Jordan Springs
Residential Subdivision
Village Five
Transport Impact Assessment

transportation planning, design and delivery

GTAconsultants

Jordan Springs

Residential Subdivision, Village Five

Transport Impact Assessment

Issue: A 25/06/14

Client: Maryland Development
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Quality Record

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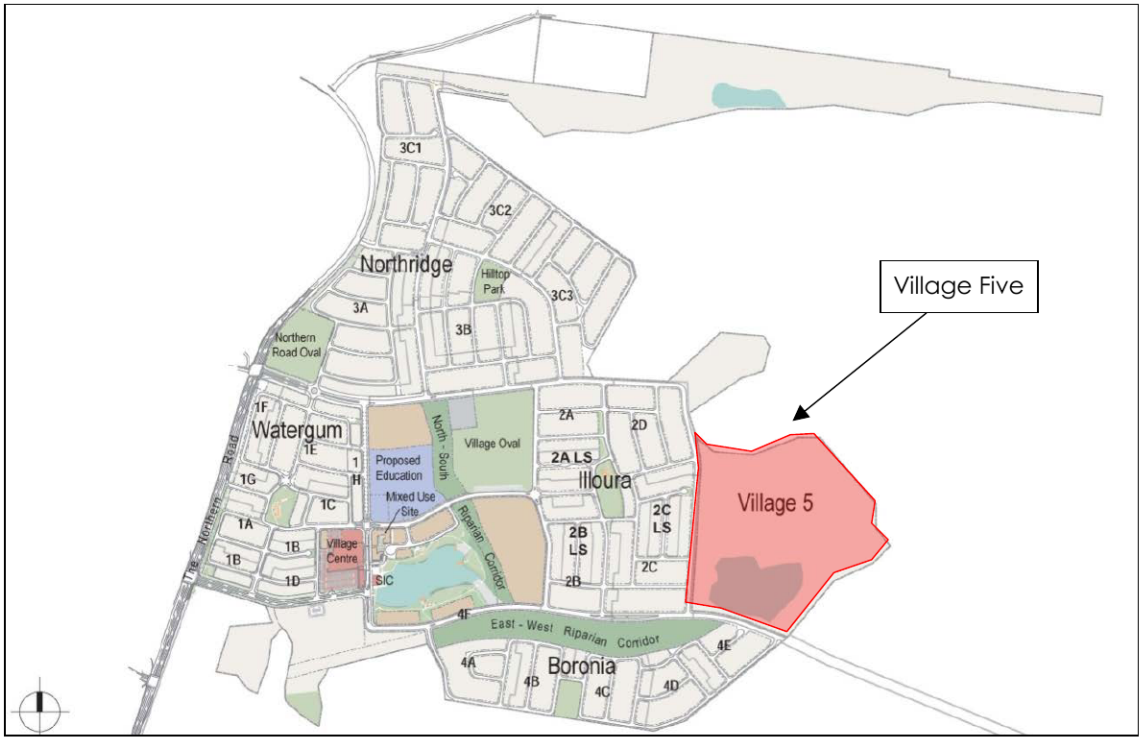
1. Introduction

1.1 Background

A development application is to be lodged with Penrith City Council for the proposed Village Five subdivision within the Jordan Springs residential development. Village Five is proposed to include 265 residential lots. The context of the proposed site within the Jordan Springs residential development is shown in Figure 1.1.

Figure 1.1: Context of Village Five within Jordan Springs



Basemap Source: Lend Lease.

GTA Consultants was commissioned by Maryland Development Company Pty Ltd in June 2014 to undertake a transport impact assessment for the proposed Village Five subdivision.

In undertaking this study, consideration was given to previous planning work which produced an indicative development matrix and road system for Jordan Springs.

1.2 Purpose of this Report

This report sets out an assessment of the anticipated transport implications of the proposed development, including consideration of the following:

i pedestrian and bicycle requirements;
ii the traffic generating characteristics of the proposed development;
iii suitability of the proposed access arrangements for the site;
iv the transport impact of the development proposal on the surrounding road network.

1.3 References

In preparing this report, reference has been made to the following:

- Penrith Council Development Control Plan (DCP) 2010
- St Marys Western Precinct – Precinct Plan – prepared by JBA dated May 2009
- plans for the proposed development prepared by J Wyndham Prince [9343], Drawing Numbers 03DA01 – 12DA11 – Revision B, dated 29 May 2014
- other documents and data as referenced in this report.

2. Jordan Springs Residential Development

The Jordan Springs residential development has been the subject of numerous studies, which have defined the land use, assessed the traffic generation and its external implications, broadly defined the structure of the road system within the site, and developed a traffic management strategy for the Precinct.

2.1 Previous Studies and Assumptions

The regional traffic and transport implications of the St Marys development site have previously been considered for the site as a whole, including the Jordan Springs (Western Precinct), Central and Ropes Crossing (Eastern) Precincts.

Figure 2.1 shows Jordan Springs (shown as Western Precinct in the figure), Central Precinct, Dunheved and Eastern Precinct within the entire St Marys re-development.

Figure 2.1: Context of Jordan Springs within St Marys Redevelopment Area

Source: Western Precinct St Marys Precinct Plan and Development Control Strategy (JBA, 2009).

The Central Precinct of the St Marys re-development area has not been constructed. There is no direct road connection between the Eastern Precinct (Ropes Crossing) and Jordan Springs.

Studies of particular relevance to the Jordan Springs subdivision are:

- *St Marys Development Revised Transport Management Plan Traffic Study (Sims Varley, 2004)*
- *St Marys Development Transport Management Study (SKM, 2007)*
- *St Marys Western Precinct Plan Traffic and Transport Report (SKM, 2009)*
- *Western Precinct St Marys Precinct Plan and Development Control Strategy (JBA, 2009).*

The traffic planning management outlined in the previous traffic and transport reports and Precinct Plans are briefly reviewed below and form some of the background to the review of the proposed Village Five subdivision.

2.2 Road System

The main collector road system through Jordan Springs consists of a loop around the centre of the Precinct, with two roads (Jordan Springs Boulevard and Greenwood Parkway) leading off in a westerly direction to The Northern Road. The western (north-south oriented) road of the loop would be a "main street", also known as Lakeside Parade, providing access to the Village Centre. Figure 2.2 shows the Framework Plan.

The easterly connection through the Regional Park to the Central Precinct has changed slightly from the Framework Plan. Central Precinct will now connect with Lakeside Parade which is located south of the Village Centre as opposed to north of the Village Centre as indicated in the Framework Plan.

The road connections to The Northern Road for Jordan Springs include the following:

- Northern – Village 3C Stage 1(left-in/ left-out) access (Road 1)
- Central (north) – Greenwood Parkway/ Borrowdale Way (four-way signalised)
- Central (south) – Watkin Street (left-in/ left-out) access
- Southern – Jordan Springs Boulevard (three-way signalised).

The Northern Road is currently being upgraded from Andrews Road to Borrowdale Road. The Northern Road will have two travel lanes in each direction, separated by a median.

The Jordan Springs ultimate connections with The Northern Road are proposed to be completed by mid-2015 along with the upgrade of The Northern Road, except for the left-in/ left-out intersection at Village 3C Stage 1, which is to be constructed separately following The Northern Road upgrade.

The layout of the intersections of The Northern Road with Jordan Springs Boulevard and with Greenwood Parkway/ Borrowdale Way is shown in **Appendix A.**

Figure 2.2: Jordan Springs Framework Plan

Note: Location of all elements indicative only, subject to confirmation via detailed design.

Source: St Marys Western Precinct Plan Traffic and Transport Report, SKM, May 2009.

2.3 Traffic Flows and Assessment

The SKM Western Precinct Plan Traffic and Transport report presents morning peak hour link flows at representative locations on the primary internal road network of the Jordan Springs (Western Precinct) as a whole. These were developed by dividing the area into twelve sub-areas and applying the assumptions used in the Sims Varley study (2004).

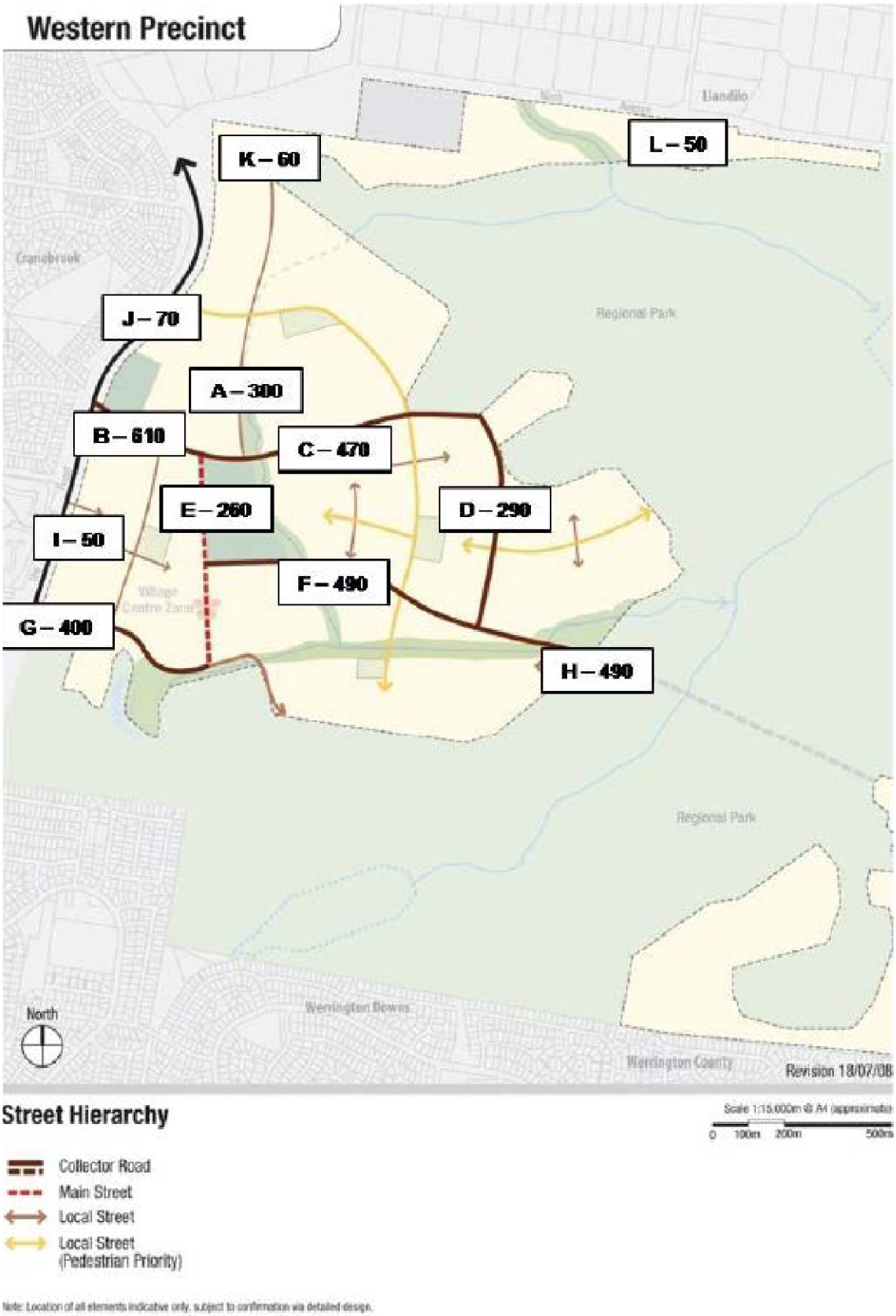
The estimated mid-block two way flows per hour are shown on Figure 2.3. Whilst the road layout for the Jordan Springs Boulevard has altered since the preparation of this plan, the traffic volume estimates are still applicable.

Halcrow Traffic Consultants prepared a traffic assessment for the entire Western Precinct in order to consider the traffic context of the proposals in the Western Precinct subdivision. The traffic assessment considered the initial findings of the SKM report and refined the traffic forecasts based on the proposed collector road layout.

The traffic assessment for the completed state of the entire Western Precinct including the Village Centre as provided in the previous reports is generally still applicable; however it does not include the proposed mixed use development on the south side of Jordan Springs Boulevard. A summary of the traffic assessment is contained in **Appendix B**.

The traffic assessment of the full Western Precinct development assumed indicative retail, community, commercial and educational land uses.

Figure 2.3: Jordan Springs Traffic Forecasts



Source: St Marys Western Precinct Plan Traffic and Transport Report, SKM, May 2009.

2.4 Public Transport

The Sims Varley 2004 study for Western Precinct concluded that bus services would be the most effective form of transport for the site, both in terms of economic feasibility and in providing a high quality public transport service.

The system would be "bus friendly" with high quality collector bus routes, a highly legible system, direct pedestrian connections and no circuitous connections between sub areas.

Bus stops and shelters would be provided at regular intervals and their exact locations will be determined in conjunction with bus operators, the Department of Transport and Penrith Council.

Figure 2.4 shows proposed bus routes and potential bus stops within the Western Precinct, with the aim of providing access for buses and to allow them to travel within 400m (five minutes walk) of 90 per cent of dwellings and within easy walking distance (ten minutes walk) of all dwellings in the Western Precinct.

A bus route is proposed to be provided along Greenwood Parkway adjacent to Village Five, with a proposed bus stop in close proximity of Road 1. This will ensure that no less than 90 per cent of dwellings within Village Five are within an acceptable walking distance of a bus stop. It is intended that following the completion of the Central Precinct, a bus route would connect the Western Precinct with the Central Precinct.

Figure 2.4: Bus Transport Network

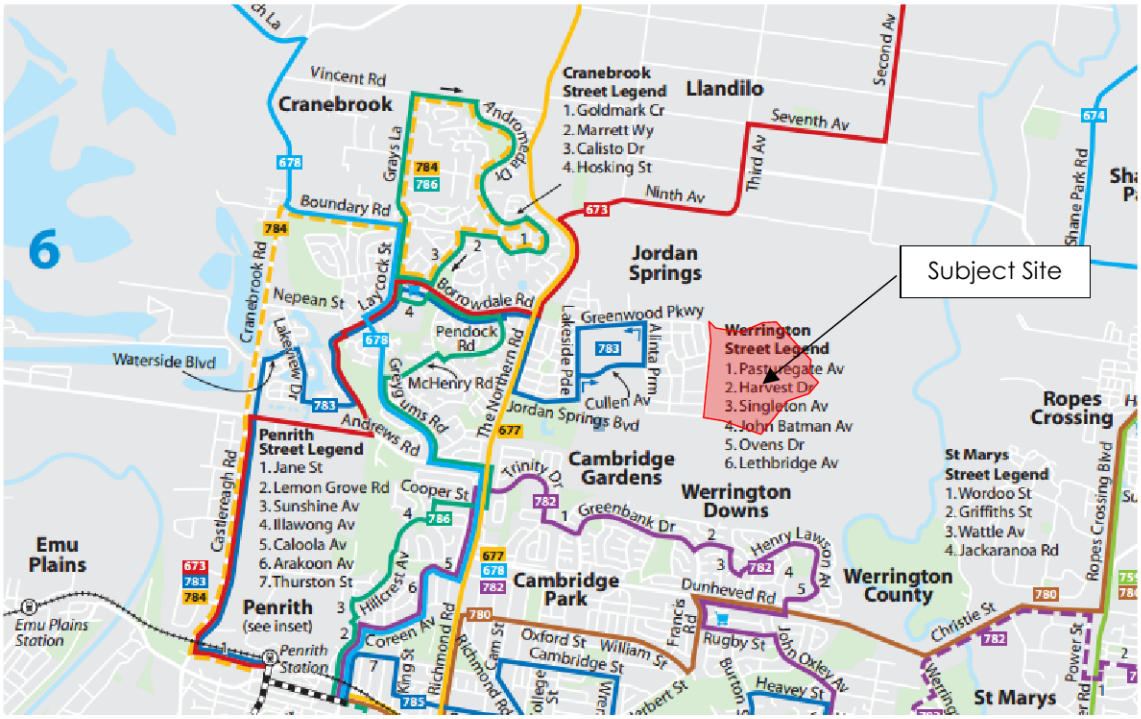
Source: Lend Lease dated 30 May 2014

Route 783 bus currently operates along Greenwood Parkway, Alinta Promenade and Lakeside Parade/ Jordan Springs Boulevard. Services operate between Jordan Springs and Penrith Railway Station on approximately half hour intervals between 6.42am and 7:44pm on a typical weekday. The bus route is only temporary and would change to a final route based on the bus stop locations shown in Figure 2.4 following consultation with the bus operator and once the majority of houses are occupied.

In addition, bus services 673, 677 and 786 are within walking distance to the site, these provide alternate access to Penrith Railway Station. Other limited bus services on routes 673 and 677 connect the site to Windsor and Richmond.

A bus network in the vicinity of Jordan Springs is shown in Figure 2.5.

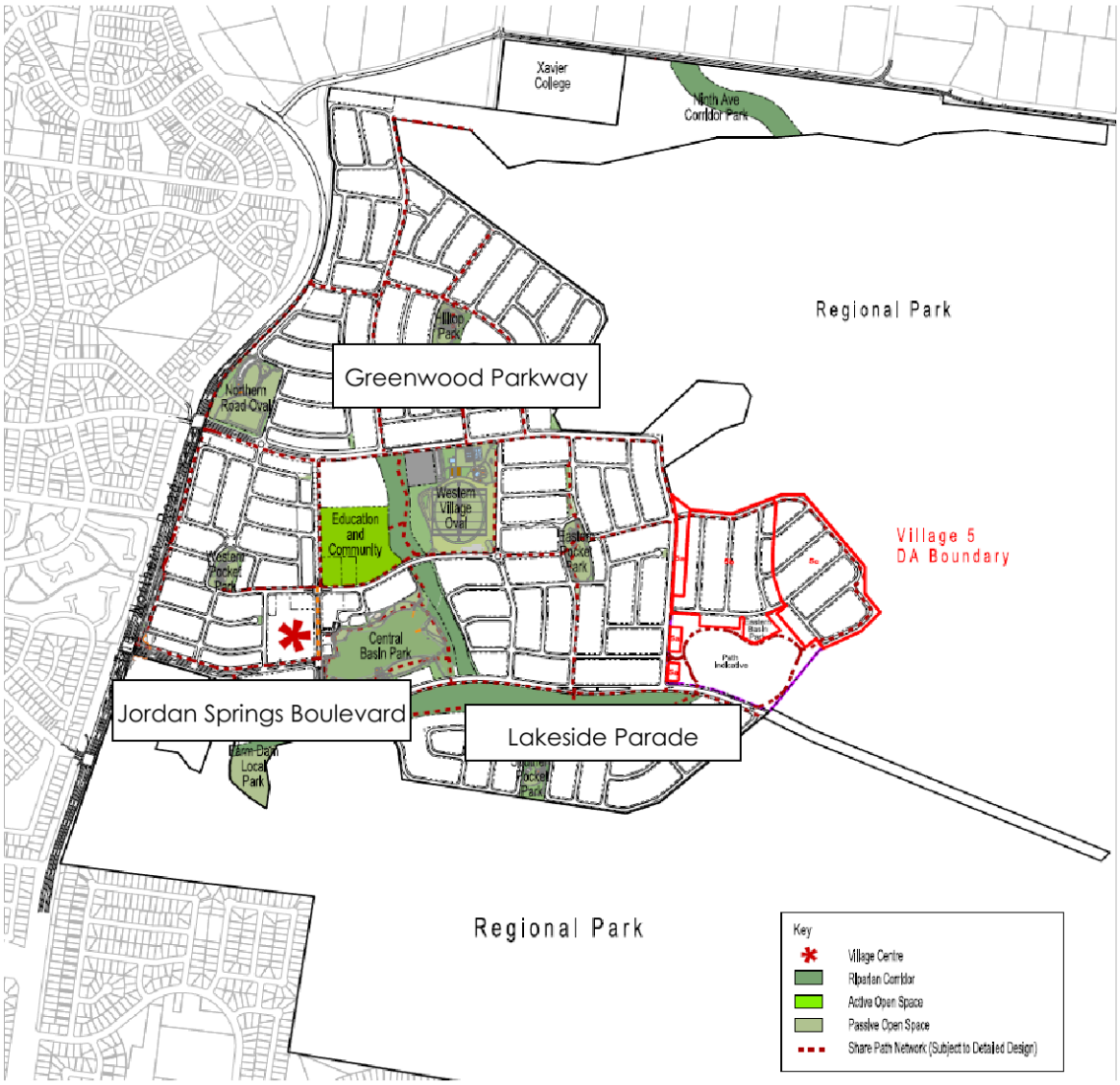
Figure 2.5: Local Bus Network



2.5 Walking and Cycling

Pedestrian and cyclist facilities are included in the 'Western Precinct Development Control Strategy'. Local roads would carry low traffic volumes, and would be suitable for cyclists in mixed traffic conditions. Shared cycle and pedestrian paths are proposed along the major internal roads as shown in Figure 2.6.

Figure 2.6: Pedestrian and Cycle Network



Source: Lend Lease dated 30 May 2014

3. Village Five Development

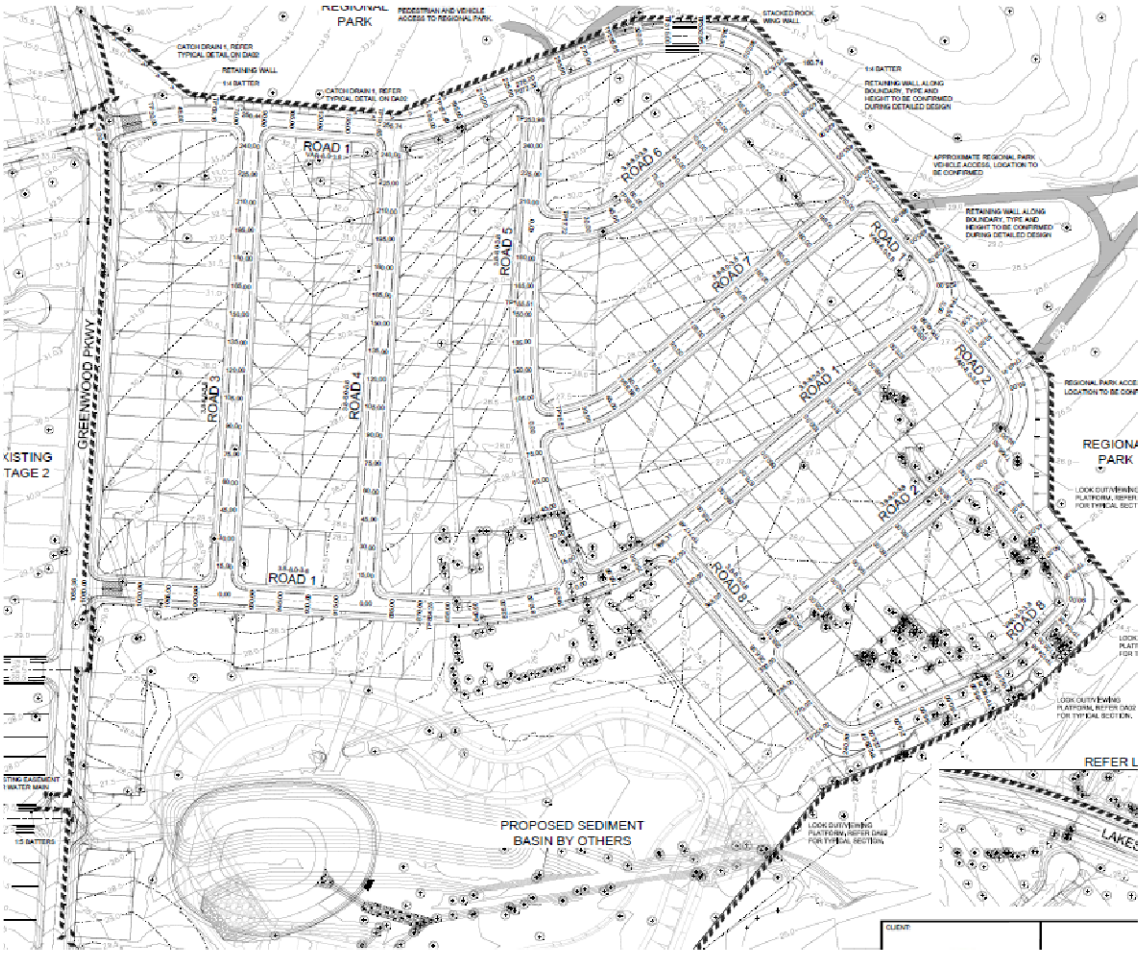
3.1 Development Proposal

This study considers the Village Five residential subdivision within Jordan Springs. Village Five comprises 265 residential lots and new roads and infrastructure.

The construction of Village Five and its associated roads will be undertaken in one stage if market conditions remain. In the event that the market conditions changes, the village will be delivered in three stages; 5a, 5b and 5c. It is proposed to commence Village Five construction in August 2014 and it is expected to be completed by March 2015.

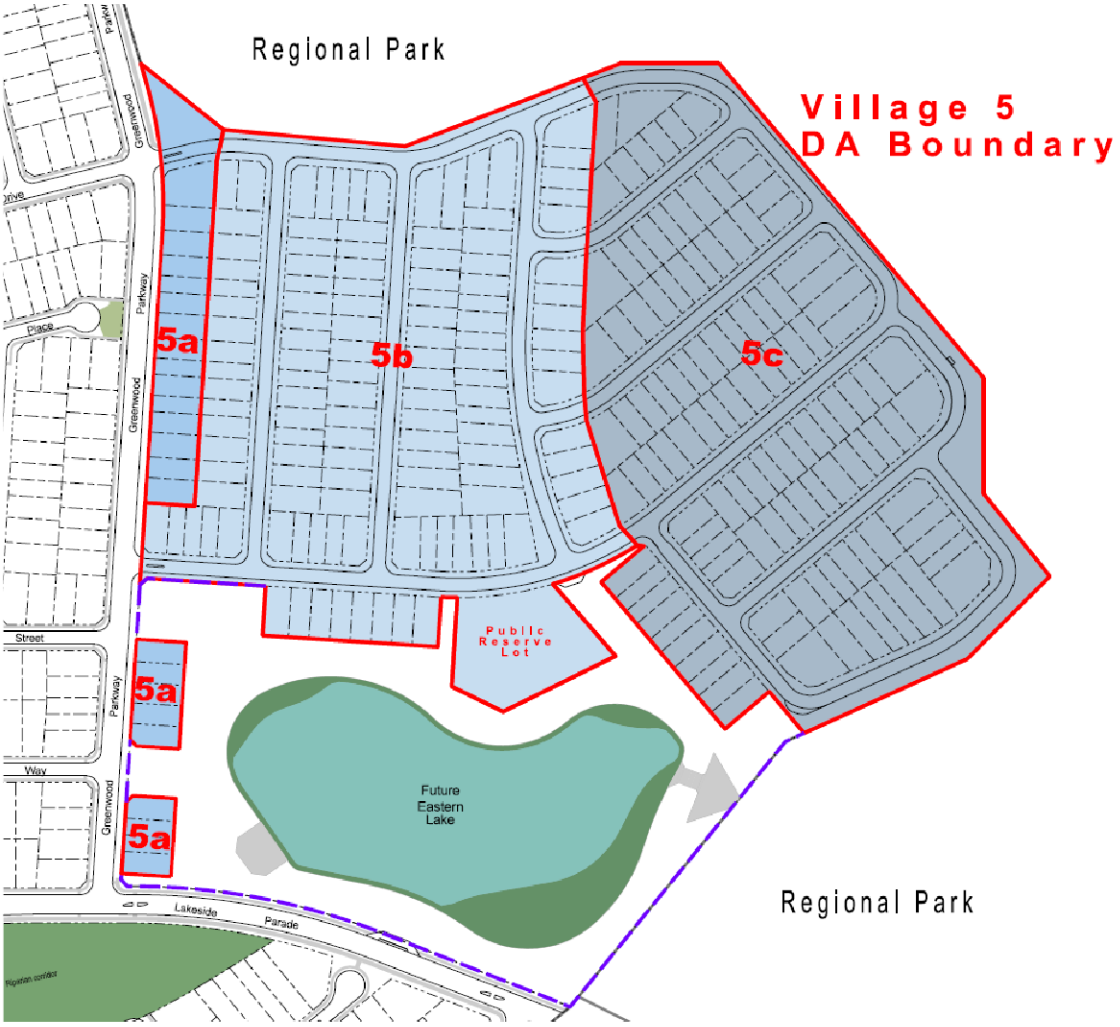
The layout of the proposed Village Five residential development and stages of construction (if required) are shown in Figure 3.1 and Figure 3.2.

Figure 3.1: Village Five Development Layout



Source: J. Wyndham Prince

Figure 3.2: Village Five Development Staging Plan (if required)



Source: Maryland Development Group

3.2 Internal Road Network

3.2.1 Cross Sectional Layout

All roads within Village Five are proposed to be minor local roads with parking on both sides as identified in the 'Western Precinct Plan', which have the following typical characteristics expect for the perimeter roads around the Regional Park:

- 15.6m reserve
- 8.0m carriageways
- 3.8m verges on each side.

The perimeter roads of the subdivision, including Road 1, Road 2 and Road 8 have the following typical characteristics:

- 17.6m reserve
- 8.0m carriageways
- 4.8m verges on each side.

The proposed 8.0m carriageways would ensure there is appropriate access for 8.8m Category 1 fire tankers along all roads within the subdivision, particularly the perimeter roads.

3.2.2 Intersection Controls

The intersections within Village Five are proposed to be all tee intersections with the exception of Greenwood Parkway and Tengala Drive intersection. The tee intersections would typically require 'Give Way' controls for the minor road and the 'Stop' control would apply to Tengala Drive and Road 1 where the roads intersect with Greenwood Parkway.

A review of intersection sight distances would be undertaken at the detailed design stage to ensure sufficient sight distances were available for the design vehicle speeds, and to identify any locations which may require "Stop" control rather than "Give Way" control.

Swept path analysis of an 8.8m service vehicle, the typical size of a Council waste collection vehicle and Category 1 fire tanker, and a 12.5m rigid truck was undertaken by J. Wyndham Prince to demonstrate access to the subdivision from Greenwood Parkway. The swept paths are provided in **Appendix C**.

A bus route will not be provided through the internal Village 5 road network. As such, the intersections of Greenwood Parkway and Road No 1have been designed to cater for a Council waste collection vehicle and Category 1 fire tanker.

3.2.3 Traffic Management

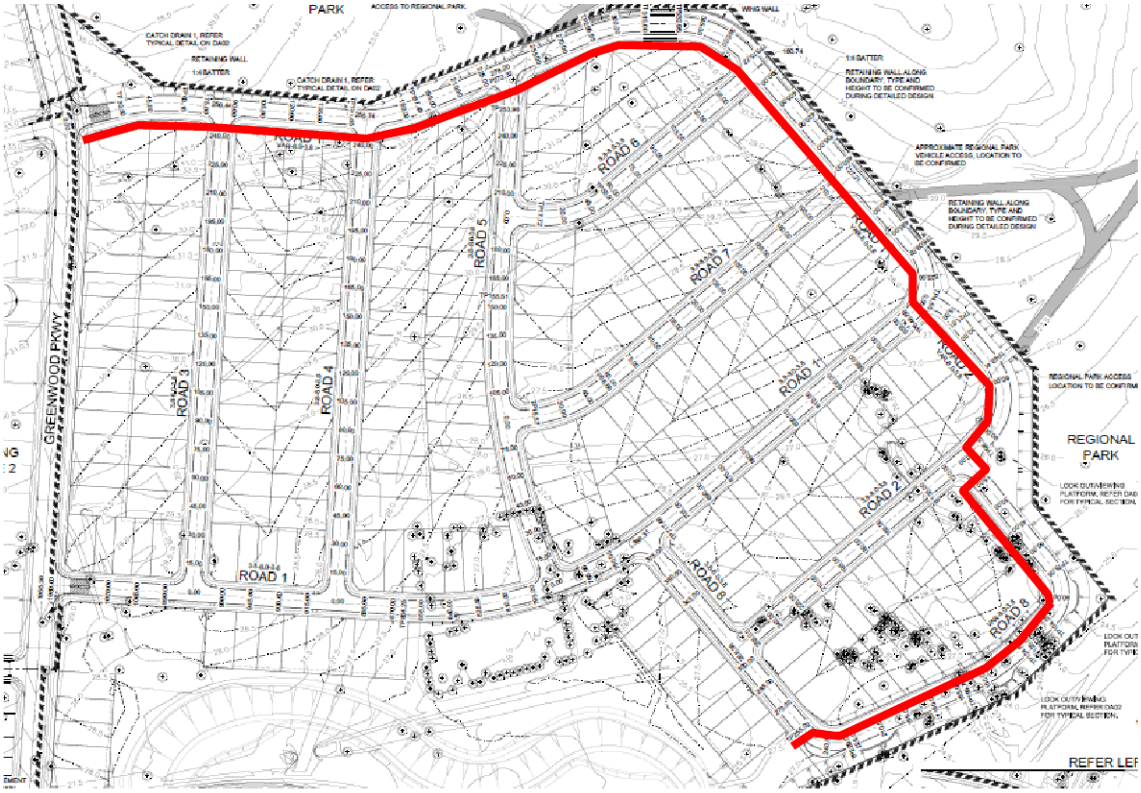
The proposed layout of the roads within the subdivision comprises a permeable modified right angle grid street system, which would promote connectivity and ease of movement for pedestrians, cyclists and pedestrians, while limiting the potential for through traffic intrusion. This is consistent with the subdivision design principles set out in the Development Control Strategy.

The layout of the road system within Village Five would generally tend to discourage high vehicle speeds, as road lengths are proposed to be limited where possible such that there would be insufficient road length for drivers to build up inappropriate speeds and kerbside parking will narrow the road widths. A section of Road 1, immediately north of the Village 5 East Lake is the exception. To mitigate the potential issue of high vehicle speeds on Road 1, splitter islands and paver road texture will be provided at the intersection of Road 1 and Road 5 as a traffic calming measure.

3.3 Pedestrian Facilities

1.5m wide footpaths will be provided on both sides of all internal roads and a 2.5m shared path will be provided on the 'inside' side of the perimeter roads of the subdivision including Road 1, Road 2 and Road 8, as shown in Figure 3.3.

Figure 3.3: Village 5 - Shared Path Facilities



Source: JWP

4. Traffic Impact Assessment

A traffic analysis has been undertaken to ensure that the key intersections operate satisfactorily after completion of Village Five and all other approved or pending approval developments within the Jordan Springs residential subdivision.

4.1 Jordan Springs Residential Subdivision

Previous development applications have been submitted for the Jordan Springs subdivision. The documents which describe the traffic impacts of these development applications are listed below.

- *Western Precinct Villages 1A, 1B and 1C Traffic Assessment (Halcrow, 2009)*
- *Western Precinct Village 1D Builders Display Village Traffic Assessment (Halcrow, 2010)*
- *Western Precinct Villages 1E - 1G Traffic Assessment (Halcrow, 2010)*
- *Western Precinct Main Street Extension (Halcrow 2010)*
- *Western Precinct Village 2 Traffic Assessment (Halcrow, 2011)*
- *Western Precinct Village 3A Traffic Assessment (Halcrow, 2011)*
- *Western Precinct Village 3B Traffic Assessment (Halcrow, 2011)*
- *Jordan Springs – Relocation of the Builders Display Village Car Park Traffic Assessment (Halcrow, 2011)*
- *Jordan Springs Village 4 and Road 21 Traffic Assessment (GTA Consultants, 2012)*
- *Jordan Springs – Builders Display Village Car Park No. 2 Traffic Assessment (GTA Consultants, 2012)*
- *Jordan Springs – North Lake Access Road - Traffic Assessment (GTA Consultants, 2012)*
- *Jordan Springs Village 3C, Stage 1 – Traffic Assessment (GTA Consultants, June 2013)*
- *Jordan Springs Village 3C, Stage 2 – Traffic Assessment (GTA Consultants, August 2013)*
- *Jordan Springs Village 12 – Traffic Assessment (GTA Consultants, February 2014)*
- *Jordan Springs Mixed Use Development (C.I.D. Group) – Traffic Assessment (GTA Consultants, March 2014).*
- *Jordan Springs Village 3C, Stage 3 – Traffic Assessment (GTA Consultants, April 2014).*

4.1.1 Summary of Approved or Pending Approval Developments

The following approved or pending approval developments were assessed in conjunction with the Village Five development (approximate numbers only):

- Village One – 249 Residential Lots and 18 Display Homes
- Village Two – 405 Residential Lots and 22 Display Homes
- Village Three A & B – 277 Residential Lots
- Village Three C, Stage 1 – 210 Residential Lots
- Village Three C, Stage 2 – 166 Residential Lots
- Village Three C, Stage 3 – 203 Residential Lots
- Village Four – 291 Residential Lots
- Village Twelves – 91 Residential Lots
- Road 21 – 9 Residential Lots
- Road 21 – 20 Apartments
- Mixed Use Site – 100 Apartments
- Mixed Use Site – Retail 400m^2
- Village Centre – Retail 4,000m^2
- Village Centre – Medical Centre 2 Practitioners
- Village Centre – Child Care Centre – 120 Places
- Village Centre – Residential Lots (6,8,9) – 36 Residential Lots
- Village Centre – 28 Apartments
- C.I.D. Group Mixed Use Development (Townhouse) – 64 townhouses and 5 SOHOs
- C.I.D. Group Mixed Use Development (Piazza) – 160 apartments
- C.I.D. Group Mixed Use Development (Piazza) – Restaurant 1,537m^2
- C.I.D. Group Mixed Use Development (Piazza) – Retail 1,039m^2
- C.I.D. Group Mixed Use Development (Piazza) – Office 75m^2.

Construction of Village 1, Village 2, Village 3A, 3B, 3C Stage 1 and Village 4 and their roads and associated infrastructure have been completed.

The Village Centre, a mixed use site, Village 3C Stage 2 and a number of roads have all been approved and are currently under construction.

Village 3C Stage 3, Village 12 and the C.I.D. Group Mixed Use Development are pending approval.

4.2 Trip Forecasting

The trip rate calculations for all approved developments or are pending approval within Jordan Springs and Village Five are shown in Table 4.1.

Table 4.1: Jordan Springs Residential Development Trip Forecasting.

Development	Lot Type	Number/Gross Leasable Floor Area	AM/PM Trip Rate	AM Peak Movements	PM Peak Movements	Saturday Trip Rate	Saturday Movements
Village 1A to 1C	Residential lots	109	0.75	82	82	0.68	74
Village 1D	Display Homes	18	1	18	18	2.66	48
Village 1E to 1G	Residential lots	140	0.75	105	105	0.68	95
Village 2A	Residential lots	75		56	56		51
	Display Homes	22	1	22	22	2.66	59
Village 2B	Residential lots	70	0.75	53	53	0.68	48
	Living Streets lots	24		18	18		16
Village 2C	Residential lots	111		83	83		75
	Living Streets lots	23		17	17		16
Village 2D	Residential lots	102		77	77		69
Village 3A	Residential lots	139		104	104		95
Village 3B	Residential lots	138		104	104		94
Village 3C1	Residential lots	210		158	158		143
Village 3C2	Residential lots	166		125	125		113
Village 3C3	Residential lots	203		153	153		139
Village 4	Residential lots	291		218	218		198
Village 5	Residential lots	265		199	199		180
Village 12	Residential lots	91		68	68		62
Road 21 (Lakeside Parade)	Residential lots	9		7	7		6
	Apartments	20	0.50	10	10	0.45	9
Mixed Use Site	Apartments	100		50	50		45
	Retail (Retail/Commercial)	400	6 trips/100m2	0	24	7.5 trips /100m2	30
Village Centre	Retail	4,000		0	240		300
	Medical Centre	2 Practitioners	5.8 movements /practitioner	12	12	5.8 movements /practitioner	12
	Child Care Centre	120 Places	0.7 movements / child	84	84	-	0
	Residential lots (6, 8,9)	36	0.75	27	27	0.68	24
	Apartment (7)	28	0.50	14	14	0.45	13

Table 4.1: Internal Jordan Springs Trip Forecasting – Continued

Development	Lot Type	Number/Gross Leasable Floor Area	AM/PM Trip Rate	AM Peak Movements	PM Peak Movements	Saturday Trip Rate	Saturday Movements
C.I.D. Group Townhouses	2 Bedroom Townhouses	54	0.50	27	27	0.45	24
	3 Bedroom Townhouses	10	0.65	7	7	0.60	6
	2 bedroom SOHO	1	0.50	1	1	0.45	0
	3 bedroom SOHO	4	0.65	3	3	0.60	2
C.I.D. Group Piazza	1 Bedroom Apartment	20	0.4	8	8	0.35	7
	2 Bedroom Apartment	123	0.5	62	62	0.45	55
	3 Bedroom Apartment	17	0.65	11	11	0.60	10
	Restaurant	1,537	5 trips/100m2	0	77	7.5 trips /100m2	115
	Retail	1,039	6 trips/100m2	0	62	7.5 trips /100m2	78
	Office	75	1.6 trips/100m2	1	1	-	0
Total				**1984**	**2387**		**2311**

The total traffic generated from all of the approved or pending approval developments within Jordan Springs and Village Five is estimated to be:

- 1,984 vehicle movements per hour during the weekday morning peak
- 2,387 vehicle movements per hour during the weekday afternoon peak
- 2,311 vehicle movements per hour during the weekend peak hour.

In reality, and as recognised in the SKM report, 25% of the residential trips and 50% of the retail trips will be contained within Jordan Springs. No containment reduction was provided for office trips, therefore 25% has been adopted for this assessment.

Based on the above, the total traffic generated from the approved or pending approval developments within Jordan Springs and Village Five that would access The Northern Road is estimated to be:

- 1,473 vehicle movements per hour during the weekday morning peak
- 1,683 vehicle movements per hour during the weekday afternoon peak
- 1,608 vehicle movements per hour during the weekend peak hour.

4.3 Background Traffic

Weekday and Saturday peak hour traffic and classification surveys were conducted at the intersection of The Northern Road and Borrowdale Way on Saturday 30 April 2011 and Monday 2 May 2011.

The surveyed traffic volumes along The Northern Road during the peak periods are shown in Table 4.2.

Table 4.2: 2011 Surveyed Peak Hour Traffic Volumes

Peak Hour	Traffic Volumes (per hour)		
	Northbound	Southbound	Total
Weekday AM	869	960	1,829
Weekday PM	913	831	1,744
Saturday Midday	785	694	1,479

More recently, traffic counts were undertaken at the intersection of The Northern Road and Ninth Avenue on Thursday 27 March 2014 and Saturday 5 April 2014. The peak hours are summarised in Table 4.3.

Table 4.3: 2014 Surveyed Peak Hour Traffic Volumes

Peak Hour	Traffic Volumes (per hour)		
	Northbound	Southbound	Total
Weekday AM	862	854	1716
Weekday PM	798	918	1716
Saturday Midday	674	725	1399

Table 4.2 and Table 4.3 show that the traffic volumes on The Northern Road immediately south of Ninth Avenue have reduced by 6% and 2% during the weekday AM and PM peak hours respectively and 5% during the Saturday midday peak hour. It is thought that the reduction in traffic volumes along The Northern Road may be associated with the current construction work on The Northern Road and that traffic is using an alternative route to The Northern Road.

As a conservative approach, the traffic assessment was undertaken based on the 2011 traffic survey volumes. To determine the anticipated background traffic in 2016, an annual traffic growth rate of 2% and 4% has been applied to the 2011 surveyed local roads and The Northern Road traffic volumes respectively.

4.4 Traffic Distribution and Assignment

The distribution and assignment of Jordan Springs residential development traffic was undertaken based on the Halcrow Traffic Consultants traffic assessment, summarised in **Appendix B**, which considered the initial findings of the SKM report.

The Northern Road signalised connections with Greenwood Parkway and Jordan Springs Boulevard would predominantly be used by residents and visitors to the Village Five subdivision. The anticipated traffic volumes at these two connections during the weekday and Saturday surveyed peak periods are presented in Figure 4.1 to Figure 4.3.

Figure 4.1: The Northern Road – Anticipated 2016 Traffic Volumes (Weekday AM)

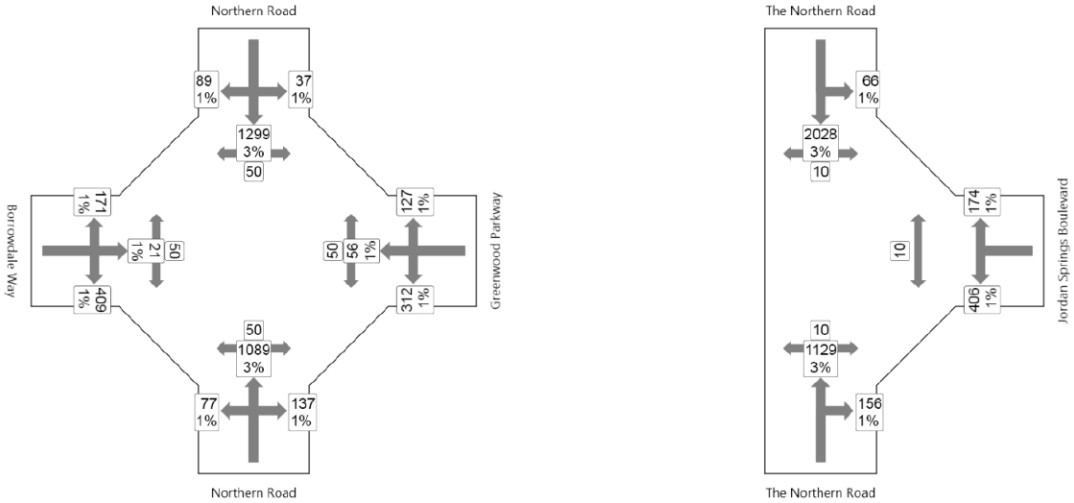


Figure 4.2: The Northern Road – Anticipated 2016 Traffic Volumes (Weekday PM)

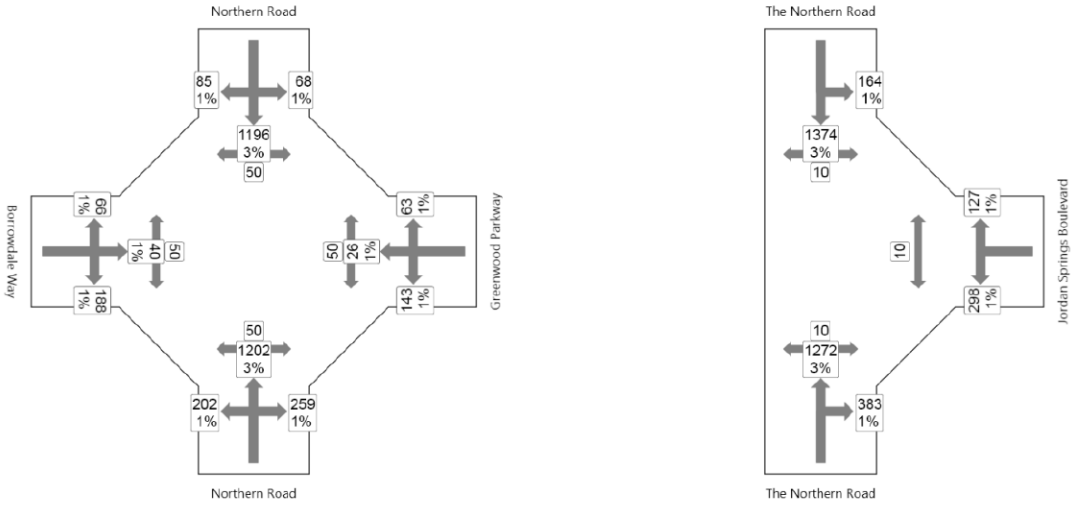
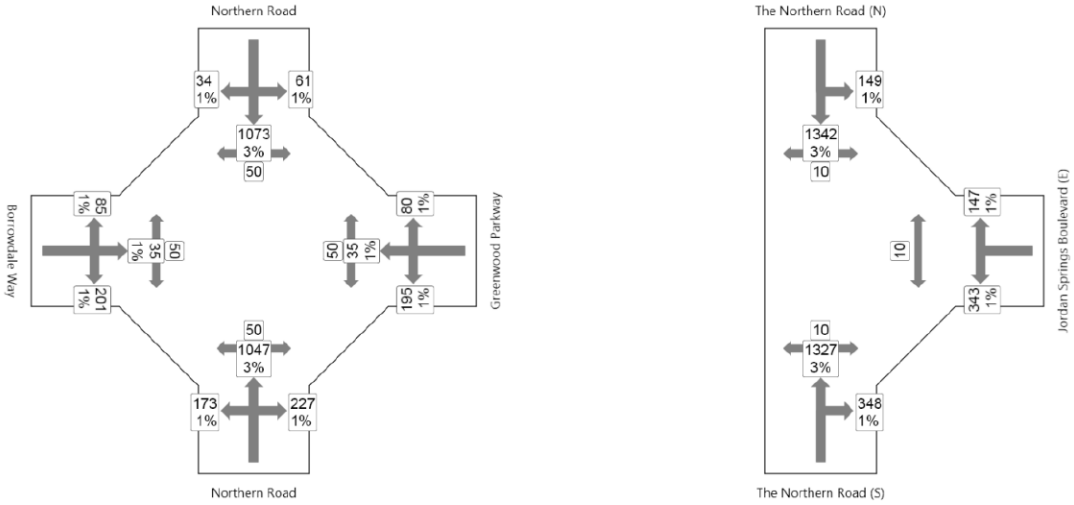


Figure 4.3: The Northern Road – Anticipated 2016 Traffic Volumes (Saturday Midday)



4.5 Intersection Operation

The operation of the following intersections have been assessed using SIDRA INTERSECTION[1], a computer based modelling package which calculates intersection performance:

- The Northern Road and Greenwood Parkway/ Borrowdale Way
- The Northern Road and Jordan Springs Boulevard
- Lakeside Parade and Jordan Springs Boulevard.

The commonly used measure of intersection performance, as defined by the RMS, is vehicle delay. SIDRA INTERSECTION determines the average delay that vehicles encounter and provides a measure of the level of service.

Table 4.4 shows the criteria that SIDRA INTERSECTION adopts in assessing the level of service.

Table 4.4: SIDRA INTERSECTION Level of Service Criteria

Level of Service (LOS)	Average Delay per vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

[1] Program used under license from Akcelik & Associates Pty Ltd.

Results of the SIDRA analysis at completion of the proposed development (2016), and assuming full occupy of all approved and pending approval developments as well as Village Five, are shown below in Table 4.5.

Table 4.5: 2016 Traffic Analysis Results – AM, PM and Saturday Midday Peak

Intersection	Level of Service	Vehicle Delay (seconds)*	Level of Service	Vehicle Delay (seconds)*	Level of Service	Vehicle Delay (seconds)*
	Thursday AM		Thursday PM		Saturday Midday	
The Northern Road/ Greenwood Parkway/ Borrowdale Way	C	38	C	35	C	32
The Northern Road and Jordan Springs Boulevard	B	23	B	25	B	26
Lakeside Parade/ Jordan Springs Boulevard	A	12	A	10	C	38

* Reported delay is the average delay for signalised intersections and highest vehicle delay for roundabouts / priority intersections.

It should be noted that no allowance for 'pass-by' traffic for the retail developments was made. A reduction in 'pass-by' traffic will be made once the size and use of the retail developments are ascertained.

The results of the analysis indicate that the operation of The Northern Road and each of the Jordan Springs accesses would operate satisfactorily, with acceptable delays. The results are similar for the internal priority-controlled intersection of Lakeside Parade/ Jordan Springs Boulevard.

4.6 The Northern Road Accesses - Road Capacity Check

The forecasted traffic generation of Village Five would predominantly use the Greenwood Parkway/ Borrowdale Way and Jordan Springs Boulevard accesses.

Village Five is anticipated to generate 148 trips per hour during the weekday AM/ PM peak hours and 133 trips per hour during the Saturday peak hour which will access The Northern Road.

As such, the weekday AM, PM and Saturday peak hour trips from all developments within the Jordan Springs development which have been approved or pending approval, including Village Five, are shown in Table 4.6.

Table 4.6: Jordan Springs – Road Network Forecasted Traffic Volumes – Village Five

Access	Peak Period	Forecasted Trips Per Hour (Two-Way)	Jordan Springs Masterplan (Two-Way)
Northern Access (Stage 3C1 Road 1- Left-In/ Left-Out access)	Weekday AM	129	70
	Weekday PM	105	-
	Saturday Midday	100	-
Central Access (Greenwood Parkway)	Weekday AM	654	610
	Weekday PM	570	-
	Saturday Midday	600	-
Southern Access (Jordan Springs Boulevard)	Weekday AM	762	400
	Weekday PM	520	-
	Saturday Midday	938	-

The forecasted traffic volumes within Jordan Springs will be divided between Jordan Springs Boulevard, Watkins Street access (left-in/ left-out), Greenwood Parkway and the Stage 3C1 access (left-in/ left-out). The forecasted weekday morning link traffic volumes are generally consistent with the estimated volumes of the SKM masterplan, except at Jordan Springs Boulevard where forecasted weekday morning traffic volumes would exceed the estimate. The forecasted volumes on Jordan Springs Boulevard are higher than initially anticipated in the JBA Western Precinct plan due to the realignment of Lakeside Parade.

Nonetheless, the forecasted volumes are sufficiently low that a single lane road would have the operational capacity to satisfactorily accommodate the traffic, noting that a typical two-lane urban road could be expected to carry up to 900 vehicles per hour each way.

5. Conclusion

Based on the analysis and discussions presented within this report, the following conclusions are made:

- The development of the Jordan Springs subdivision has been the subject of numerous studies which have broadly defined the development yield and internal road system.
- A Development Control Strategy was developed to address streets types, public transport, pedestrian and cycle facilities and traffic management within Jordan Springs.
- The subject subdivision relates to Village Five which will comprise of 265 residential lots and construction of local roads and intersections.
- The proposed road cross sections are generally consistent with the typologies set out in the '*Western Precinct Development Control Strategy*', as developed with Penrith City Council.
- The intersections within Village Five are proposed to be all tee intersections except for the four way intersection of Greenwood Parkway/ Tengala Drive and Road 1 (Village 5).
- The road system layout is generally permeable and would discourage high vehicle speeds through limiting road lengths.
- The proposed pedestrian and cycle facilities within Village Five are consistent with the Development Control Strategy. A 2.5m shared path will be provided on the 'inside' side of the perimeter roads of the subdivision including Road 1, Road 2 and Road 8.
- The forecasted weekday AM/ PM and Saturday midday peak hour traffic volumes from Village Five are estimated to be 199 trips per hour and 180 trips per hour, respectively.
- The forecasted weekday AM/ PM and Saturday midday peak hour traffic volumes from Village Five which are forecasted to travel to/ from The Northern Road are estimated to be 148 trips per hour and 133 trips per hour, respectively.
- The combined forecasted traffic volume for all of the approved Jordan Springs developments, including Village Five, is approximately 1,984 trips per peak hour and 2,387 trips per peak hour during the weekday AM and PM peak hour, respectively, whilst the Saturday peak hour traffic volume is estimated to be 2,311 trips per hour.
- The combined forecasted traffic volume for all of the approved Jordan Springs developments which is forecasted to travel to/ from The Northern Road during the weekday AM and PM peak hour is estimated to be 1,473 trips per hour and 1,683 trips per hour respectively, whilst the Saturday peak hour traffic volume is estimated to be 1,608 trips per hour.
- Traffic modelling indicates that the proposed The Northern Road signalised intersections at Greenwood Parkway/ Borrowdale Way and Jordan Springs Boulevard would satisfactorily cater for the estimated traffic flow for all Jordan Springs development traffic.
- Traffic modelling also indicates that the Lakeside Parade/ Jordan Springs Boulevard intersection would operate satisfactorily.

As such, the proposed Village Five subdivision within the Western Precinct is consistent with previous planning for the site, and with the Development Control Strategy.

Appendix A

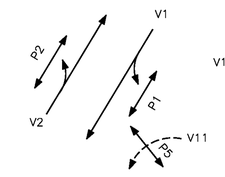
The Northern Road Signalised Intersection Layouts

DRAWN BY CADD
DO NOT AMEND MANUALLY

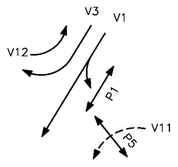
0154.358.VV.3567

Date in Service 26/06/00
Date Reconstruction

NSW GOVERNMENT Transport Roads & Maritime Services



A PHASE



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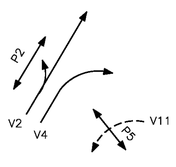

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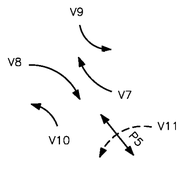
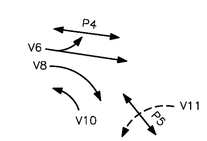
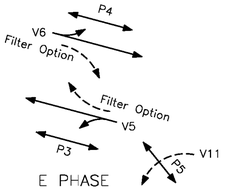


D PHASE

D1 PHASE



D2 PHASE



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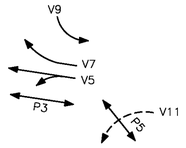
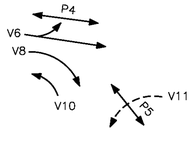


F1 PHASE



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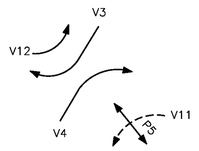

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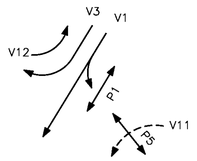
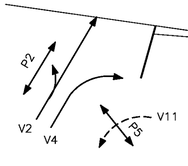


G1 PHASE

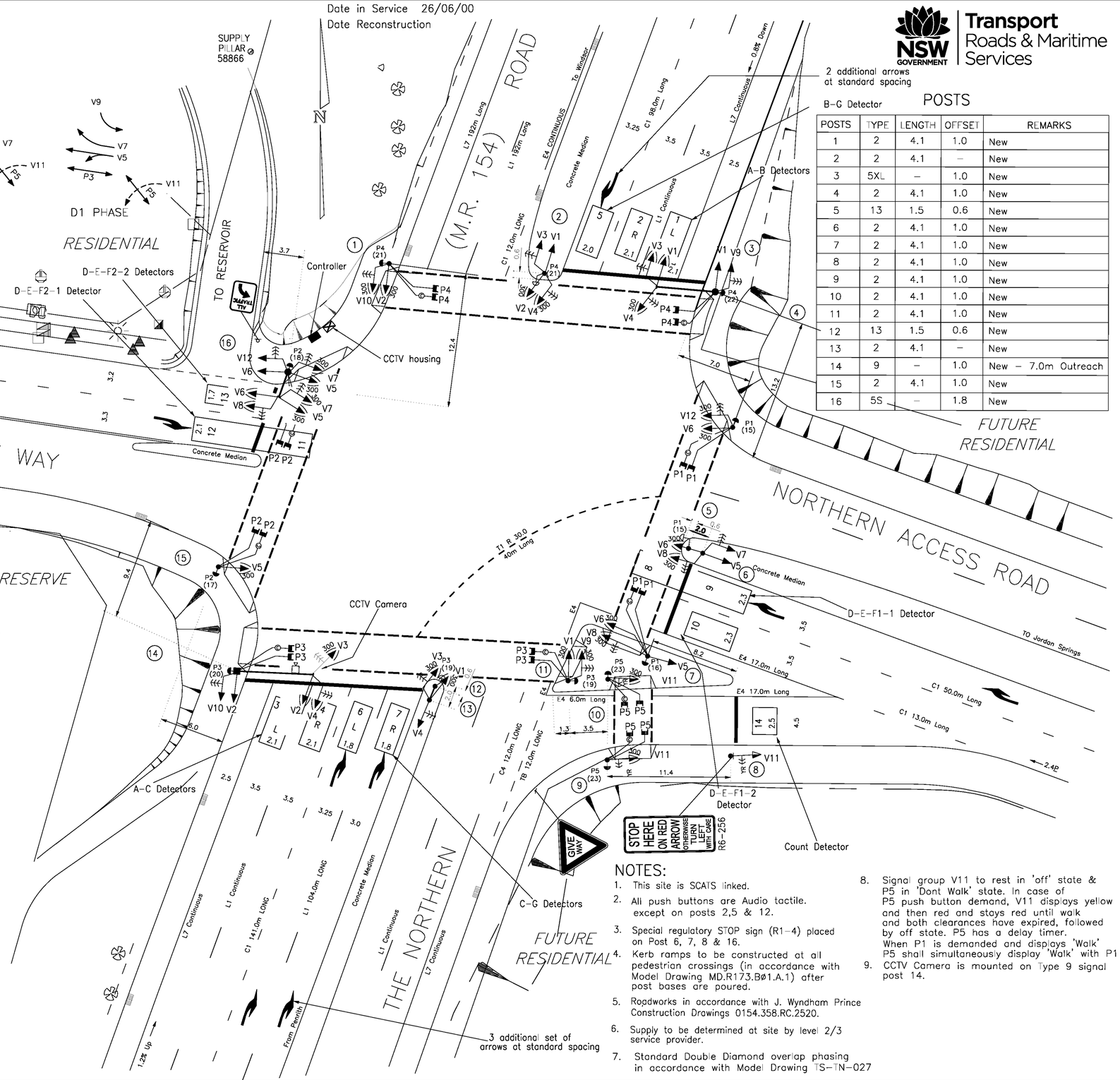


G2 PHASE

MOVEMENTS
SIGNAL GROUP / PHASE CHART

SIGNAL GROUP	PHASE DURING WHICH GREEN DISPLAYED												OVERLAPS PERMITTED	OVERLAP CONDITIONS	STD. TABLE	DURATION OF R.A.
	A	B	C	D	D1	D2	E	F1	F2	G	G1	G2				
V1	X	X									X		G1/A/B, B/A. A/G1*	*P1 NOT RUNNING	TS–TN–027	
V2	X		X									X	G2/A/C, C/A. A/G2*	*P2 NOT RUNNING	TS–TN–027	
V3		X								X	X		G/G1, B/G		TS–TN–027	
V4			X							X		X	G/G2, C/G		TS–TN–027	
V5				X			X	X					D1/E/F1		TS–TN–027	
V6					X		X		X				D2/E/F2		TS–TN–027	
V7				X	X			X					D/D1		TS–TN–027	ARROW TIME $
V8				X		X			X				D/D2		TS–TN–027	ARROW TIME @
V9				X	X			X					D/D1/F1/G1* F1/A*	*P1 NOT DEMANDED	156	ARROW TIME #
V10				X		X			X				D/D2/F2/G2* F2/A*	*P2 NOT DEMANDED	156	ARROW TIME %
V11																SEE NOTE 8
V12		X								X	X		G/G1		156	ARROW TIME $
P1	X	X									X		G1/A/B		108	
P2	X		X									X	G2/A/C		108	
P3					X		X	X					D1/E, F1/E		111	
P4						X	X		X				D2/E, F2/E		112	
P5	X	X	X	X	X	X	X	X	X	X	X	X				SEE NOTE 8

$ PB ON POST 3 EXTENDS RA TIME
@ PB ON POST 14 EXTENDS RA TIME
# PB ON POST 7 EXTENDS RA TIME
% PB ON POST 16 EXTENDS RA TIME



POSTS

POSTS	TYPE	LENGTH	OFFSET	REMARKS
1	2	4.1	1.0	New
2	2	4.1	–	New
3	5XL	–	1.0	New
4	2	4.1	1.0	New
5	13	1.5	0.6	New
6	2	4.1	1.0	New
7	2	4.1	1.0	New
8	2	4.1	1.0	New
9	2	4.1	1.0	New
10	2	4.1	1.0	New
11	2	4.1	1.0	New
12	13	1.5	0.6	New
13	2	4.1	–	New
14	9	–	1.0	New – 7.0m Outreach
15	2	4.1	1.0	New
16	5S	–	1.8	New

NOTES:

1. This site is SCATS linked.
2. All push buttons are Audio tactile. except on posts 2,5 & 12.
3. Special regulatory STOP sign (R1–4) placed on Post 6, 7, 8 & 16.
4. Kerb ramps to be constructed at all pedestrian crossings (in accordance with Model Drawing MD.R173.BØ1.A.1) after post bases are poured.
5. Roadworks in accordance with J. Wyndham Prince Construction Drawings 0154.358.RC.2520.
6. Supply to be determined at site by level 2/3 service provider.
7. Standard Double Diamond overlap phasing in accordance with Model Drawing TS–TN–027
8. Signal group V11 to rest in 'off' state & P5 in 'Dont Walk' state. In case of P5 push button demand, V11 displays yellow and then red and stays red until walk and both clearances have expired, followed by off state. P5 has a delay timer. When P1 is demanded and displays 'Walk' P5 shall simultaneously display 'Walk' with P1
9. CCTV Camera is mounted on Type 9 signal post 14.

A ORIGINAL ISSUE
B Issue: As directed by Mr S.Singh.Sydney Project Services
Amended: Stop line adjasent to post 3 from 600mm to 300mm. K.I. 25/ 07/2013

PUBLIC UTILITY LEGEND		REFERENCE PLANS	
HYDRANT	□	SYMBOLS/ABBS.	VD003-6
STOP VALVE	⩓	STD POSIT	VD001-5
GAS VALVE	⌗	DET SCHED EXP	VD018-10
SEWER MANHOLE	⊗	PRES. DETECT	VC005-17
TELECOM PIT	▨	SSG DIS. SEQ.	VD018-8
ELECT LIGHT POLE	☌		
POWER POLE	○		
STAY POLE	⊘		
TELEPHONE BOX	T	SURVEYOR : Insight Surveying	
TELECOM PILLAR	⊘	DATE : 2010	

U.B.D. Ref. Map 144, D12
I.S.G. CO-ORDS E: 274 175 N: 1 267 160
DESIGNED JS
CHECKED AM
AM
SITE CHECKED
RW
RECOMMENDED

DESIGN APPROVAL
APPROVED
R NETTLE
POSITION DIRECTOR
DATE 10.07.12
DESIGN PREPARED BY TRANSPORT AND TRAFFIC PLANNING ASSOCIATES

RMS ACCEPTANCE
RECOMMENDED
POSITION NETWORK OPERATIONS NETWORK LEADER
DATE 18.10.12
ACCEPTED
POSITION ROAD NETWORK MANAGER
DATE 22.10.12

ROADS AND MARITIME SERVICES

PENRITH COUNCIL AREA
TRAFFIC SIGNALS AT THE INTERSECTION OF THE NORTHERN ROAD (MR 154), BORROWDALE WAY & NORTHERN ACCESS MT.PLEASANT

DESIGN LAYOUT TCS No 3567

EXISTING ☐ PROPOSED ☒
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SCALE 5 0 (1:200) 5 10
ISSUE B
FILE 358 TS 248
SUPERSEDES SHEET/ISSUE 4A
REGN. 0154.358.VV.3567
SHEET 4

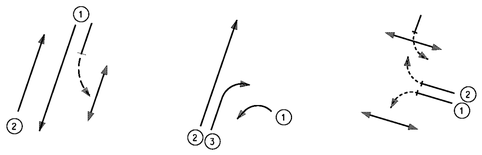
30/07/2013 12:01:03 PM K:\Signals\TCS\vv3500-vv3599\vv3567\Drawings\VV3567_4B.dgn

DRAWN BY CADD
DO NOT AMEND MANUALLY

0154.358.VV.4396

DATE IN SERVICE : 00/00/00

NSW GOVERNMENT Transport Roads & Maritime Services



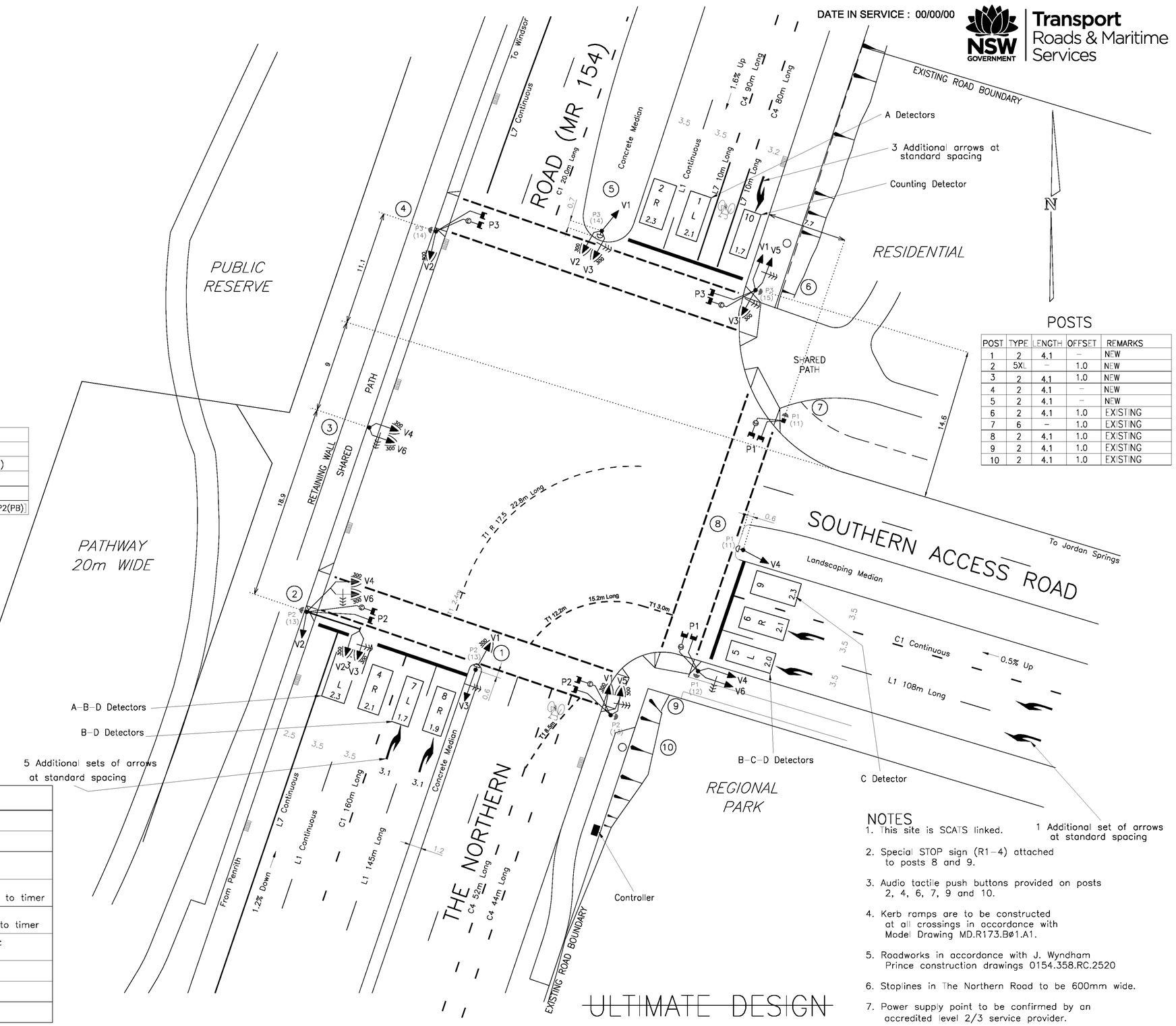
MOVEMENTS

DETECTOR SPECIFICATION

Detector		Specifications			
A	FN	A(L)	A(E1)		
	SG/PS	$\overline{A}$	A		
	DS	–	–		
A-B-D	FN	A(L)	A(E2)		
	SG/PS	$\overline{V2}$	A		
	DS	–	$\overline{B(NEXT).D(NEXT)}$		
cont. A-B-D	FN	B(E2)		D(E2)	
	SG/PS	B		D	
	DS	$\overline{A(NEXT).D(NEXT)}$		$\overline{A(NEXT).B(NEXT)}$	
B-C-D	FN	B(PR)	B(CL)	D(PR)	D(CL)
	SG/PS	$\overline{B.C.D}$	C	$\overline{B.C.D}$	C
	DS	$\overline{C+P2(PB)}$	B-C-D(NG)	$Z+.\overline{C+P2(PB)}$	Z+.B-C-D(NG)
cont. B-C-D	FN	B(E1)		C(E1)	D(E1)
	SG/PS	B		C	D
	DS	$\overline{C(NEXT)+P2(PB)}.\overline{D(NEXT)}$		$\overline{B(NEXT).D(NEXT)}$	$\overline{B(NEXT).[C(NEXT)+P2(PB)]}$
B-D	FN	B(L)	D(L)	B(E3)	D(E3)
	SG/PS	$\overline{V3}$	$\overline{V3}$	B	D
	DS	–	Z+	$\overline{D(NEXT)}$	$\overline{B(NEXT)}$
C	FN	C(L)	C(E2)		
	SG/PS	$\overline{C}$	C		
	DS	–	–		
P1 P.B.	FN	A(PB)	C(L)		
	SG/PS	$\overline{P1(WALK)}$	A.P1(WALK)		
	DS	–	$\overline{B.C.D}$		
P2 P.B.	FN	C(PB)	A(L)		
	SG/PS	$\overline{P2(WALK)}$	C.P2(WALK)		
	DS	–	$\overline{A.B.D}$		
P3 P.B.	FN	C(PB)	A(L)		
	SG/PS	$\overline{P3(WALK)}$	C.P3(WALK)		
	DS	–	$\overline{A.B.D}$		

SIGNAL GROUP/PHASE CHART

SIGNAL GROUP	PHASES WHEN GREEN A	B	C	D	STANDARD TABLE	REMARKS
V1	X				1	
V2	X	X		X	3	
V3		X		X	34	
V4			C		74	Timed Red protection for 'P3' ped. PB on Post 6 extends Red subject to timer
V5	C		C		79	Timed R.A. protection for 'P1' ped. PB on Post 9 extends RA subject to timer
V6		X	C	X	15	R.A. protection for 'P2' ped Walk & Clearance (Full Protection)
P1	X				2	
P2			X		2	
P3			X		2	



POSTS

POST	TYPE	LENGTH	OFFSET	REMARKS
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2	5XL	–	1.0	NEW
3	2	4.1	1.0	NEW
4	2	4.1	–	NEW
5	2	4.1	–	NEW
6	2	4.1	1.0	EXISTING
7	6	–	1.0	EXISTING
8	2	4.1	1.0	EXISTING
9	2	4.1	1.0	EXISTING
10	2	4.1	1.0	EXISTING

NOTES
1. This site is SCATS linked.
2. Special STOP sign (R1-4) attached to posts 8 and 9.
3. Audio tactile push buttons provided on posts 2, 4, 6, 7, 9 and 10.
4. Kerb ramps are to be constructed at all crossings in accordance with Model Drawing MD.R173.B01.A1.
5. Roadworks in accordance with J. Wyndham Prince construction drawings 0154.358.RC.2520
6. Stoplines in The Northern Road to be 600mm wide.
7. Power supply point to be confirmed by an accredited level 2/3 service provider.

1 Additional set of arrows at standard spacing

A ORIGINAL ISSUE
B ISSUE AMENDED: TB LINE TO REFLECT CORRECT LOCATION 16/07/13 O.S.

PUBLIC UTILITY LEGEND		REFERENCE PLANS	
HYDRANT	□	SYMBOLS/ABBS.	VD003-6
STOP VALVE	△	STD POSIT	VD001-5
GAS VALVE	#	PRES. DETECT	VC005-17
SEWER MANHOLE	Ⓢ	VEH. GROUP OP	TS-TN-019
TELECOM PIT	◪	DET. LOGIC OP	TS-TN-020
ELECT LIGHT POLE	☌	PED. MOVEMNT OP	TS-TN-021
POWER POLE	○		
STAY POLE	⊘		
TELEPHONE BOX	T	SURVEYOR : Insight Surveying	
TELECOM PILLAR	⊘	DATE : 2010	

U.B.D. Ref. Map 144 D13
I.S.G. CO-ORDS E: 274 314 N: 1 256 866
DESIGNED JS
CHECKED CT
CT
SITE CHECKED
RW
RECOMMENDED

DESIGN APPROVAL
APPROVED
R.NETTLE
POSITION DIRECTOR
DATE 10.07.12
DESIGN PREPARED BY TRANSPORT AND TRAFFIC PLANNING ASSOCIATES

RMS ACCEPTANCE
RECOMMENDED
POSITION N.O.T.L.
DATE
ACCEPTED
POSITION R.N. MANAGER
DATE 22/10/12

ROADS AND MARITIME SERVICES
PENRITH COUNCIL AREA
TRAFFIC SIGNALS AT THE INTERSECTION OF THE NORTHERN ROAD (MR 154) AND SOUTHERN ACCESS ROAD
CRANEBROOK
DESIGN LAYOUT TCS No 4396

EXISTING ☐ PROPOSED ☒
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ISSUE B
FILE 358 TS 373
SUPERSEDES SHEET/ISSUE 1A
REGN. 0154.358.VV.4396
SHEET 1

16/07/2013 2:50:36 PM K:\Signals\TCS\vv4300-vv4399\vv4396\Drawings\VV4396_1B.dgn

Appendix B

Western Precinct Traffic Forecasts Layouts

In order to assess the implications of the proposed subdivisions within the context of the Western Precinct, forecasts of evening peak hour traffic for the internal collector road system were developed for full development of the Western Precinct, based on the current dwelling yield plan and the current internal road system layout.

Land Use Mix for Western Precinct

Since the production of the SKM Precinct Plan, the land use mix in the Western Precinct has changed.

The SKM study assumed the following land use mix for the Western Precinct as a whole:

- 2,446 residential dwellings
- 3.4ha retail
- 4.9ha education.

The current land use mix for the Western Precinct as a whole includes:

- 2,490 residential dwellings
- 7,500m^2 retail GLFA
- 2,000 m^2 commercial GLFA
- 4.9ha education.

This assessment examines commercial land use as well as residential, retail and educational land use which were not previously examined in detail as part of the SKM Western Precinct Plan.

The SKM report also relied on a collector road layout which favoured movements to the northern collector road from the central precinct. A revised collector road layout directly connects the Central Precinct with Jordan Springs Boulevard.

Therefore the values calculated in this report vary from those contained in the Precinct Plan. The variance largely is reflected in higher traffic volumes along Jordan Springs Boulevard.

Traffic Assessment

Western Precinct was divided into Villages 1 to 6 according to the dwelling yield plan, with additional zones for retail/commercial and education/community facilities, and the following assumptions used for evening peak hour traffic conditions:

Land Use

- Western Precinct 2,446 dwellings
- Village Centre 7,500m^2 GLFA retail
- Village Centre 2,000 m^2 commercial.

Traffic Generation

- Residential 0.75 trips per dwelling in evening peak
- Retail 6 trips per 100m2 GLFA in evening peak
- Commercial 2 trips per 100m2 GLFA evening peak.

Traffic Distribution

- Residential 75% inbound in evening peak
- 25% of retail trips are pass-by traffic
- 50% of retail trips are generated from within the Western Precinct
- 25% of residential trips are contained within the Western Precinct (to/from retail, education and community facilities)

- Directional distribution on the external road system based on the assumptions used by SKM regarding the design of the access intersections: 70% to/from the south, 20% to/from the north and 10% to/from the west.

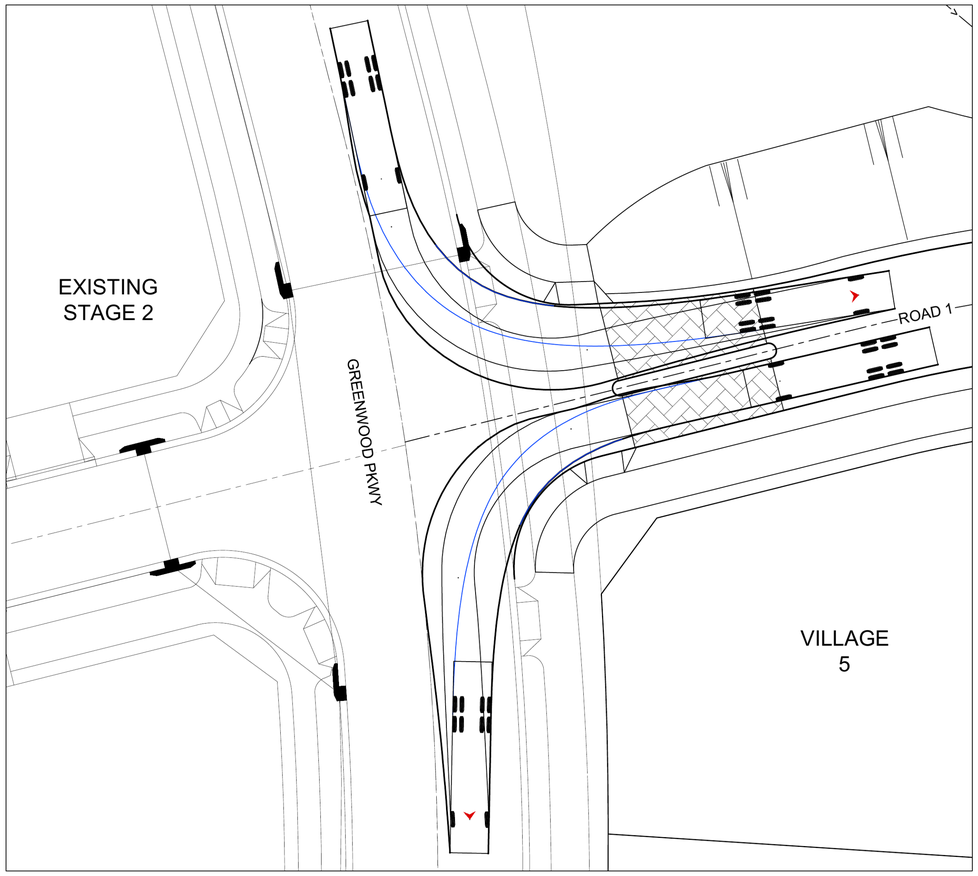
It is expected that some traffic generated by the Central Precinct would use Western Precinct roads to access the external road system. Detailed analysis of the Central Precinct is beyond the scope of this study. The SKM Traffic and Transport Plan report (2009) indicates that the Central Precinct is estimated to generate some 983 vehicle trips per hour, and for the purpose of allowing for Central Precinct through traffic within Western Precinct, it was assumed that 50 per cent of the Central Precinct traffic would travel through the Western Precinct. This traffic was assumed to use both the southern and northern collector roads to travel between The Northern Road and the Central Precinct.

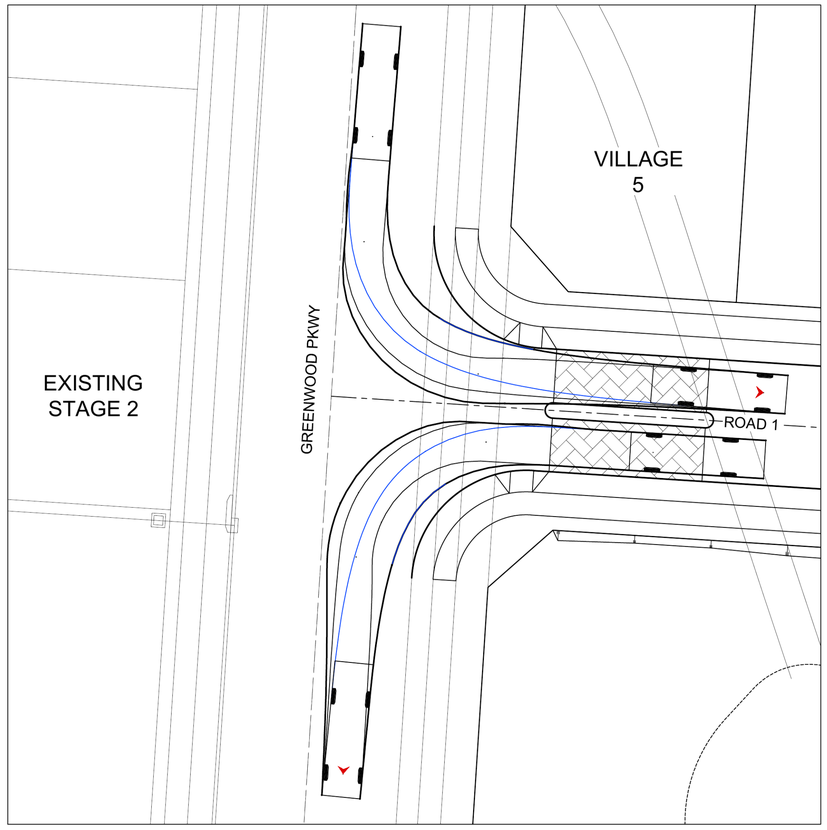
The evening peak hour was chosen as the retail activity is expected to be higher during the evening peak than the morning peak. This will result in a more robust assessment of future traffic volumes and their implications on road and intersection designs.

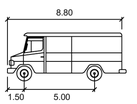
The results of the assessment found that the general layout of the intersections reflect those reported in the SKM report.

Appendix C

Swept Path Analysis

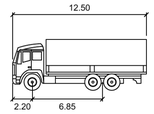






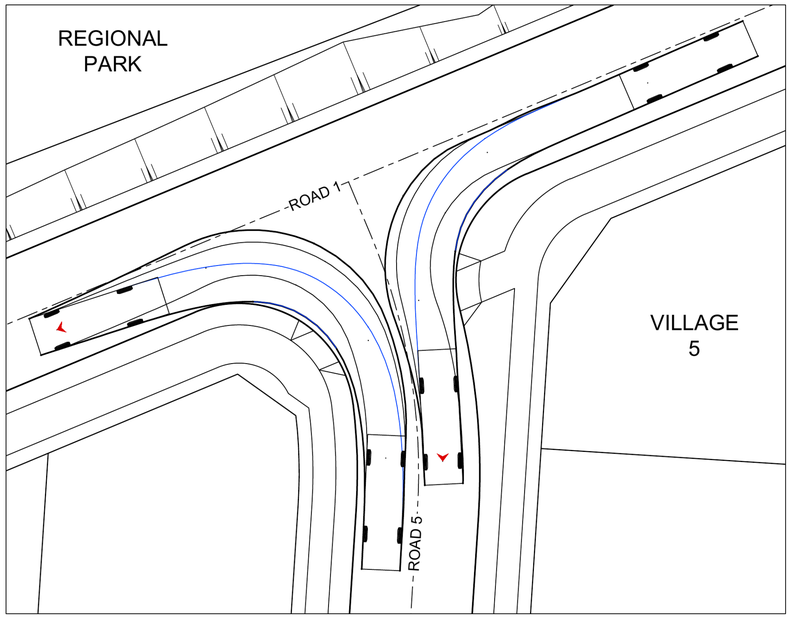
SERVICE VEHICLE

	meters
Width	: 2.50
Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 38.7



SU TRUCK

	meters
Width	: 2.50
Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 36.6



1:200 (AT A1)

4 2 0 4 8 12 16 20

METRES

A	ISSUED FOR INFORMATION	AS	AS			20/06/14
	AMENDMENT	DES	DRN	CKD	APR	DATE

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JORDAN SPRINGS
VILLAGE 5
VEHICLE MANOEUVRING PLAN

PLAN No: 9343/03DA16 A

FILE No: 934303DA16

SHEET SIZE: A1 ORIGINAL

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