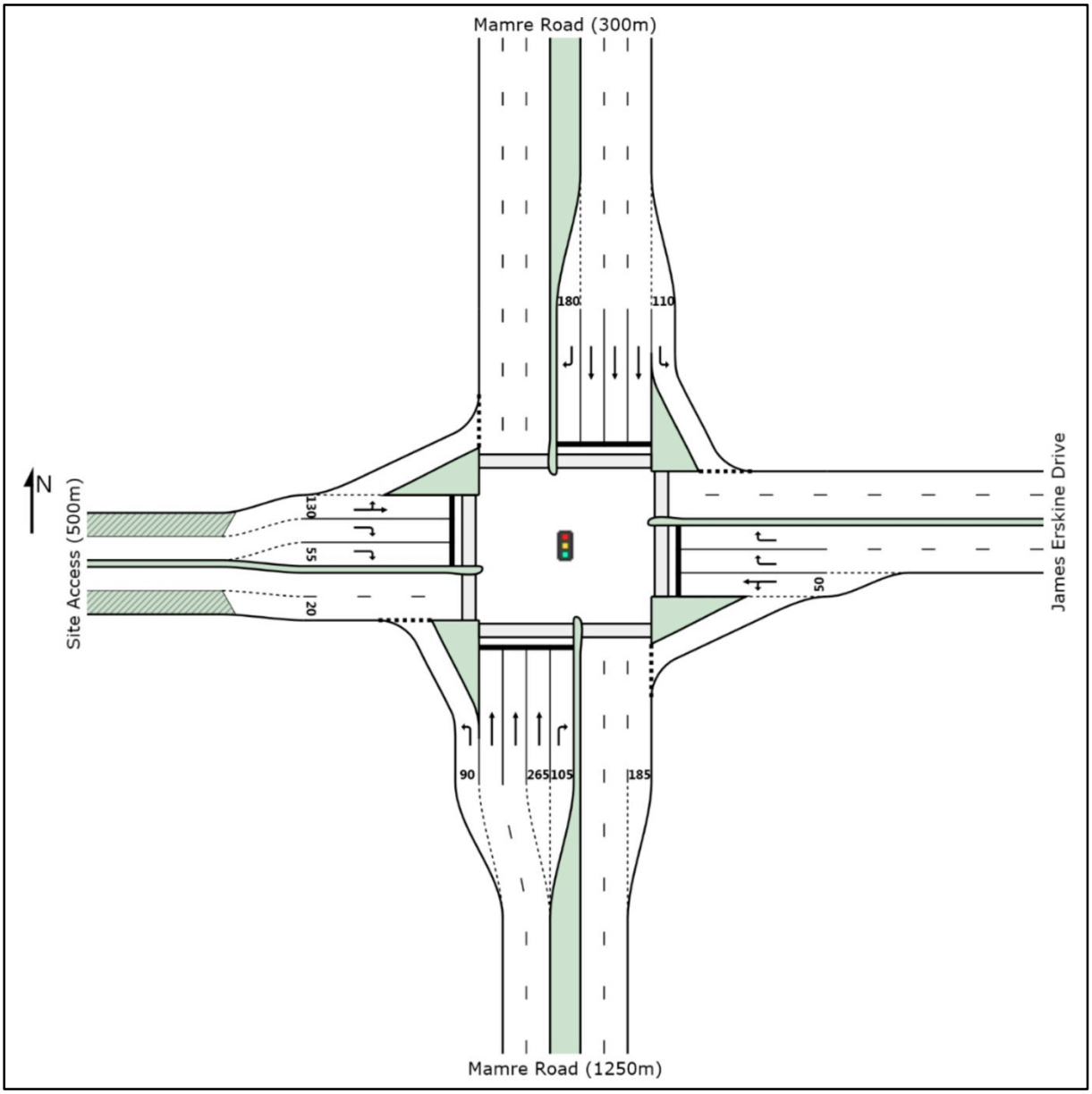


Figure 15: Proposed Intersection of Mamre Rd with James Erskine Dr & the Site Access Rd

4.7.3 Agreed Option 2 Standard Performance Testing

Table 10 presents the results of the SIDRA analysis of the 2 key intersections under the 2026 Baseline + Development traffic scenario.

Table 10: Agreed Option 2 SIDRA Results

Intersection	Period	Degree of Saturation (DOS)	Average Vehicle Delay (AVD)	Level of Service (LOS)
Mamre Rd x Erskine Park Rd	AM	0.917	37.7	C
	PM	0.892	35.1	C
Mamre Rd x James Erskine Dr x Site Access Rd	AM	0.862	40.9	C
	PM	0.976	40.3	C

The SIDRA analysis results indicate that the upgraded network under Agreed Option 2 would satisfactorily accommodate the forecast 2026 Baseline + Development traffic volumes with the intersections operating at LOS C or better. Detailed SIDRA outputs are attached to this report at **Appendix C**, which show that all short lanes (in particular right-turn lanes) have also been satisfactorily designed to accommodate forecast 95th-percentile queues.

4.8 Traffic Analysis Summary

The analysis above demonstrates that under the Agreed Option 2, the local study network – subject to the upgrades and intersection designs proposed – would satisfactorily accommodate the demands of future 2026 background traffic flows plus the forecast development traffic of the Precinct. Accordingly, the conditionally agreed Access Strategy – that proposes primary access to the entire Precinct to be provided via a new western approach to the existing signalised intersection of Mamre Road with James Erskine Drive – is supportable on traffic planning grounds.

Importantly, noting that STG1 is expected to generate about 55% of the traffic volumes forecast for the entire Precinct, it is clear that the agreed Access Strategy would satisfactorily accommodate the traffic demands of the STG1 site, which is the subject of this Planning Proposal.

5 Access & Parking

5.1 Conditionally Agreed Access Strategy

5.1.1 Ultimate Access Arrangement

With reference to the Access Strategy Plan attached at **Appendix D**, the following summarises the access strategy conditionally agreed with RMS for the entire Precinct.

- Primary Access to the Precinct to be provided via a new western connection to the existing signalised T-intersection of Mamre Road with James Erskine Drive (consistent with Agreed Option 2).
- Secondary Access to the Precinct to be provided via a left-in / left-out priority controlled intersection with Mamre Road located approximately 500 metres south of the existing intersection with James Erskine Drive.
- Internal industrial collector link roads connecting:
  - STG1 to STG2 (and the primary signalised access intersection),
  - Mandalong Close (and adjacent Lots directly accessed from Mandalong Close) to the southern developable areas of STG2 (and the primary signalised access intersection).
- Mandalong Close intersection with Mamre Road to be closed to traffic or (as a minimum) reduced to a left-in / left-out priority controlled intersection.

5.1.2 Interim Access Arrangement to STG1 site

The acquisition of third party land is required in order to deliver the Agreed Option 2 primary site access at the existing James Erskine Drive signalised intersection. Accordingly, the Planning Proposal includes rezoning areas within the Precinct with SP2 Infrastructure classification to provide the ability to acquire necessary land to deliver relevant infrastructure, such as the proposed western approach to the James Erskine Drive intersection.

Recognising that the delivery of the primary access – even with the SP2 zoning – could be a timely process, the agreed Access Strategy includes provisions for an interim seagull intersection with Mamre Road that would provide interim access to the Altis site until the primary access (and connection to it) is delivered. Once the Altis site is connected to the primary access, the seagull intersection would be 'downgraded' to a left-in / left-out intersection, consistent with the ultimate access arrangement of the agreed Access Strategy.

As required by RMS, this access would be designed and constructed in accordance with Austroads and RMS guidelines. It is envisaged that this would be the subject of a future State Significant DA for initial development within the Altis site and that DA would be supported by a traffic report that covered both design aspects and network performance aspects of the proposed seagull intersection.

5.2 Internal Road

The internal road will be designed in accordance with the requirements of C10 Transport Access and Parking of the Penrith DCP 2014. In this regard, Table C10.1 states the following for an Industrial Road:

- 20.6 metre road reserve, consisting of:
  - 2 x 3.8 metre verge widths (including a 1.5 metre concrete footway within each verge),
  - 13.0 metre carriageway, comprising:
    - 7.0 metres for travel lanes in both directions,
    - 2 x 3.0 metre parking lanes.

With regard to the Altis site, the internal road will also make provisions for access to STG2 towards the proposed primary access at the James Erskine Drive signalised intersection. The connection road will be constructed as an industrial collector road as per Council's DCP requirements. Subject to the future rezoning of STG2, a proponent will discuss the requirements of the connection with Penrith City Council, DPE and RMS. A similar industrial collector road would connect the primary access to Mandalong Close, in accordance with the agreed Access Strategy.

5.3 Parking Provisions

The following applicable car parking rates are to be adopted for industrial uses, in accordance with Council's DCP 2014:

- 1 space per 75 m^2 of total GFA

The following applicable car parking rates are to be adopted for warehouse uses, in accordance with the RMS Guide:

- 1 space per 300 m^2 of warehouse GFA
- 1 space per 40 m^2 of ancillary office GFA (consistent also with the DCP rate for general office space).

With regard to warehouse development, DCP 2014 – Section C10 prescribes the following minimum parking rate for warehouse developments:

- 1 space per 100 m^2 of total GFA

Application of this rate to the Proposal for the Precinct suggests a requirement for some 5,050 parking spaces across the Precinct to comply with the DCP.

However, there are indications that Council's warehouse parking requirement is potentially in excess of actual parking demands for warehouse development, specifically as a factor of lower warehouse employee numbers. Amongst other factors, significant technological advances have resulted in lower employee densities within warehouse developments, with the 2012 Employment Typology Study for the WSEA for example indicating employment densities of less than 20 employees per hectare across much of western Sydney. As a consequence, many industrial sites now provide car parking in excess of the actual parking requirements of end users.

Accordingly, it is proposed that the warehouse car parking requirements be consistent with the rates outlined in the RMS Guide. The adoption of the RMS minimum rate of 1 space per 300 m^2 is considered appropriate and sustainable, and is consistent with both the RMS Guidelines and State Planning. The proposed minimum rates will enable the required flexibility in the design of future developments whilst still ensuring sufficient parking to accommodate both the current and future parking requirements of tenants. Application of the RMS Guide parking rate would have a requirement for approximately 1,700 parking spaces across the Precinct, which would provide a sufficient quantum of parking.

6 Conclusions

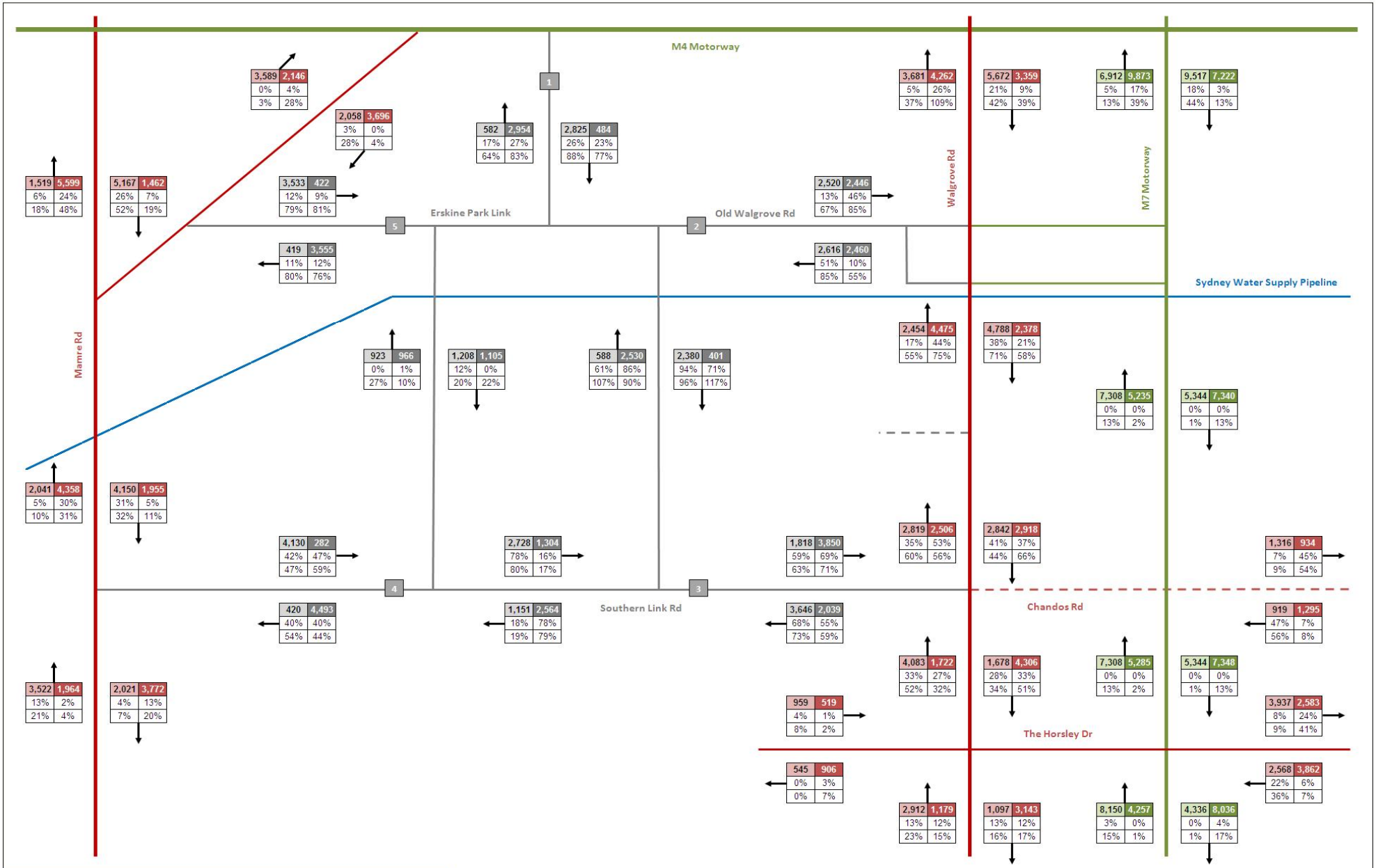
The key findings of this Traffic Impact Assessment are:

- Ason Group has been engaged by Altis Property Partners to prepare a TIA report relating to a Planning Proposal to rezone the subject STG1 site within the Precinct for industrial / warehousing use.
- An Access Strategy has been conditionally agreed with RMS that adopts the Option 2 access arrangement and proposes Primary access to the Precinct to be provided via a new western connection to the existing signalised T-intersection of Mamre Road with James Erskine Drive. Secondary Access to the Precinct would be provided via a left-in / left-out priority controlled intersection with Mamre Road located approximately 500 metres south of the existing intersection with James Erskine Drive.
- Option 2 requires land that is under third party ownership. It is therefore important to note that Altis agreed to proceed with the Planning Proposal on the basis of the preferred RMS Option 2 on the understanding that RMS and/or other authorities would provide the necessary mechanisms to gain control of the third party land so that Altis could (if required) bring forward the construction of the RMS preferred intersection and relevant road connections between the intersection and the Altis site.
- Interim Development of (part of) the Altis site would be accommodated by an interim access to STG1 via a seagull priority controlled intersection with Mamre Road situated in the location of the proposed secondary access. This interim seagull intersection would be downgraded to a left-in / left-out priority controlled intersection in accordance with the agreed Access Strategy following delivery of (and connection to) the proposed 4-way signalised primary access intersection at James Erskine Drive.
- Traffic analysis demonstrates that under the Agreed Option 2 access arrangement, the local study network – subject to the indicative upgrades and intersection designs proposed – would satisfactorily accommodate the demands of future 2026 background traffic flows plus the forecast development traffic of the Precinct.
- Recognising that STG1 is expected to generate about 55% of the traffic volumes forecast for the entire Precinct, it is clear that the agreed Access Strategy would satisfactorily accommodate the traffic demands of the STG1 site, which is the subject of this Planning Proposal.
- The intersection upgrades presented in this report are indicative only and based on the 2031 traffic forecasts presented in the 2011 Aecom Report. The eventual upgrades will be determined by the Mamre Road Upgrade study being undertaken by RMS, which includes updating the strategic EMME/2 modelling that informed the 2031 traffic forecasts in the Aecom Report.

- The internal road will be designed in accordance with the requirements of C10 Transport Access and Parking of the Penrith DCP 2014. The internal road will also make provisions for an access to the future development lands to the north (STG2). This connection will be constructed as an industrial collector road as per Council DCP requirements.
- Car parking for industrial uses and ancillary office uses will be provided in accordance with the rates stipulated in Council's DCP. In response to indications that Council's DCP rate for warehouse car parking is potentially in excess of actual warehouse parking demands, it is proposed that the minimum warehouse parking will be determined at a rate of 1 spaces per 300 m^2 in accordance with the RMS Guide rates.
- These proposed minimum rates would enable the required flexibility in the design of future developments whilst still ensuring sufficient parking to accommodate both the current and future parking requirements of tenants.

It is therefore concluded that the Mamre West Land Investigation Area Planning Proposal is supportable on traffic planning grounds.

Appendix A



6015904 - Southern Link Road Network - Strategic Transport Assessment

2031 Emme/2 Strategic Traffic Modelling

Average 2 Hour AM Peak (07:00 - 09:00) | PM Peak (16:00 - 18:00)

Preferred Option - Dual lane Wallgrove Road to Horsley Drive and Four lane carriageway on The Horsley Drive | Scenarios: 46501 | 45502

Wednesday, 02 March, 2011

Key:

AM Peak Volumes
% South of Pipeline
% All WSEA

PM Peak Volumes
% South of Pipeline
% All WSEA

AECOM

Appendix B

LANE SUMMARY

Site: AM 2026 MR & EPR

Network: AM 2026 Mamre Road Network - Option 1

Mamre Road x Erskine Park Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (300m)															
Lane 1	272	14.0	272	14.0	1303	0.208	100	11.2	LOS A	10.1	79.4	Full	300	0.0	0.0
Lane 2	272	14.0	272	14.0	1303	0.208	100	11.4	LOS A	10.2	80.3	Full	300	0.0	0.0
Lane 3	277	14.0	277	14.0	305	0.908	100	81.4	LOS F	21.0	164.6	Full	300	0.0	0.0
Lane 4	277	14.0	277	14.0	305	0.908	100	81.4	LOS F	21.0	164.6	Short	270	0.0	NA
Approach	1096	14.0	1096	14.0		0.908		46.7	LOS D	21.0	164.6				
East: Erskine Park Road (600m)															
Lane 1	536	14.0	536	14.0	707	0.758	100	44.9	LOS D	31.0	243.2	Short	245	0.0	NA
Lane 2	536	14.0	536	14.0	707	0.758	100	44.9	LOS D	31.0	243.2	Full	600	0.0	0.0
Lane 3	107	14.0	107	14.0	329	0.324	100	60.1	LOS E	6.3	49.5	Full	600	0.0	0.0
Lane 4	107	14.0	107	14.0	329	0.324	100	60.1	LOS E	6.3	49.5	Short	230	0.0	NA
Approach	1285	14.0	1285	14.0		0.758		47.4	LOS D	31.0	243.2				
North: Mamre Road (500m+)															
Lane 1	1130	14.0	1130	14.0	1232	0.917	100	32.5	LOS C	47.1	369.2	Short	255	0.0	NA
Lane 2	595	14.0	595	14.0	903	0.659	72[5]	27.7	LOS B	29.9	234.4	Full	500	0.0	0.0
Lane 3	595	14.0	595	14.0	903	0.659	72[5]	27.7	LOS B	29.9	234.4	Full	500	0.0	0.0
Approach	2321	14.0	2321	14.0		0.917		30.0	LOS C	47.1	369.2				
Intersection	4702	14.0	4702	14.0		0.917		38.7	LOS C	47.1	369.2				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

5 Lane under-utilisation found by the program

LANE SUMMARY

Site: PM 2026 MR & EPR

Network: PM 2026 Mamre Road Network - Option 1

Mamre Road x Erskine Park Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (300m)															
Lane 1	650	14.0	650	14.0	1161	0.560	100	4.4	LOS A	8.3	64.7	Full	300	0.0	0.0
Lane 2	650	14.0	650	14.0	1161	0.560	100	7.3	LOS A	12.8	100.0	Full	300	0.0	0.0
Lane 3	557	14.0	557	14.0	682	0.817	100	50.0	LOS D	35.0	274.4	Full	300	0.0	0.0
Lane 4	558	14.0	557	14.0	682	0.817	100	50.0	LOS D	35.0	274.4	Short	270	0.0	NA
Approach	2416	14.0	2416	14.0		0.817		26.2	LOS B	35.0	274.4				
East: Erskine Park Road (600m)															
Lane 1	240	14.0	240	14.0	1219	0.197	100	14.5	LOS A	5.3	41.5	Short	245	0.0	NA
Lane 2	240	14.0	240	14.0	1219	0.197	100	14.5	LOS A	5.3	41.5	Full	600	0.0	0.0
Lane 3	413	14.0	413	14.0	463	0.892	100	73.6	LOS F	31.3	245.4	Full	600	0.0	0.0
Lane 4	413	14.0	413	14.0	463	0.892	100	73.6	LOS F	31.3	245.4	Short	230	0.0	NA
Approach	1305	14.0	1305	14.0		0.892		51.9	LOS D	31.3	245.4				
North: Mamre Road (500m+)															
Lane 1	433	14.0	433	14.0	537	0.806	100	27.2	LOS B	17.9	140.3	Short	255	0.0	NA
Lane 2	230	14.0	230	14.0	361	0.637	79[5]	55.8	LOS D	14.5	114.0	Full	500	0.0	0.0
Lane 3	230	14.0	230	14.0	361	0.637	79[5]	55.8	LOS D	14.5	114.0	Full	500	0.0	0.0
Approach	893	14.0	893	14.0		0.806		41.9	LOS C	17.9	140.3				
Intersection	4614	14.0	4614	14.0		0.892		36.5	LOS C	35.0	274.4				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

5 Lane under-utilisation found by the program

LANE SUMMARY

Site: AM 2026 MR & JED

Network: AM 2026 Mamre Road Network - Option 1

Mamre Road x James Erskine Drive
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (500m)															
Lane 1	325	14.0	325	14.0	1316	0.247	100	4.8	LOS A	4.6	36.4	Full	500	0.0	0.0
Lane 2	325	14.0	325	14.0	1316	0.247	100	4.3	LOS A	4.2	32.7	Full	500	0.0	0.0
Lane 3	325	14.0	325	14.0	1316	0.247	100	4.3	LOS A	4.2	32.7	Short	200	0.0	NA
Lane 4	215	14.0	215	14.0	292	0.735	100	50.3	LOS D	12.7	99.3	Short	120	0.0	NA
Approach	1189	14.0	1189	14.0		0.735		12.7	LOS A	12.7	99.3				
East: James Erskine Drive															
Lane 1	107	20.0	107	20.0	364	0.294	100	30.0	LOS C	3.2	26.5	Full	170	0.0	0.0
Lane 2	90	20.0	90	20.0	305	0.294	100	59.2	LOS E	5.3	43.7	Full	170	0.0	0.0
Approach	197	20.0	197	20.0		0.294		43.3	LOS D	5.3	43.7				
North: Mamre Road (300m)															
Lane 1	351	14.0	351	14.0	1304	0.269	100	10.2	LOS A	5.7	44.9	Short	110	0.0	NA
Lane 2	551	14.0	551	14.0	752[1]	0.733	100	40.8	LOS C	33.4	261.8	Full	300	0.0	0.0
Lane 3	680	14.0	680	14.0	929	0.733	100	27.6	LOS B	35.4	277.7	Full	300	0.0	0.0
Lane 4	680	14.0	680	14.0	929	0.733	100	3.4	LOS A	8.8	68.7	Full	300	0.0	0.0
Approach	2263	14.0	2263	14.0		0.733		20.9	LOS B	35.4	277.7				
Intersection	3649	14.3	3649	14.3		0.735		19.4	LOS B	35.4	277.7				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the adjacent full-length lanes. Some upstream delays at entry to short lanes are not included.

PHASING SUMMARY

Site: AM 2026 MR & JED

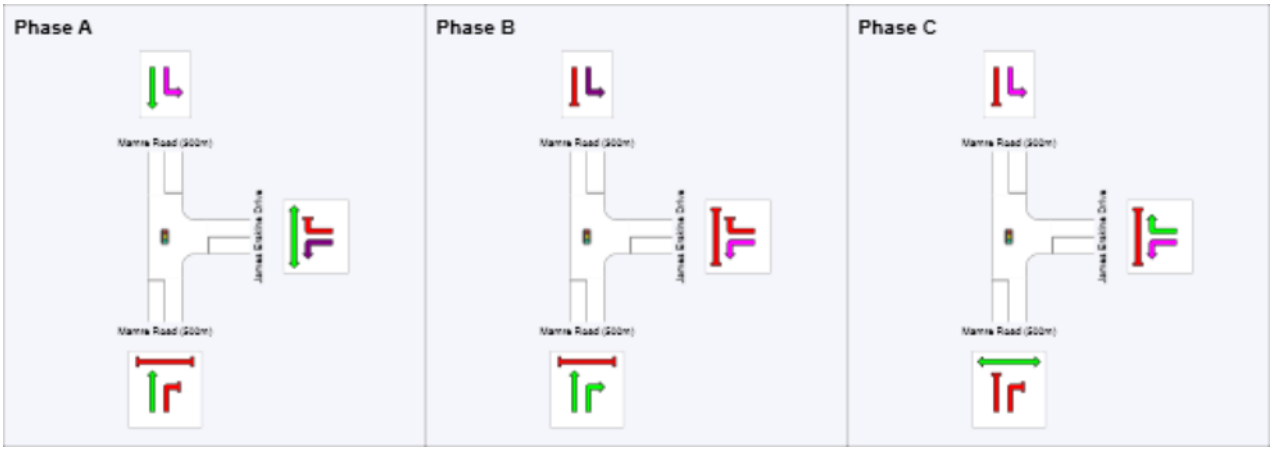
Network: AM 2026 Mamre Road Network - Option 1

Mamre Road x James Erskine Drive
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Phase times determined by the program
Sequence: Leading Right Turn
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Reference Phase	Yes	No	No
Phase Change Time (sec)	14	92	122
Green Time (sec)	72	24	26
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	78	30	32
Phase Split	56 %	21 %	23 %



LANE SUMMARY

Site: PM 2026 MR & JED

Network: PM 2026 Mamre Road Network - Option 1

Mamre Road x James Erskine Drive
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (500m)															
Lane 1	685	14.0	685	14.0	1316	0.520	100	6.2	LOS A	13.5	106.2	Full	500	0.0	0.0
Lane 2	685	14.0	685	14.0	1316	0.520	100	6.3	LOS A	13.6	106.7	Full	500	0.0	0.0
Lane 3	685	14.0	685	14.0	1316	0.520	100	6.3	LOS A	13.6	106.7	Short	200	0.0	NA
Lane 4	87	14.0	87	14.0	305	0.286	100	69.7	LOS E	5.8	45.2	Short	120	0.0	NA
Approach	2141	14.0	2141	14.0		0.520		8.8	LOS A	13.6	106.7				
East: James Erskine Drive															
Lane 1	318	20.0	318	20.0	364	0.872	100	57.5	LOS E	20.1	165.2	Full	170	0.0	2.4
Lane 2	266	20.0	266	20.0	305	0.872	100	77.0	LOS F	20.0	164.2	Full	170	0.0	1.9
Approach	584	20.0	584	20.0		0.872		66.4	LOS E	20.1	165.2				
North: Mamre Road (300m)															
Lane 1	141	14.0	141	14.0	1385	0.102	100	8.3	LOS A	0.9	7.1	Short	110	0.0	NA
Lane 2	266	14.0	266	14.0	916	0.290	100	21.0	LOS B	9.3	72.7	Full	300	0.0	0.0
Lane 3	266	14.0	266	14.0	916	0.290	100	13.1	LOS A	6.0	47.3	Full	300	0.0	0.0
Lane 4	266	14.0	266	14.0	916	0.290	100	1.5	LOS A	0.9	7.0	Full	300	0.0	0.0
Approach	939	14.0	939	14.0		0.290		11.4	LOS A	9.3	72.7				
Intersection	3664	15.0	3664	15.0		0.872		18.6	LOS B	20.1	165.2				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

PHASING SUMMARY

Site: PM 2026 MR & JED

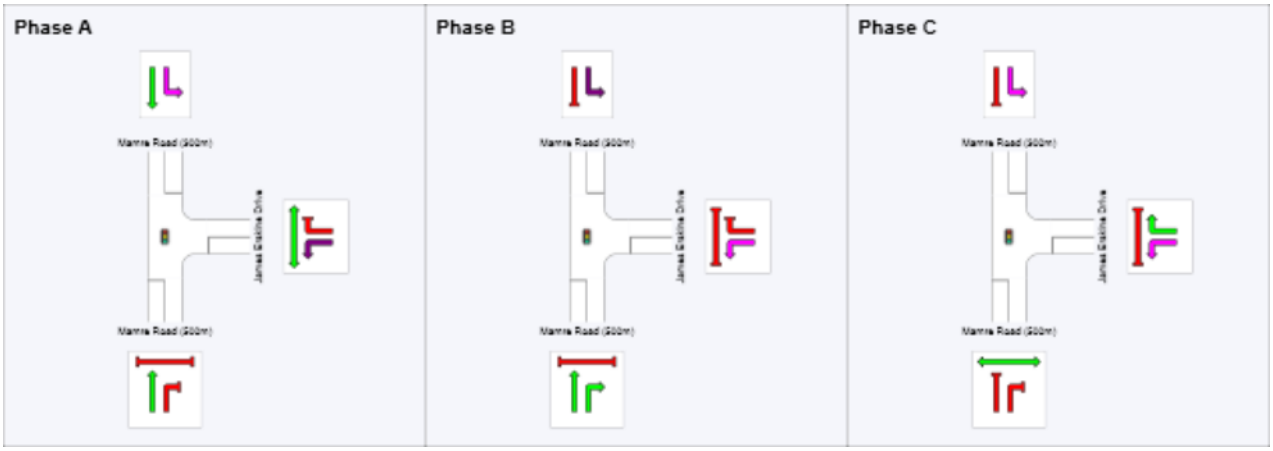
Network: PM 2026 Mamre Road Network - Option 1

Mamre Road x James Erskine Drive
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Phase times determined by the program
Sequence: Leading Right Turn
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Reference Phase	Yes	No	No
Phase Change Time (sec)	126	63	94
Green Time (sec)	71	25	26
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	77	31	32
Phase Split	55 %	22 %	23 %



LANE SUMMARY

Site: AM 2026 MR & SA

Network: AM 2026 Mamre Road Network - Option 1

Mamre Road x Site Access Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (750m)															
Lane 1	192	14.0	192	14.0	1197	0.160	100	11.0	LOS A	3.0	23.2	Short	90	0.0	NA
Lane 2	514	14.0	514	14.0	744[1]	0.690	100	30.6	LOS C	26.3	206.1	Full	750	0.0	0.0
Lane 3	570	14.0	570	14.0	826	0.690	100	32.0	LOS C	30.5	239.1	Full	750	0.0	0.0
Approach	1276	14.0	1276	14.0		0.690		28.3	LOS B	30.5	239.1				
North: Mamre Road (500m)															
Lane 1	836	14.0	836	14.0	1380	0.606	100	0.7	LOS A	2.7	21.5	Full	500	0.0	0.0
Lane 2	836	14.0	836	14.0	1380	0.606	100	0.7	LOS A	2.7	21.5	Full	500	0.0	0.0
Lane 3	315	14.0	315	14.0	451	0.699	100	48.2	LOS D	18.0	140.9	Short	155	0.0	NA
Approach	1987	14.0	1987	14.0		0.699		8.3	LOS A	18.0	140.9				
West: Site Access Road															
Lane 1	105	20.0	105	20.0	775	0.135	100	12.0	LOS A	2.3	19.1	Short	155	0.0	NA
Lane 2	32	20.0	32	20.0	246	0.130	100	60.8	LOS E	1.9	15.7	Short (P)	185	0.0	NA
Lane 3	32	20.0	32	20.0	246	0.130	100	60.8	LOS E	1.9	15.7	Full	500	0.0	0.0
Approach	169	20.0	169	20.0		0.135		30.5	LOS C	2.3	19.1				
Intersection	3432	14.3	3432	14.3		0.699		16.8	LOS B	30.5	239.1				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the adjacent full-length lanes. Some upstream delays at entry to short lanes are not included.

PHASING SUMMARY

Site: AM 2026 MR & SA

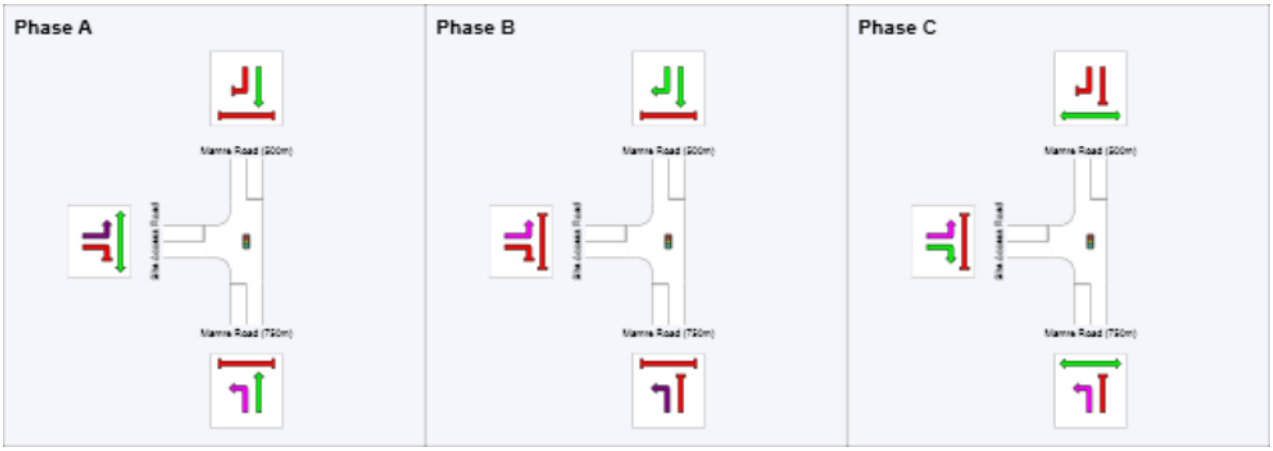
Network: AM 2026 Mamre Road Network - Option 1

Mamre Road x Site Access Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Reference Phase	Yes	No	No
Phase Change Time (sec)	34	104	7
Green Time (sec)	64	37	21
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	70	43	27
Phase Split	50 %	31 %	19 %



LANE SUMMARY

Site: PM 2026 MR & SA

Network: PM 2026 Mamre Road Network - Option 1

Mamre Road x Site Access Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (750m)															
Lane 1	66	14.0	66	14.0	1418	0.047	100	8.5	LOS A	0.5	3.7	Short	90	0.0	NA
Lane 2	888	14.0	888	14.0	1113[1]	0.798	100	18.5	LOS B	41.8	327.6	Full	750	0.0	0.0
Lane 3	926	14.0	926	14.0	1161	0.798	100	19.3	LOS B	45.5	356.6	Full	750	0.0	0.0
Approach	1880	14.0	1880	14.0		0.798		18.6	LOS B	45.5	356.6				
North: Mamre Road (500m)															
Lane 1	456	14.0	456	14.0	1380	0.330	100	5.0	LOS A	8.9	69.4	Full	500	0.0	0.0
Lane 2	456	14.0	456	14.0	1380	0.330	100	3.1	LOS A	5.0	39.0	Full	500	0.0	0.0
Lane 3	108	14.0	108	14.0	134	0.806	100	85.9	LOS F	7.9	61.9	Short	155	0.0	NA
Approach	1020	14.0	1020	14.0		0.806		12.7	LOS A	8.9	69.4				
West: Site Access Road															
Lane 1	327	20.0	327	20.0	480	0.682	100	35.0	LOS C	18.8	154.5	Short	155	0.0	NA
Lane 2	100	20.0	100	20.0	246	0.406	100	63.8	LOS E	6.3	51.7	Short (P)	185	0.0	NA
Lane 3	100	20.0	100	20.0	246	0.406	100	63.8	LOS E	6.3	51.7	Full	500	0.0	0.0
Approach	527	20.0	527	20.0		0.682		46.0	LOS D	18.8	154.5				
Intersection	3427	14.9	3427	14.9		0.806		21.0	LOS B	45.5	356.6				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the adjacent full-length lanes. Some upstream delays at entry to short lanes are not included.

PHASING SUMMARY

Site: PM 2026 MR & SA

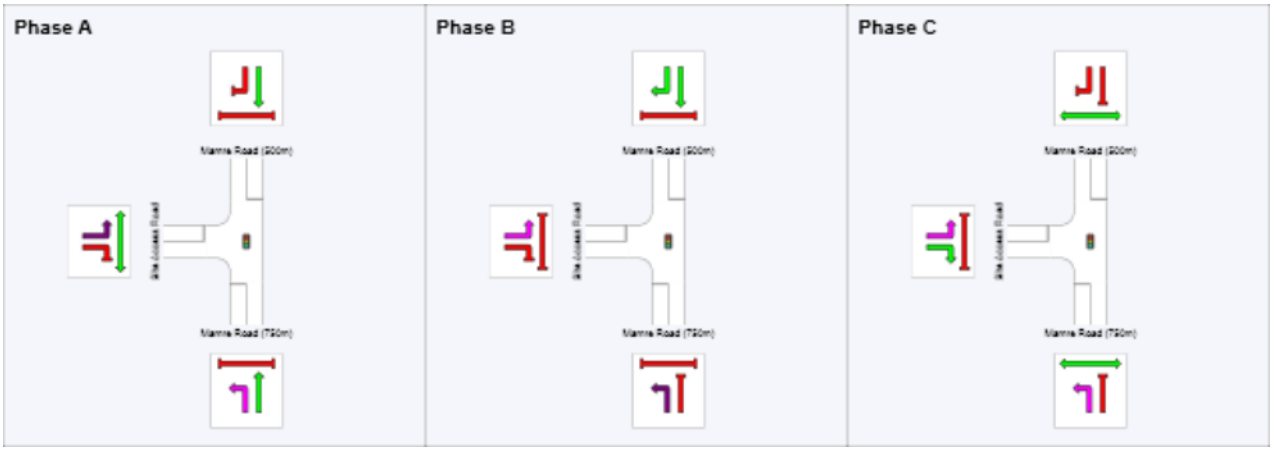
Network: PM 2026 Mamre Road Network - Option 1

Mamre Road x Site Access Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Reference Phase	Yes	No	No
Phase Change Time (sec)	106	62	79
Green Time (sec)	90	11	21
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	96	17	27
Phase Split	69 %	12 %	19 %



Appendix C

LANE SUMMARY

Site: (RMS) AM 2026 MR & EPR

Network: AM 2026 Mamre Road Network - Option 2

Mamre Road x Erskine Park Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (300m)															
Lane 1	272	14.0	272	14.0	1303	0.208	100	3.1	LOS A	2.5	19.2	Full	300	0.0	0.0
Lane 2	272	14.0	272	14.0	1303	0.208	100	1.4	LOS A	1.2	9.2	Full	300	0.0	0.0
Lane 3	277	14.0	277	14.0	305	0.908	100	81.4	LOS F	21.1	165.3	Full	300	0.0	0.0
Lane 4	277	14.0	277	14.0	305	0.908	100	81.4	LOS F	21.1	165.3	Short	270	0.0	NA
Approach	1096	14.0	1096	14.0		0.908		42.2	LOS C	21.1	165.3				
East: Erskine Park Road (600m)															
Lane 1	539	14.0	539	14.0	707	0.762	100	45.0	LOS D	31.2	244.9	Short	245	0.0	NA
Lane 2	533	14.0	533	14.0	700	0.762	100	45.0	LOS D	31.0	242.7	Full	600	-0.9 N3	0.0
Lane 3	107	14.0	107	14.0	329	0.324	100	60.1	LOS E	6.3	49.5	Full	600	0.0	0.0
Lane 4	107	14.0	107	14.0	329	0.324	100	60.1	LOS E	6.3	49.5	Short	230	0.0	NA
Approach	1285	14.0	1285	14.0		0.762		47.5	LOS D	31.2	244.9				
North: Mamre Road (500m+)															
Lane 1	1130	14.0	1130	14.0	1232	0.917	100	32.7	LOS C	47.3	371.1	Short	255	0.0	NA
Lane 2	593	14.0	593	14.0	894	0.663	72 5	27.8	LOS B	29.8	233.9	Full	500	-0.9 N3	0.0
Lane 3	598	14.0	598	14.0	903	0.663	72 5	27.8	LOS B	30.1	236.1	Full	500	0.0	0.0
Approach	2321	14.0	2321	14.0		0.917		30.2	LOS C	47.3	371.1				
Intersection	4702	14.0	4702	14.0		0.917		37.7	LOS C	47.3	371.1				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

5 Lane under-utilisation found by the program
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

LANE SUMMARY

Site: (RMS) PM 2026 MR & EPR

Network: PM 2026 Mamre Road Network - Option 2

Mamre Road x Erskine Park Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (300m)															
Lane 1	650	14.0	650	14.0	1161	0.560	100	7.0	LOS A	12.4	97.0	Full	300	0.0	0.0
Lane 2	650	14.0	650	14.0	1161	0.560	100	2.9	LOS A	5.6	44.1	Full	300	0.0	0.0
Lane 3	558	14.0	558	14.0	682	0.817	100	45.0	LOS D	32.2	252.4	Full	300	0.0	0.0
Lane 4	558	14.0	557	14.0	682	0.817	100	45.0	LOS D	32.2	252.4	Short	270	0.0	NA
Approach	2416	14.0	2416	14.0		0.817		23.4	LOS B	32.2	252.4				
East: Erskine Park Road (600m)															
Lane 1	240	14.0	240	14.0	1219	0.197	100	14.5	LOS A	5.3	41.5	Short	245	0.0	NA
Lane 2	240	14.0	240	14.0	1219	0.197	100	14.5	LOS A	5.3	41.5	Full	600	0.0	0.0
Lane 3	413	14.0	413	14.0	463	0.892	100	73.6	LOS F	31.3	245.4	Full	600	0.0	0.0
Lane 4	413	14.0	413	14.0	463	0.892	100	73.6	LOS F	31.3	245.4	Short	230	0.0	NA
Approach	1305	14.0	1305	14.0		0.892		51.9	LOS D	31.3	245.4				
North: Mamre Road (500m+)															
Lane 1	433	14.0	433	14.0	532	0.814	100	27.2	LOS B	17.6	138.1	Short	255	0.0	NA
Lane 2	230	14.0	230	14.0	361	0.637	78[5]	55.8	LOS D	14.5	114.0	Full	500	0.0	0.0
Lane 3	230	14.0	230	14.0	361	0.637	78[5]	55.8	LOS D	14.5	114.0	Full	500	0.0	0.0
Approach	893	14.0	893	14.0		0.814		41.9	LOS C	17.6	138.1				
Intersection	4614	14.0	4614	14.0		0.892		35.1	LOS C	32.2	252.4				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

5 Lane under-utilisation found by the program

LANE SUMMARY

Site: (RMS) AM 2026 MR & JED & SA

Network: AM 2026 Mamre Road Network - Option 2

Mamre Road x James Erskine Drive x Site Access Rd
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (1250m)															
Lane 1	192	14.0	192	14.0	1171	0.164	100	10.0	LOS A	2.5	19.7	Short	90	0.0	NA
Lane 2	290	14.0	290	14.0	671	0.432	100	35.1	LOS C	14.7	114.9	Full	1250	0.0	0.0
Lane 3	290	14.0	290	14.0	671	0.432	100	35.1	LOS C	14.7	114.9	Full	1250	0.0	0.0
Lane 4	290	14.0	290	14.0	671	0.432	100	35.1	LOS C	14.7	114.9	Short	265	0.0	NA
Lane 5	215	14.0	215	14.0	366	0.588	100	61.2	LOS E	13.3	104.5	Short	105	0.0	NA
Approach	1276	14.0	1276	14.0		0.588		35.7	LOS C	14.7	114.9				
East: James Erskine Drive															
Lane 1	85	20.0	85	20.0	607	0.140	100	26.8	LOS B	3.2	26.4	Short	50	0.0	NA
Lane 2	61	20.0	61	20.0	94	0.650	100	81.0	LOS F	4.4	36.1	Full	170	0.0	0.0
Lane 3	61	20.0	61	20.0	94	0.650	100	81.0	LOS F	4.4	36.1	Full	170	0.0	0.0
Approach	207	20.0	207	20.0		0.650		58.7	LOS E	4.4	36.1				
North: Mamre Road (300m)															
Lane 1	351	14.0	351	14.0	1310	0.268	100	7.7	LOS A	0.7	5.1	Short	110	0.0	NA
Lane 2	457	14.0	457	14.0	538[1]	0.850	100	59.7	LOS E	31.7	248.3	Full	300	0.0	0.0
Lane 3	570	14.0	570	14.0	671	0.850	100	47.5	LOS D	36.6	286.8	Full	300	0.0	0.9
Lane 4	570	14.0	570	14.0	671	0.850	100	23.3	LOS B	29.9	234.2	Full	300	0.0	0.0
Lane 5	315	14.0	315	14.0	366	0.862	100	80.3	LOS F	22.7	177.8	Short	180	0.0	NA
Approach	2263	14.0	2263	14.0		0.862		42.3	LOS C	36.6	286.8				
West: Site Access (500m)															
Lane 1	115	20.0	115	20.0	719	0.160	100	17.2	LOS B	2.9	23.7	Short (P)	130	0.0	NA
Lane 2	32	20.0	32	20.0	94	0.341	100	78.3	LOS F	2.2	18.3	Full	500	0.0	0.0
Lane 3	32	20.0	32	20.0	94	0.341	100	78.3	LOS F	2.2	18.3	Short	55	0.0	NA
Approach	179	20.0	179	20.0		0.341		39.0	LOS C	2.9	23.7				
Intersection	3925	14.6	3925	14.6		0.862		40.9	LOS C	36.6	286.8				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the adjacent full-length lanes. Some upstream delays at entry to short lanes are not included.

PHASING SUMMARY

Site: (RMS) AM 2026 MR & JED & SA

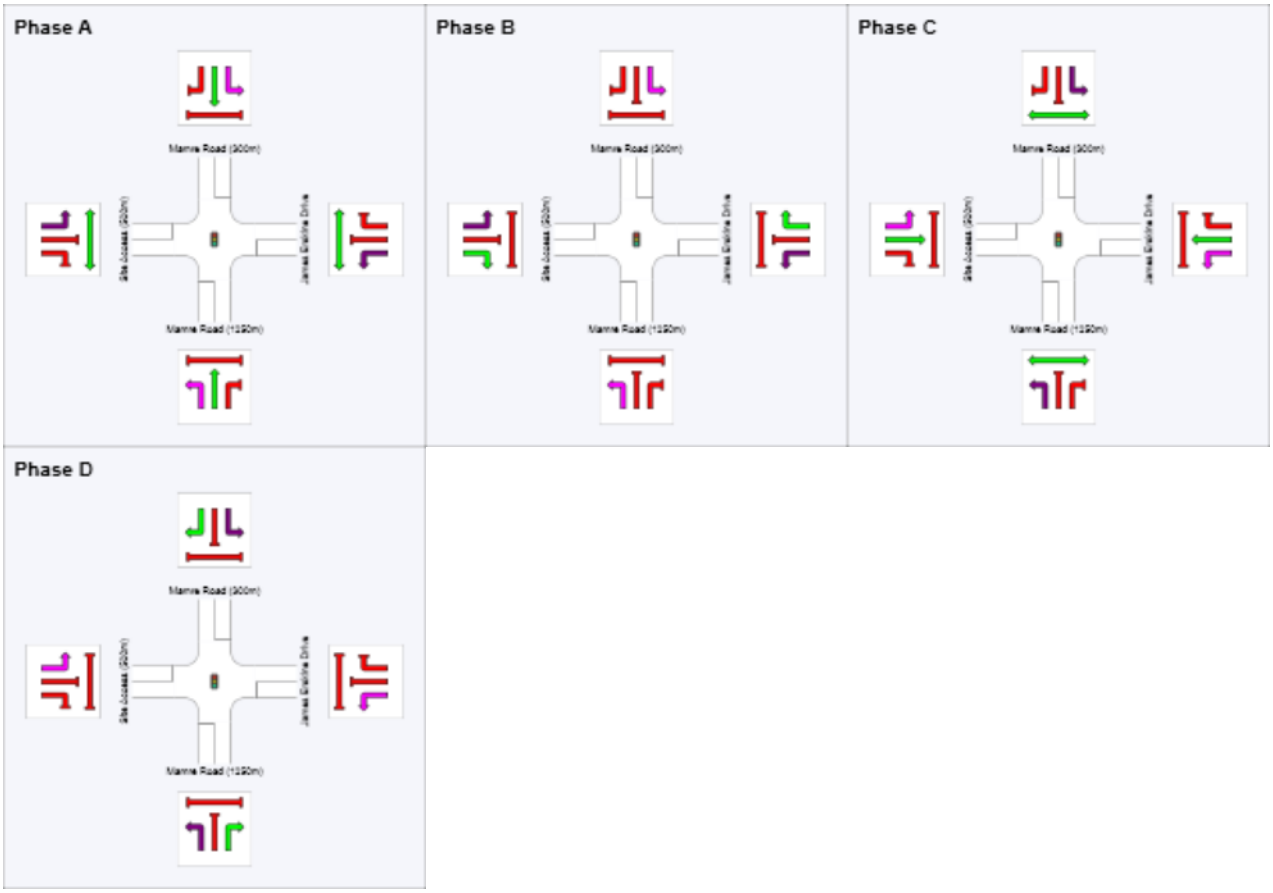
Network: AM 2026 Mamre Road Network - Option 2

Mamre Road x James Erskine Drive x Site Access Rd
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C, D
Output Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Reference Phase	Yes	No	No	No
Phase Change Time (sec)	14	72	86	118
Green Time (sec)	52	8	26	30
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	58	14	32	36
Phase Split	41 %	10 %	23 %	26 %



Normal Movement
Slip/Bypass-Lane Movement
Stopped Movement
Other Movement Class Running
Mixed Running & Stopped Movement Classes
Undetected Movement
Permitted/Opposed
Opposed Slip/Bypass-Lane
Turn On Red
Other Movement Class Stopped
Phase Transition Applied

LANE SUMMARY

Site: (RMS) PM 2026 MR & JED & SA

Network: PM 2026 Mamre Road Network - Option 2

Mamre Road x James Erskine Drive x Site Access Rd
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mamre Road (1250m)															
Lane 1	66	14.0	66	14.0	1086	0.061	100	16.9	LOS B	1.7	13.1	Short	90	0.0	NA
Lane 2	573	14.0	573	14.0	750[1]	0.764	100	34.8	LOS C	32.0	250.9	Full	1250	0.0	0.0
Lane 3	601	14.0	601	14.0	787	0.764	100	35.6	LOS C	34.4	269.4	Full	1250	0.0	0.0
Lane 4	553	14.0	553	14.0	724[1]	0.764	100	34.2	LOS C	30.4	238.1	Short	265	0.0	NA
Lane 5	87	14.0	87	14.0	146	0.595	100	77.0	LOS F	6.0	47.0	Short	105	0.0	NA
Approach	1880	14.0	1880	14.0		0.764		36.2	LOS C	34.4	269.4				
East: James Erskine Drive															
Lane 1	232	20.0	232	20.0	830	0.280	100	13.4	LOS A	4.3	35.0	Short	50	0.0	NA
Lane 2	167	20.0	167	20.0	172[1]	0.976	100	108.0	LOS F	14.8	121.6	Full	170	0.0	0.0
Lane 3	195	20.0	195	20.0	199	0.976	100	107.6	LOS F	17.4	142.5	Full	170	0.0	0.0
Approach	594	20.0	594	20.0		0.976		70.9	LOS F	17.4	142.5				
North: Mamre Road (300m)															
Lane 1	141	14.0	141	14.0	1104	0.128	100	16.0	LOS B	3.0	23.3	Short	110	0.0	NA
Lane 2	230	14.0	230	14.0	787	0.292	100	30.1	LOS C	11.5	90.3	Full	300	0.0	0.0
Lane 3	230	14.0	230	14.0	787	0.292	100	23.1	LOS B	7.8	61.2	Full	300	0.0	0.0
Lane 4	230	14.0	230	14.0	787	0.292	100	6.4	LOS A	2.8	21.7	Full	300	0.0	0.0
Lane 5	108	14.0	108	14.0	146	0.738	100	84.0	LOS F	7.8	61.0	Short	180	0.0	NA
Approach	939	14.0	939	14.0		0.738		26.7	LOS B	11.5	90.3				
West: Site Access (500m)															
Lane 1	337	20.0	337	20.0	687	0.490	100	30.0	LOS C	15.3	125.8	Short (P)	130	0.0	NA
Lane 2	100	20.0	100	20.0	199	0.501	100	69.6	LOS E	6.6	54.0	Full	500	0.0	0.0
Lane 3	100	20.0	100	20.0	199	0.501	100	69.6	LOS E	6.6	54.0	Short	55	0.0	NA
Approach	537	20.0	537	20.0		0.501		44.8	LOS D	15.3	125.8				
Intersection	3950	15.7	3950	15.7		0.976		40.3	LOS C	34.4	269.4				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.
The results of iterative calculations indicate a somewhat unstable solution. See the Diagnostics section in the Detailed Output report.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the adjacent full-length lanes. Some upstream delays at entry to short lanes are not included.

PHASING SUMMARY

Site: (RMS) PM 2026 MR & JED & SA

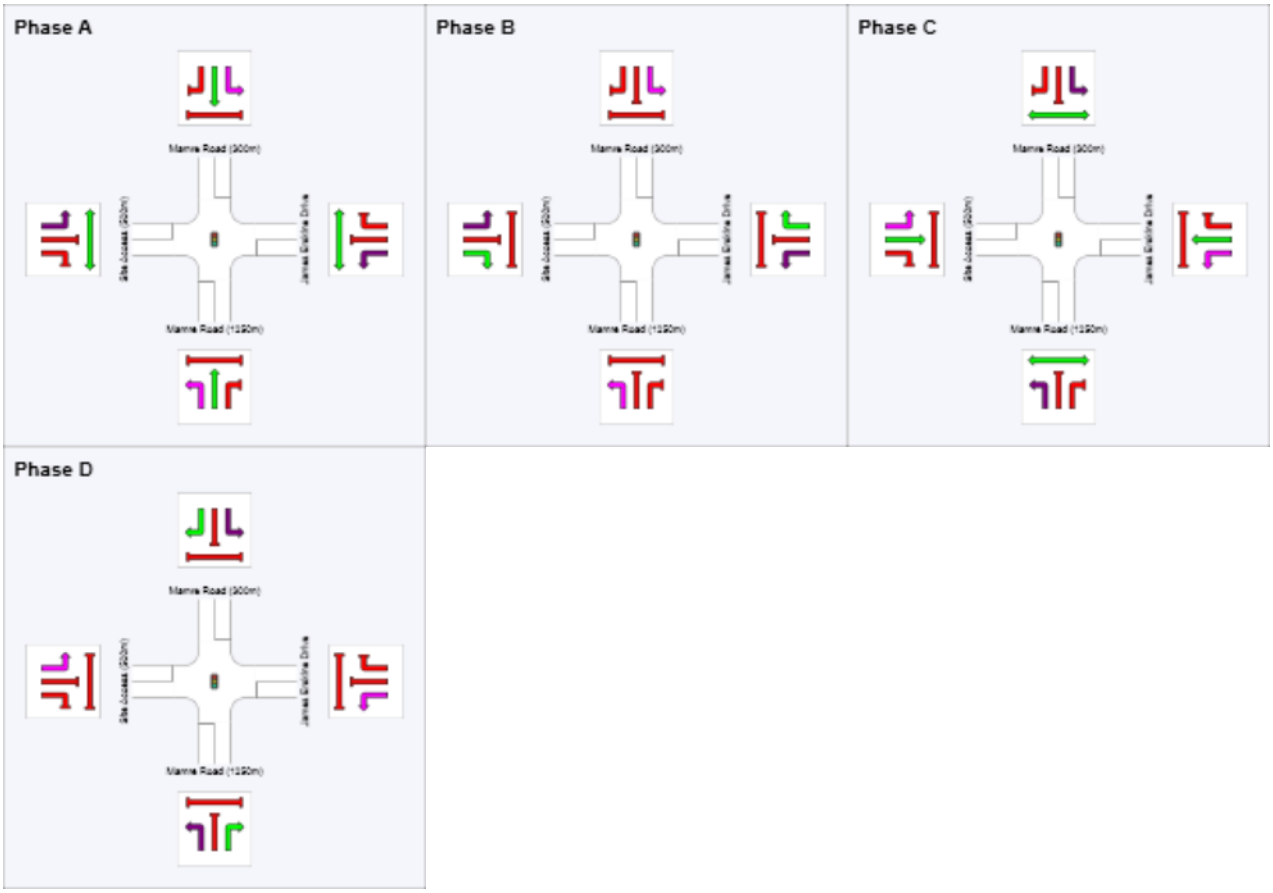
Network: PM 2026 Mamre Road Network - Option 2

Mamre Road x James Erskine Drive x Site Access Rd
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Network Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C, D
Output Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Reference Phase	Yes	No	No	No
Phase Change Time (sec)	126	53	76	108
Green Time (sec)	61	17	26	12
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	67	23	32	18
Phase Split	48 %	16 %	23 %	13 %



Normal Movement
Slip/Bypass-Lane Movement
Stopped Movement
Other Movement Class Running
Mixed Running & Stopped Movement Classes
Undetected Movement
Permitted/Opposed
Opposed Slip/Bypass-Lane
Turn On Red
Other Movement Class Stopped
Phase Transition Applied

The results of iterative calculations indicate a somewhat unstable solution. See the Diagnostics section in the Detailed Output report.

Appendix D

LEGEND

- PRECINCT BOUNDARY
- WATERWAYS AND RIPARIAN CORRIDORS
- SOUTH CREEK
- EXISTING DEVELOPMENT
- SITE BOUNDARY
- POTENTIAL STAGE 2 AREA
- RESIDENTIAL ALLOTMENTS
- EXISTING TRAFFIC LIGHTS
- INTERIM SEAGULL INTERSECTION

DEVELOPMENT COMPONENTS	Phase 1	Phase 2	Phase 3	Ultimate Arrangement
STG1	Partial Development	Full Development	Full Development	Full Development
STG2 South	-	-	Full Development	Full Development
STG2 Mandalong Close	-	-	-	Full Development
Mamre Road Upgrade	-	-	-	Completed
INFRASTRUCTURE REQUIREMENTS				
Mandalong Close Intersection	Existing	Existing	Existing	Closed, or Left-in / Left-out
Internal Link - STG2 Mandalong Close to STG2 South	Land 'Protected' by DCP for future provision	Land 'Protected' by DCP for future provision	Land 'Protected' by DCP for future provision	Constructed
James Erskine Drive Intersection	Existing	4-Way Signalised Intersection	4-Way Signalised Intersection	4-Way Signalised Intersection
Internal Link - STG2 South to STG1	Land 'Protected' by DCP for future provision	Constructed	Constructed	Constructed
STG1 Access	Full Seagull Intersection	Left-in / Left-out	Left-in / Left-out	Left-in / Left-out

0 50 100 250 500

Client: ALTIS Property Partners

Project: Mamre West Land Investigation Area

ACCESS STRATEGY

1:5000@ A3 or 1:2500@A1

DATE Jan 2016 **SKETCH NUMBER** 4648_SK092e

nettleton tribe