Supporting Traffic Impact Assessment

Lilydale Quarry Urban Renewal

V161623

Prepared for
Intrapac

30 October 2020

Cardno

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Executive Summary

Cardno Victoria Pty Ltd has been engaged by Intrapac to undertake a Supporting Traffic Impact Assessment to the Integrated Transport Plan to inform and support the preparation of the Comprehensive Development Plan (CDP) for the Lilydale Quarry urban renewal (Kinley development).

This report has been prepared to determine the likely impact of the Kinley development on the surrounding road network. This will inform a framework for future investment in transport network provisions as development progresses and demand increases. This report is to be considered in conjunction with the Integrated Transport Plan (ITP) prepared for the Lilydale Quarry urban renewal by Cardno.

A number of land uses will be provided as part of the Lilydale Quarry redevelopment, including residential dwellings, a commercial precinct, a potential future train station, a proposed Government Specialist School and mixed-use development. The development is expected to be completed in several stages under separate planning applications. Stage 1 of the development has already been approved by the Yarra Ranges Council (Permit Number YR-2014/932).

As part of this Traffic Impact Assessment, a car parking assessment was undertaken to determine the anticipated car parking demand within the site. It is assumed that the proposed residential dwellings, the potential future train station, proposed Government Specialist School and the mixed development are self-sufficient in providing an adequate number of car parking spaces to meet the anticipated demands.

The anticipated car parking demand for the land uses within the town centre (Precinct 4) is likely to be in the order of 593 car parking spaces. It is anticipated that the development will have provision for 600+ total off-street car parking spaces, excluding the potential future train station (it is assumed that a maximum of 500 spaces will be associated with potential future train station commuters). The anticipated parking provision is considered to be appropriate for the proposed level of development.

The assumed uses within the Kinley development are anticipated to generate approximately 2,300 vehicles per hour (vph) during the weekday morning peak and 2,700 vph during the weekday evening peak. Intersection analysis undertaken in the vicinity of the subject site revealed that most of the existing intersections are currently operating at capacity or are approaching capacity. Introduction of Kinley development traffic volumes into the network would deteriorate the operation of some of the intersections resulting in longer queues and delays. Whilst the operation of some of the intersections can be improved by reviewing the signal operations, road mitigation treatments to key intersections within the existing road network are recommended as part of the development to restore intersection operation back to their current states.

Further intersection analysis was undertaken at the proposed development access intersections. Traffic assessment revealed that all access locations are anticipated to operate satisfactorily with the proposed intersection layouts.

With the recommended road mitigation measures in place, it is anticipated that traffic associated with Kinley residents and commuters will not adversely affect traffic on the existing road network. Thus, there does not appear to be any traffic related concerns that would prevent this development from proceeding in accordance with the CDP.

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1 Introduction & Background

1.1 Purpose of the Traffic Impact Assessment

Cardno Victoria Pty Ltd (Cardno) has been engaged by Intrapac to prepare this Traffic Impact Assessment (TIA) report to inform and support the Integrated Transport Plan (ITP) report for the Lilydale Quarry Stage 2 land (the subject site), which will in turn inform and support the preparation of the Comprehensive Development Plan (CDP) and Infrastructure Contributions Agreement (ICA).

1.2 Consultation

To inform the preparation of the CDP, stakeholder consultation has been undertaken with agencies across key themes including Sustainability, Land Use, Open Space, Integrated Water Management, Heritage, and Integrated Transport. An extensive series of workshops and meetings were held with key government agencies between late 2018 and early 2020 based on each theme to gain feedback to inform the development of the CDP.

In addition to the consultant team, the following organisations participated in the Integrated Transport consultation process:

- Yarra Ranges Council (Council);
- Victorian Planning Authority (VPA);
- Transport for Victoria (TfV), now part of Department of Transport (DoT);
- VicRoads, now part of DoT;
- Public Transport Victoria (PTV), now part of DoT;
- Department of Environment, Land, Water and Planning (DELWP); and
- Department of Economic Development, Jobs, Transport and Resources (DEDJTR), now Department of Jobs, Precincts and Regions (DJPR).

2 Existing Conditions

2.1 Road Network

The subject site is located such that it has convenient access to the strategic northeast – southwest arterial road network, which also provides direct access to the nearby Lilydale Major Activity Centre (MAC).

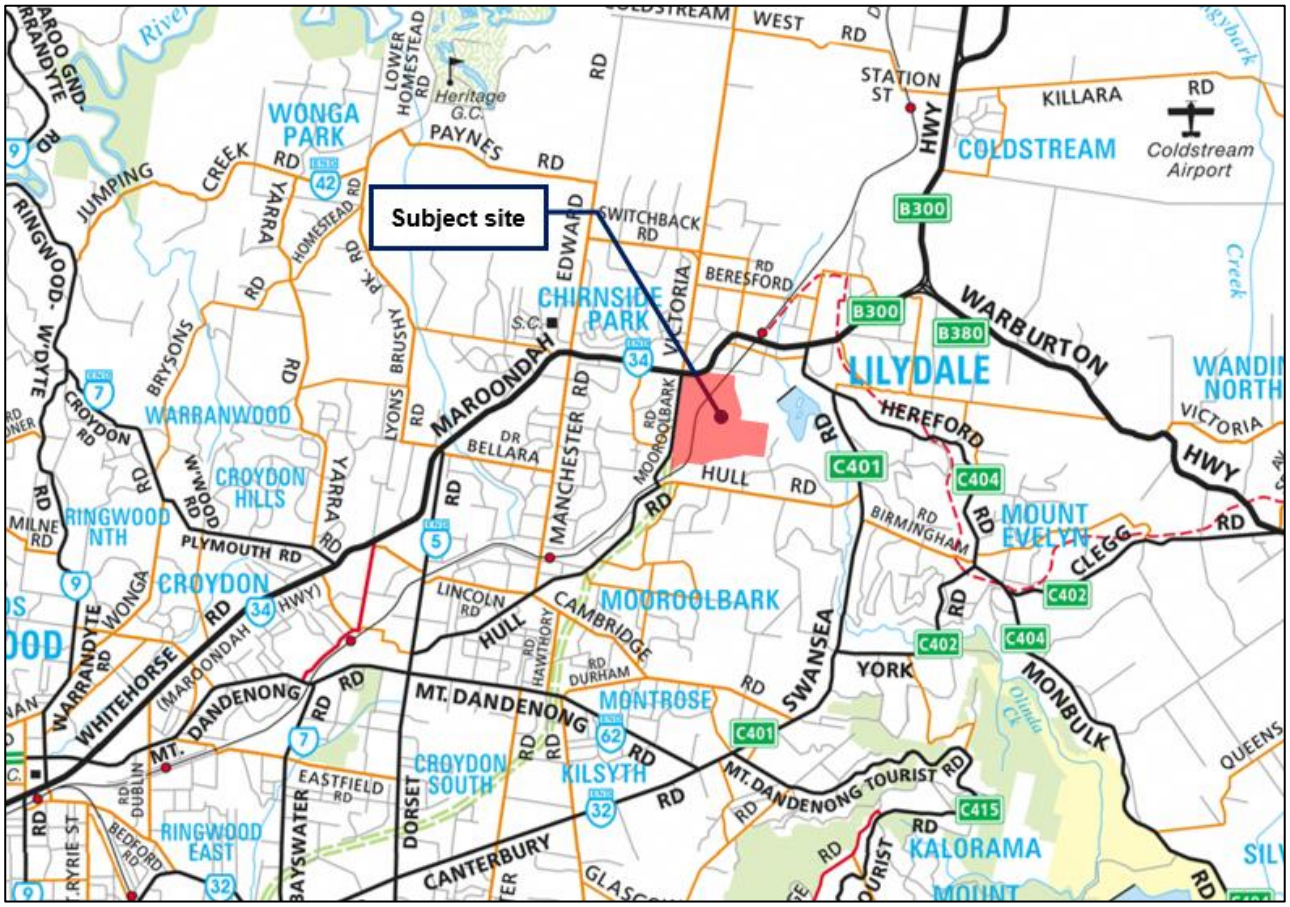
2.1.1 Strategic Road Network

The strategic road network comprises DoT declared roads i.e. freeways and arterial roads, along with certain Council managed secondary arterial and collector roads (or major roads).

With direct access to the strategic road network including Mooroolbark Road and the nearby Maroondah Highway, the subject site has excellent strategic road access to Metropolitan and Major Activity Centres.

The location of the subject site with respect to the strategic road network is shown below.

Figure 2-1 Strategic Road Network Links



Source: Melway

2.1.2 Mooroolbark Road

Mooroolbark Road is a primary arterial road that extends along the western boundary of the subject site. The road is orientated north-south, and provides a connection between Maroondah Highway to the north and Hull Road to the south. Mooroolbark Road has an undivided carriageway and provides a single traffic lane in each direction with a posted speed limit of 70 km/h. According to traffic volume information prepared by DoT, the AADT on the road is 4,000 vehicles (in 2016).

At its northern end, Mooroolbark Road connects to Maroondah Highway via a signalised intersection, and at its southern end, Mooroolbark Road connects to Hull Road via a signalised intersection under a railway bridge. The layouts of these intersections are shown in Figure 2-2 and Figure 2-3, respectively.

Figure 2-2 Victoria Road / Maroondah Highway / Mooroolbark Road Intersection

Figure 2-3 Mooroolbark Road / Hull Road Intersection

Source: Nearmap

2.1.3 Hull Road

Hull Road east of Mooroolbark Road is classified as a major road (acting as a secondary arterial road) under the control and management of Council, providing an east-west connection between Mooroolbark Road to the west and Swansea Road to the east. In the vicinity of the subject site, Hull Road operates as a single carriageway and provides one traffic lane in each direction with gravel shoulders on each side and a speed limit of 70 km/h. At intersections with side roads (such as Carronvale Road, Camelot Court and Summerhill Park Drive) the road widens to provide auxiliary right-turn lanes.

West of Mooroolbark Road, Hull Road is a primary arterial road under the control and management of DoT forming, in conjunction with Mooroolbark Road, an arterial connection between Dorset Road in Croydon and the Maroondah Highway in Lilydale.

2.1.4 Maroondah Highway

The Maroondah Highway is a primary arterial road that abuts the north-western boundary of the subject site. The road is generally orientated east-west and provides a connection to Mooroolbark Road to the west and the Lilydale town centre to the east. Proximate to the subject site, Maroondah Highway has a divided carriageway up to approximately 200 metres east of the Mooroolbark Road intersection, with the remaining carriageway to the east undivided. Two westbound lanes and a single eastbound traffic lane are provided, with a speed limit of 80 km/h. According to traffic volume information prepared by DoT, the AADT on the road is 13,000 to 15,000 vehicles (in 2016).

Footpaths are provided on both sides of Maroondah Highway, including pedestrian-only access through to Taylor Street to the east.

2.1.5 Taylor Street

Taylor Street is an unsealed local street that extends along the northern boundary of the subject site, with connections to Cave Hill Road and Melba Avenue to the east and a cul-de-sac at the western extent of the road. Taylor Street provides for two-way traffic movements with a default speed limit of 50 km/h.

A footpath is provided on the northern side of the road, providing pedestrian access to the Maroondah Highway footpath.

A 30 metre wide road reserve is provided, with an additional 30 metre wide road reserve to the immediate south as a provision for the future Lilydale Bypass.

2.1.6 Melba Avenue

Melba Avenue is a local street located to the north of the subject site which provides an east-west connection between the Taylor Street / Cave Hill Road intersection to the west and the Hutchinson Street / Jarlo Drive intersection to the east. Melba Avenue provides a single traffic lane in each direction with a speed limit of 40 km/h.

A footpath is provided on the northern side of Melba Avenue, offset from the road by up to 45 metres.

A 60 to 80 metre wide road reserve is provided as a provision for the future Lilydale Bypass.

2.2 Traffic Volumes

Existing traffic volumes in the vicinity of the subject site were determined based on survey data and SCATS volume data at signalised intersections.

2.2.1 Traffic Surveys

Turning movement surveys were undertaken on Thursday 14 May 2015 at the following intersections during the anticipated peak hours.

- John Street / Hutchinson Street;
- Hutchinson Street / Maroondah Highway;
- John Street / Cave Hill Road;
- Hardy Street / Anderson Street;
- John Street / Maroondah Highway;
- Mooroolbark Road / Churchill Drive; and
- Mooroolbark Road / Landscape Drive.

A summary of the 2015 survey data is provided in in Appendix A.

An additional turning movement survey was undertaken at the Hutchinson Street / Jarlo Drive / Melba Avenue intersection on Thursday 17 October 2019 to determine the current traffic volumes accessing the Box Hill Institute, which is provided in Appendix A.

2.2.2 SCATS Data

The Data.Vic website provides signal intersection data at major signalised intersections in Victoria. Turning movement data was extracted from the SCATS detector loops located at the following intersections on Thursday 14 May 2015 and Tuesday 5 March 2019:

- Maroondah Highway / Anderson Street (2015 and 2019 data);
- Swansea Road / Hull Road (2015 data only);
- Maroondah Highway / Victoria Road / Mooroolbark Road (2015 and 2019 data);
- Mooroolbark Road / Hull Road (2015 data only); and
- Hutchinson Street / John Street (2019 data only).

2.2.3 Data Evaluation

Scrutiny of the survey data revealed that the morning commuter peak typically occurs between 8.00 am and 9.00 am and the afternoon commuter peak typically occurs between 4.30 pm and 5.30 pm.

To determine the current traffic volumes on the adjacent road network, the 2015 survey data and the SCATS volumes were projected to existing traffic volumes (2020) using an annual compound growth rate of 1.1%.

A high-level comparative assessment was undertaken using the 2019 SCATS volumes (mentioned in Section 2.2.2) to determine the appropriateness of continuing to adopt 2015 traffic volumes and using a growth factor for this traffic impact assessment. SCATS data for the Maroondah Highway / Victoria Road / Mooroolbark Road intersection and the Maroondah Highway / Anderson Street intersection were extracted on Tuesday 5 March 2019 and compared against the 2019 projected volumes. Refer to Table 2-1 for a summary of the comparison assessment.

The assessment revealed that the projected 2019 volumes are generally higher than the actual volumes identified at the signalised intersections (2019 SCATS volumes). Any assessment undertaken using the projected traffic volumes would therefore result in a more conservative approach than if actual traffic volumes are used. Given this, it is considered appropriate to utilise the projected 2020 traffic volumes as a base for this traffic impact assessment. Notwithstanding this, the traffic volumes adopted for traffic assessment at the Hutchinson Street / Jarlo Drive / Melba Avenue intersection are based on the survey undertaken in October 2019.

Table 2-1 Comparison of Predicted and Actual 2019 Traffic Volumes

Int.	Peak	Approach	2019 Projected Volumes	2019 SCATS Volumes	Difference*
Maroondah Highway / Mooroolbark Road	AM Peak Hour	Mooroolbark Rd (S)	555	531	-4%
		Maroondah Hwy (E)	1,199	1,035	-14%
		Victoria Rd (N)	690	617	-11%
		Maroondah Hwy (W)	1,383	1,152	-17%
	PM Peak Hour	Mooroolbark Rd (S)	419	399	-5%
		Maroondah Hwy (E)	1,084	1,166	8%
		Victoria Rd (N)	612	625	2%
		Maroondah Hwy (W)	1,774	1,308	-26%
Maroondah Highway / Anderson Street	AM Peak Hour	Swansea Rd (S)	1,047	623	-40%
		Maroondah Hwy (E)	1,696	1,962	16%
		Anderson St (N)	254	227	-11%
		Maroondah Hwy (W)	555	547	-1%
	PM Peak Hour	Swansea Rd (S)	1,160	862	-26%
		Maroondah Hwy (E)	1,212	1,394	15%
		Anderson St (N)	309	284	-8%
		Maroondah Hwy (W)	983	1,028	5%

** Green refers to approaches where the actual volume is less than the predicted volume and red refers to approaches where the actual volume is greater than the predicted volume*

2.3 Active Transport Modes

An Integrated Transport Plan has been prepared by Cardno for the urban renewal of Lilydale Quarry. The ITP identifies opportunities to integrate a proposed transport network, which considers all users, with the existing surrounding network. This will inform a framework for future investment in transport network provisions as development progresses and demand increases.

Kinley is located such that 20-minute neighbourhood principles and objectives can be met through the provision of a higher density urban core consisting of Transit Oriented Development (TOD) integrated with a potential future train station and public transport interchange along the Lilydale Railway Line.

A permeable and connected overall masterplan is proposed, with a road hierarchy which accommodates and promotes all users, including walkers, cyclists and bus routes. Rail crossings for vehicles and pedestrians have been strategically located to promote a connected community that is able to efficiently access and integrate with the external transport network. Connections to the external active transport network includes key existing off-road shared paths such as the Lilydale-Warburton rail trail, Bayswater-Lilydale trail and Olinda Creek trail.

Refer to the Cardno Integrated Transport Plan: Lilydale Quarry Urban Renewal report for detailed discussions in relation to current and future active modes of transportation in the vicinity of the Kinley development.

3 Proposed Development

3.1 Anticipated Development

The development scenario and yield used as the basis for the traffic assessment is outlined in Table 3-1. Given the development is in the concept master planning stage, some assumptions regarding the nature of the non-residential uses have been made.

Table 3-1 Anticipated Development Yield

Area (Stage & Precinct)	Development Use	Number / Area
Southern Area (Stage 1)	Conventional Dwellings	191 dwellings
Western Area (Stage 2 - Precinct 1)	Conventional Dwellings	287 dwellings
	Large Medium Density (3 or more bedrooms) Dwellings	233
	Medium Density (1 – 2 bedrooms) Dwellings	100 dwellings
	Mixed Use Commercial	6,250 m^2 GFA
	Potential Carpark	200 spaces
Northern, Eastern & Central Areas (Stage 2 – Precincts 2, 3 & 4)	Conventional Dwellings	486 dwellings
	Large Medium Density (3 or more bedrooms) Dwellings	787
	Medium Density (1 – 2 bedrooms) Dwellings	566 dwellings
	High Density Dwellings	600 dwellings
	Proposed Government Specialist School	250 students
	Recreation Reservation	6.77 hectares
	Civic Institution	2,750 m^2 GFA
	Office Commercial	12,300 m^2 GFA
	Retail Opportunity	5,300 m^2 GFA
	Potential Carparks	900 spaces

Kinley could ultimately comprise a total of approximately 3,250 dwellings (including the dwellings in Stage 1), with non-residential uses centred around Transit Orientated Development in the 'urban core' area (proximate to the potential future train station) such as an educational facility, civic institution and office and retail areas. A mixed use / commercial area at the north-west corner of the site is also envisioned.

An internal network of roads is proposed to be provided within the development with four primary access points to the external road network. These include:

- Signals at the Mooroolbark Road / Churchill Drive intersection (DI-RD-01);
- Signals at the Mooroolbark Road / Landscape Drive intersection (DI-RD-02);
- Signals at the Honour Avenue / Hull Road intersection (DI-RD-03); and
- A roundabout at the Hutchinson Street / Melba Avenue intersection and provision of a roundabout connection to Box Hill Institute to the south (DI-RD-04).

Refer to Appendix B for the concept layout plans detailing the above.

3.2 Development Staging

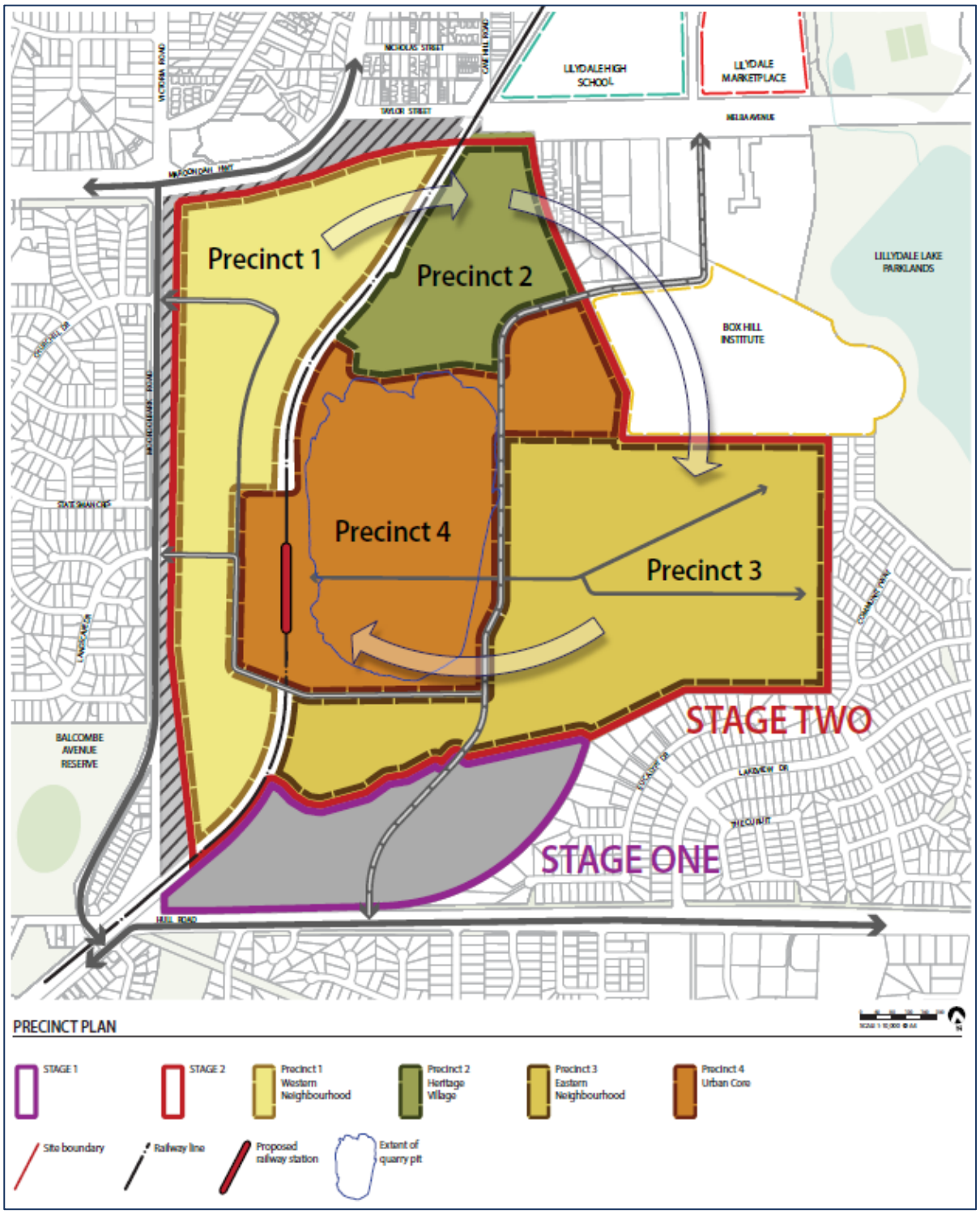
The development of the site will occur progressively over a 20-plus year period until the full yield is realised. As such, the transport network will not be required to cater for projected population immediately. The current and future road and movement network will be considered further as part of the precinct planning stages, responding to the immediate development access needs whilst still considering the ultimate transport network structure.

Development staging will be determined largely by the development proposals on land within the precinct and the availability of infrastructure services. The proposed staging plan (shown in Figure 3-1) is considered to be indicative only and will be further refined through the preparation of detailed precinct plans. Two (or more) precincts may be developed concurrently, subject to the approval of the respective precinct plans.

As such, it has been assumed that for the purpose of this study the development will be completed in two stages as follows:

1. Stage One (Southern Neighbourhood); and
2. Stage Two:
    a. Precinct 1 (Western Neighbourhood),
    b. Precinct 2 (Heritage Village),
    c. Precinct 3 (Eastern Neighbourhood), and
    d. Precinct 4 (Urban Core).

Figure 3-1 Staging Plan



Given that the development staging of the precincts in Stage 2 is indicative only, we have split the subject development into three 'areas' given that the area west of the Lilydale Railway Line (comprising Stage 2 Precinct 1) will have a different traffic distribution than the area east of the railway line (comprising Stage 2 Precincts 2, 3 and 4). The split is as follows:

- Southern Area, comprising Stage 1;
- Western Area, comprising Stage 2 – Precinct 1; and
- Northern, Eastern and Central Area, comprising Stage 2 – Precincts 2, 3 and 4.

This traffic impact assessment has been prepared considering the overall traffic generation of the Kinley development. It is assumed that detailed assessments will be undertaken as development progresses to meet the infrastructure upgrades requirements of each additional stage and precinct.

3.3 Stage 1 (Approved)

Planning Permit No. YR-2014/932 was issued for the development of the Stage 1 or southern area in December 2014 and allows for the development of some 190 residential dwellings with supporting infrastructure.

The Cardno Stage 1 TIA report assessed a development yield of 220 dwellings for the Stage 1 development area. The yield plan for Stage 1 currently contemplates 191 dwellings. The analysis outlined in the Cardno Stage 1 TIA was agreed with both Council and DoT (formerly TfV and VicRoads) at the time following lengthy consultation.

The road network infrastructure approved to facilitate the Stage 1 development includes the partial construction of the North-South Boulevard Connector Street (now known as Honour Avenue) within the site and the construction of the Honour Avenue / Hull Road interim priority-controlled intersection.

A new intersection to Hull Road will be constructed as part of Stage 1, with appropriate widening on Hull Road to provide turning lanes to safely accommodate turning movements. All access to the Stage 1 development area will initially be via the Honour Avenue / Hull Road T-intersection. Improvements will also be made to the existing Hull Road / Mooroolbark Road intersection and a pedestrian refuge provided to provide a linkage between the rail trail (located internal to Kinley) and the Carrum – Warburton Trail to the south.

The ultimate form of the Honour Avenue / Hull Road intersection will be a signalised intersection, designed to provide two through traffic lanes on the Hull Road approaches in addition to left-turn slip lanes in and out of Kinley. The layout will cater for the full development of Kinley as well as background traffic for a 10+ year design horizon.

4 Car Parking Assessment

Car parking requirements for new developments are specified in Column A of Table 1 Clause 52.06 of the Yarra Ranges Planning Scheme. A recent amendment to the to the Victorian Planning Provisions, Amendment VC148 – Planning Advisory Note 72 (July, 2018), indicates that the reduced car parking rates specified in Column B can be adopted if any part of the land is identified as being within 400 m of the Principal Public Transport Network (PPTN).

The subject site is currently outside of the PPTN; however, it is anticipated that a large portion of the site including the town centre area will form part of the PPTN following the future provision of a potential future train station within Kinley. Given this, the car parking rates listed under Column B are considered appropriate for the proposed land uses within the development.

4.1 Statutory Car Parking Requirements

The statutory car parking rates proposed for adoption for the various land uses within the Kinley development are listed in Table 4-1.

Table 4-1 Statutory Car Parking Rates Applicable to Kinley

Land Use	Column B Statutory Car Parking Rate
Residential Dwellings	1 space per one or two bedroom dwelling, plus 2 spaces per three or more bedroom dwellings
Shop	3.5 spaces per 100m^2 of Leasable Floor Area (LFA)
Educational Facility (Proposed Government Specialist School)	0.3 spaces per student that is part of the maximum number of students on the site at any time
Recreational Reserve	Not provided
Place of Assembly	0.3 spaces per patron permitted
Office	3 spaces per 100m^2 of Net Floor Area (NFA)
Train Station	Not provided

Car parking spaces for residents will be primarily provided within each allotment as secure off-street spaces and their visitors will generally be accommodated on-street. Thus, further assessment has not been undertaken in this regard.

The proposed mixed-use facility located in the northwest corner of the subject site has been assumed to be self-sufficient, meeting the statutory car parking requirements internally.

The Planning Scheme currently does not provide a car parking rate for train stations or recreational reserves. As stated in Clause 52.06-6 of the Planning Scheme:

> *"Where a use of land is not specified in Table 1 or where a car parking requirement is not specified for the use in another provision of the planning scheme or in a schedule to the Parking Overlay, before a new use commences or the floor area or site area of an existing use is increased, car parking spaces must be provided to the satisfaction of the responsible authority."*

Given the above, further discussion in relation to car parking provision for the potential future train station and recreational reserve are provided in Sections 4.3 and 4.4, respectively.

4.2 Proposed Government Specialist School

For conservatism, it is assumed that the proposed Government Specialist School will utilise the off-street car parking provided in the town centre. Whilst the facility is located within the 'Urban Core' it is somewhat separated from the town centre due to its position on the eastern boundary of the site (on the opposite side of the internal North-South Boulevard Connector Street). Thus, car parking provision for the facility has been assumed to be 'unbundled' as to promote the use of active and public transport.

Notwithstanding this, if the Government Specialist School is to be ultimately delivered in this location, it would be subject to further planning. As part of that process, it may be determined that the school must have provision for an adequate number of off-street car parking spaces on-site in order to satisfy the statutory

requirement and accommodate the anticipated car parking demand. Additionally, the facility maybe required to expand and include some of the Box Hill Institute land to the east of the site for use as car parking.

4.3 Train Station

A high-level assessment was undertaken at recently developed train stations across Victoria using *Nearmap* aerial imagery to determine the parking provision of new railway stations. The key findings of the assessment are summarised in Table 4-2.

Table 4-2 Parking Provision at Outer Suburban Train Stations

Train Station	Approximate Car Parking Provision
Noble Park Railway Station	360 spaces
Springvale Railway Station	240 spaces
Gardiner Railway Station	240 spaces
Ringwood Railway Station	160 spaces
Average	**250 spaces**

The assessment revealed that train stations generally have provision for approximately 100 – 400 car parking spaces, depending the location and access to activity centres and other modes of transportation.

The potential future Kinley Railway Station is expected to be a minor train station, catering primarily to Kinley residents, employees and students. Due to its close proximity to the Lilydale Railway Station, it is likely to only attract local commuters (i.e. primarily from within Kinley) or those in surrounding residential catchments to the immediate west of the site. Therefore, a car park accommodating 200 spaces is considered appropriate for external commuters to the potential future Kinley Railway Station. It is assumed that the anticipated external demand for the station would be fully accommodated within the train station car park located in Precinct 1, with any parking associated with local train station commuters being accommodated within the Kinley town centre car parking areas.

Notwithstanding the above assessment, DoT has requested that 500 car parking spaces be allocated for potential future train station commuters for the purpose of traffic impact assessment. Given this and considering the preceding discussion, it has been assumed that:

- The 200 spaces in the potential carpark located in the Western Neighbourhood (Stage 2 – Precinct 1) are assumed to be associated with potential future train station commuters residing outside of Kinley; and
- 300 of the 500 spaces in the potential multideck carpark located in the Urban Core (Stage 2 – Precinct 4) are anticipated to be associated with potential future train station commuters residing in Kinley.

4.4 Recreational Reserve

The CDP for Kinley includes 6.7 hectares of land proposed to be allocated for a district level recreation reserve located at the northern edge of the site, directly east of the railway line.

Car parking requirements for recreation reserves are typically dependant on the types of sports facilities located on site and the scheduling of sporting activities (such as training, events and games). A detailed traffic impact assessment will be undertaken in due course to determine the parking requirements of the proposed recreational reserve. It is expected that the proposed recreational reserve will be self-sufficient, with adequate off-street car parking provided to meet the anticipated demands.

4.5 Anticipated Car Parking Requirements

The anticipated car parking requirements for the commercial land uses (i.e. non-residential, non-self-sufficient) within Kinley development is summarised in Table 4-3.

Table 4-3 Kinley Statutory Car Parking Requirements

Land Use	Lot / Area	Car Parking Rate	Car Parking Requirement
Residential Dwellings	3,250 lots	*Self-sufficient*	
Mixed Use Super Lot	6,250 m^2	*Self-sufficient*	
Potential Future Train Station	As advised by DoT for adoption		500 spaces
Proposed Government Specialist School	250 students	0.3 to each student	75 spaces
Recreational Reserve	67,700 m^2	*Self-sufficient*	
Civic Institution [1]	250 patrons	0.3 to each patron permitted	75 spaces
Office	12,300 m^2 GFA	3 to each 100m^2 of NFA	295 spaces
Freestanding Retail	5,300 m^2 GFA	3.5 to each 100m^2 of LFA	148 spaces
Total	**Car Parking Requirement**		**1,093 spaces**

Note 1: 250 patrons assumed
Note 2: GFA refers to Gross Floor Area
Note 3: LFA refers to Leasable Floor Area
Note 4: NFA refers to Net Floor Area
Note 5: NFA and LFA is assumed to be 80% of the GFA

The car parking requirement for the land uses proposed within the Kinley town centre (Stage 2 – Precinct 4) is 1,093 spaces. The town centre is expected to provide 600+ off-street car parking spaces once the 500 spaces associated with the potential future train station are considered, thus satisfying the statutory car parking requirements. Thus, a maximum target of 1,100 off-street car parking spaces is recommended for the development to prevent oversupply and encourage a balance between private vehicle, active transport and public transport options.

5 Traffic Impact Assessment

5.1 Traffic Generation

Cardno has undertaken a thorough trip generation study with the primary aim to appease authority concerns over the trip generation rates proposed for the Kinley development.

A technical memorandum was prepared by Cardno in February 2020 to provide sufficient justification to gain DoT and YRC in-principal agreement (via GTA Consultants) on proposed traffic generation rates prior to finalising the Kinley traffic impact assessment. The technical memo was presented to Council and DoT at a meeting held on 11 February 2020 and at a workshop held on the 20 February 2020.

DoT (in consultation with Council) provided further comments on the proposed traffic generation rates via a letter on 6 August 2020, to which Cardno provided responses on 17 August 2020. In a letter response to Cardno on 17 September 2020, the DoT supplied recommendations for alteration where deemed appropriate and thus, the traffic generation rates for the traffic impact assessment were agreed upon.

The traffic generation rates and the process as to how these were derived and subsequently agreed upon are summarised in the subsequent sections.

5.1.1 Residential Development Trip Generation Rates

The Roads and Maritime Services (RMS) of NSW 'Guide to Traffic Generating Developments' suggests adopting a traffic generation rate of 0.85 trips for each conventional dwelling, .0.40-0.65 trips for each medium density dwelling and 0.29 trips for each high density dwelling during the morning and evening commuter peak hours.

The RMS Technical Direction TDT 2013/04a (provided to supplement the current Guide), suggests that traffic generation is likely to be slightly higher for low density dwellings and lower for high density dwellings.

Given the transit oriented nature of the proposed Kinley development, an empirical assessment and a literature review was undertaken to determine realistic and appropriate traffic generation rates for the residential land use within Kinley.

5.1.1.1 Empirical Assessment

An empirical assessment was undertaken using the Lakeview Heights Estate located immediately to the east of Kinley that predominantly consists of detached residential dwellings. The estate forms an enclosed road network with sole access to the external road network provided via two access road connections to Hull Road. It is bound by Lilydale Lake to the north, Olinda Creek and the Hull Road Wetlands to the east, Hull Road to the south and the Lilydale Quarry to the west. A locality plan of the Lakeview Heights Estate is shown in Figure 5-1.

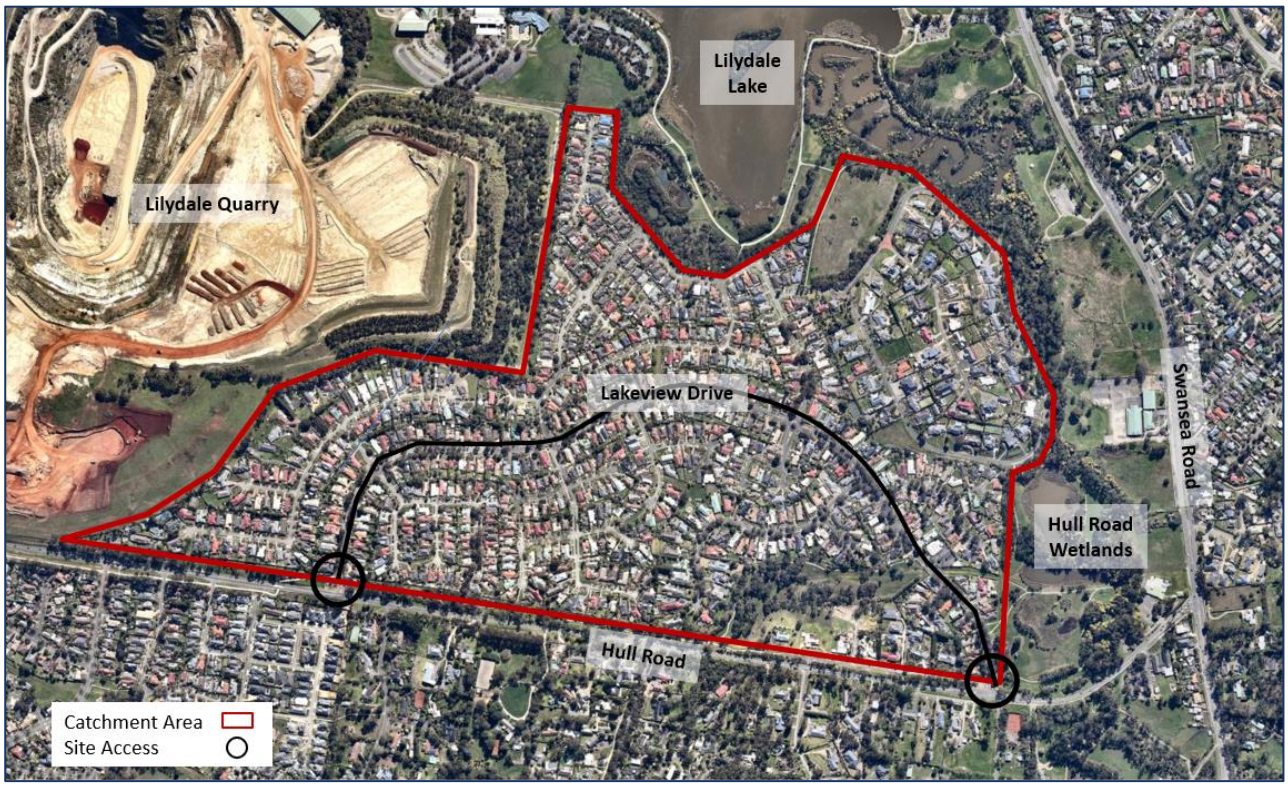
Lakeview Drive operates as a connector street, running as a crescent north of Hull Road, between the two access points to the external road network. This road provides the only vehicular access for the residential estate of 806 dwellings and two commercial premises.

The isolated residential nature of the Lakeview Heights Estate makes it a suitable location to determine the traffic volumes generated solely by residential development in the Lilydale area. It is noted that there are minimal commercial facilities located within the estate and therefore the number of internal trips is likely to be minimal. Residents accessing shops, schools and railway stations will have to enter and exit via the two Hull Road intersections.

An automated tube count was undertaken to determine the amount of traffic accessing Lakeview Heights. Two traffic counters were placed at either end of Lakeview Drive, as detailed Figure 5-2. Data was obtained for the last week of October (from Friday 25 October 2019 to Thursday 31 October 2019), and the results of the traffic survey are provided in Table 5-1.

Scrutiny of the survey data revealed that the Lakeview Heights Estate generates a total of 5,955 vehicle movements per day, 516 vehicle movements per hour during the morning peak period and 597 vehicle movements per hour during the evening peak.

Figure 5-1 Lakeview Heights Estate



© Nearmap Pty Ltd (Image Date 31 August 2019)

Figure 5-2 Left: Tube Counter Placement on Lakeview Drive (West) – Aerial View
Right: Tube Counter Between Hull Road Carriageway and Shared Use Path – Aerial View

Table 5-1 Traffic Survey Volume Results

	Vehicles per Day Weekly Average	Vehicles per Hour AM Peak	Vehicles per Hour PM Peak
Lakeview Drive (West)	3,195 vpd	264 vph	332 vph
Lakeview Drive (East)	2,760 vpd	252 vph	265 vph
Lakeview Heights Estate Trips	5,955 vpd	516 vph	597 vph

To determine the residential traffic generation rates for the Lakeview Heights Estate, the commercial traffic generation needs to be discounted. The commercial properties are located at 18-22 Lakeview Drive and 24

Lakeview Drive. The former was previously a CFA office but now operates as a health services office and the latter operates as Lakeview Kindergarten and Childcare.

The trip generation rates adopted for the commercial uses within the Lakeview Heights Estate are detailed in Table 5-2.

Table 5-2 Adopted Commercial Trip Generation Rates

Commercial Use	Area/No.	Daily	AM Peak	PM Peak
Kindergarten & Childcare	38 Approved Places	4 trips/day	1 trip/hour	1 trip/hour
Health Services Office	510m^2	11 trips/100m^2/day	2 trips/100m^2/hr	2 trips/100m^2/hr

Further to the above, a conservative trip reduction allowance of 20% has been adopted for internal/shared trips. This results in a total external traffic generation of the commercial uses of 166 vehicles per day (vpd) and 39 vehicles per hour (vph) during both the morning and evening peak periods.

Consequently, the residential traffic generation is likely to be in the order of 5,789 vpd, 477 vph during the morning peak and 558 vph during the evening peak. Given that Lakeview Heights currently consists of 806 residential dwellings, the residential traffic generation is likely to be:

- 7.2 trips per day for the weekly average, equivalent the annual average daily traffic (AADT) volume;
- 0.59 trips per hour during the morning peak period; and
- 0.69 trips per hour during the evening peak period.

Based on the survey results the average external traffic generation for conventional residential dwellings is likely to be in the order of 0.64 (average) trips per dwelling during the morning and evening peak hours. This is equivalent to 25% below the traffic generation rates listed in the RTA Guide (2002). Table 5-3 summarises the residential traffic generation rates appropriate to be adopted for any residential development in Lilydale based on a locality factor of 0.75 as per the empirical assessment.

Table 5-3 Peak Hour Residential Trip Generation Rates Based on Case Study

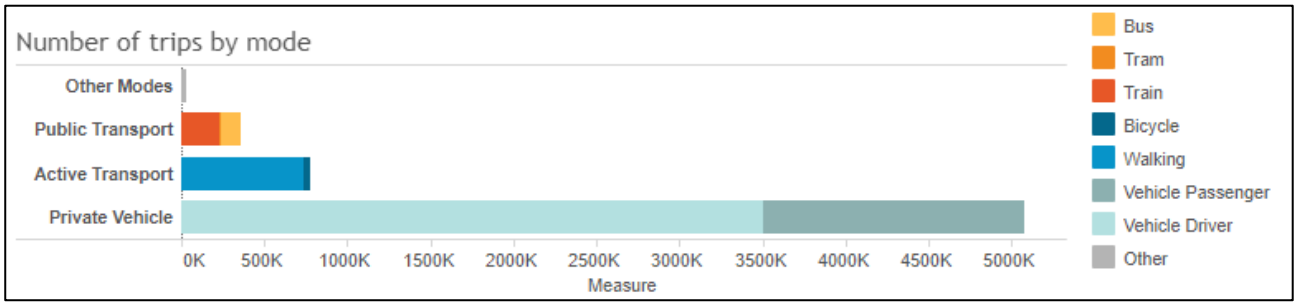
Residential Density	RTA Guide Peak Hour Trip Generation Rates	Locality Factor	Lilydale Residential Trip Generation Rates
Low Density (Conventional Dwellings)	0.85 trips/dwelling	0.75	0.64 trips/dwelling
Medium Density (Townhouses)	0.57 trips/dwelling	0.75	0.43 trips/dwelling
High Density (Apartments)	0.29 trips/dwelling	0.75	0.22 trips/dwelling

5.1.1.2 Literature Review

A literature review was undertaken to establish an appropriate traffic generation rate for Transit Oriented Development (TOD). The Victorian Integrated Survey of Travel and Activity (VISTA) prepared by Transport for Victoria (TfV) details the mode share number by number of trips for Outer Melbourne, where the subject site is situated. An extract of this information is produced in Figure 5-3.

Data is also available for the Yarra Ranges Local Government Area (LGA); however, this is highly skewed given the regional nature of the municipality. Given this, the information from the VISTA Trip Profiler for the Outer Melbourne region of Victoria for the latest survey period (2014-2016) would be more representative of a typical residential estate in the suburb of Lilydale, such as the Lakeview Heights Estate.

Figure 5-3 VISTA Number of Trips by Mode (Outer Melbourne, 2014-16 Survey Period, Weekday Trips)



© VISTA – Trip Profiler, Transport for Victoria (last saved 3 September 2018)

Analysis of the above data indicate that:

- 81.3% of trips occur via private vehicle (56.1% by vehicle driver and 25.2% by vehicle passenger);
- 12.4% of trips occur via active transport (11.8% by walking and 0.6% by cycling);
- 5.8% of trips occur via public transport (3.8% by train and 2.0% by bus); and
- the remaining 0.5% of trips occur via other modes.

As discussed in the ITP prepared for the Lilydale Quarry redevelopment, Kinley is proposed to be a Transit Orientated Development (TOD) designed to reduce reliance on passenger vehicles. Reliance on passenger vehicles will be reduced by providing convenient access to public transport, encouraging higher density living adjacent the Lilydale Railway Line, creating local job opportunities, providing pedestrian and bicycle facilities throughout the estate and within the urban core area.

Based on a literature review of effects of TODs on travel characteristics, it was found that:

- TOD households are twice as likely to not own a car and own roughly half as many cars as comparable households not living in TODs[1];
- TOD commuters typically use active transport two to five times more than other commuters in the region and transit mode share can vary from 5% to nearly 50%; and
- Traditional traffic impact studies might end up overstating the potential congestion inducing effects of TOD housing in large rail-served metropolitan areas by as much as 50 percent[2].

Given the above, it is anticipated that trips via public transport will approximately double and that active transport trips will increase a proportional amount. Therefore, the mode share for a TOD in Lilydale (such as Kinley) could be in the order of:

- 70% of trips via private vehicle;
- 18% of trips via active transport;
- 11.5% of trips via public transport; and
- 0.5% of trips via other modes.

The above represents a relative shift of 14% from private vehicle mode share to active and public transport modes. A summary of the anticipated residential traffic generation rates based on the 14% mode shift is as outlined in Table 5-4.

Table 5-4 Peak Hour Residential Trip Generation Rates for a TOD in Lilydale

Residential Density	Lilydale Typical Trip Generation Rate	Percentage Mode Shift	Lilydale TOD Trip Generation Rate
Low Density (Conventional Dwellings)	0.64 trips/dwelling	14%	0.55 trips/dwelling
Medium Density (Townhouses)	0.43 trips/dwelling	14%	0.37 trips/dwelling
High Density (Apartments)	0.22 trips/dwelling	14%	0.19 trips/dwelling

5.1.1.3 Proposed Development – Kinley

The internal residential trip generation rates for the Kinley development are expected to be similar to those found for the Lakeview Heights Estate. However, given the transit-oriented nature of the Kinley development, it is anticipated that the external peak hour traffic generation will be much lower.

As noted earlier, the traffic generation rates based on the empirical assessment and the literature review as summarised above have been presented to the Yarra Ranges Shire Council and DoT in February and August 2020. Following final correspondence with the DoT and Yarra Ranges Shire Council on 17

[1] *TCRP Report 128: Effects of TOD on Housing, Parking, and Travel*, Transportation Research Board, January 2008
[2] *Vehicle Trip Reduction Impacts of Transit-Oriented Housing*, Journal of Public Transportation, Vol. 11, Vol. 3, September 2008

September 2020, the traffic generations rates summarised in Table 5-5 have been adopted for the Kinley development.

Note the daily traffic generation rates were calculated assuming the peak hour traffic volumes is equivalent to 10% of the daily traffic volume.

Table 5-5 Trip Generation Rates Adopted for Kinley – TOD scenario

Residential Density	Peak Hour	Daily
Low Density (Conventional Dwellings)	0.7 trips/dwelling	7 trips/dwelling
Large Medium Density (3 or more bedrooms)	0.65 trips/dwelling	6.5 trips/dwelling
Medium Density (1 -2 bedrooms)	0.5 trips/dwelling	5 trips/dwelling
High Density (Apartments)	0.3 trips/dwelling	3 trips/dwelling

5.1.2 Non-Residential Trip Generation Rates

5.1.2.1 Mixed Use Commercial Super Lot

The north-western corner of the Kinley development will form a super lot for mixed / commercial use. At this stage the precise future land use of this super lot is difficult to predict; however, for the purposes of preparing a traffic impact assessment for the Kinley development it is assumed that the super lot will form a medical centre or general business office.

The primary access to the super lot will be via left in / left out access on Maroondah Highway. Secondary access points will be provided via internal access roads within the Kinley development.

A trip generation rate for the super lot was determined based on the peak period traffic generation equation listed in the RTA Guide for a shopping centre.

$$Trips\ per\ 1{,}000m^2\ GFA = 20 \times slow\ trade + 51 \times fast\ trade + 155\ \times supermarket + 46\ \times speciality\ shops + 22\ \times medical\ or\ office$$

$$Trips = \frac{22}{1{,}000m^2} = 0.022\ trips\ per\ m^2 GFA = 2.2\ trips\ per\ 100m^2\ of\ GFA$$

As per the above equation, a traffic generation rate of 2.2 trips per 100m^2 of GFA has been adopted for the purposes of this assessment.

It has been assumed that 50% of the trips generated by the mixed use commercial super lot will be accessing the external road network via Kinley development site accesses. This reduction factor applied to the RTA traffic generation rate reflects the likelihood of internal trips (from residential land uses) and non-auto trips resulting from the Transit Oriented Development (TOD) nature of the Kinley development.

The 50% reduction factor is also in line with Commentary 8 of *Austroads Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments*, which provides information on the proportion of new, diverted and undiverted trips to retail centres, and indicates that approximately 50% of trips are new trips and 50% are existing vehicles already on the road network (for retail centres 3,000 to 20,000 sqm in size).

5.1.2.2 Potential Future Train Station

The potential future train station is expected to primarily service a local catchment, given that the Lilydale Railway Station is located approximately 1.8 km north of the site. This along with the fact that the residents will be in close proximity to the potential future train station will encourage a significant number of commuters to access the station by active modes of transportation. This is likely to reduce the overall reliance on passenger vehicles and therefore reduce the peak hour trip generation to and from the site.

The carpark associated with the potential future train station will be comprised of primarily daily commuters (i.e. local residents catching the train to travel to and from work or education). On this basis, the majority of parking turnover will occur during the morning and evening commuter peak periods. Given that the morning peak period for a train station generally occurs in a 2.5-hour period between 7:00 am and 9:30 am, and similarly the evening peak occurs between 4:00 pm and 6:30 pm, a trip generation rate of 0.5 vehicle movements per space has been adopted for both the morning and evening commuter peak hour periods.

5.1.2.3 Proposed Government Specialist School

The anticipated external trip generation rates for the proposed Government Specialist School have been determined based on an empirical assessment.

Local Characteristics

There are numerous primary / secondary educational facilities located close to the future Kinley development; hence, it is assumed that students accessing the proposed facility would primarily be from a small catchment, within a radius of 1 km of the site (approx.). Figure 5-4 illustrates the indicative area of the educational facility catchment and the location of primary and/or secondary schools near Kinley.

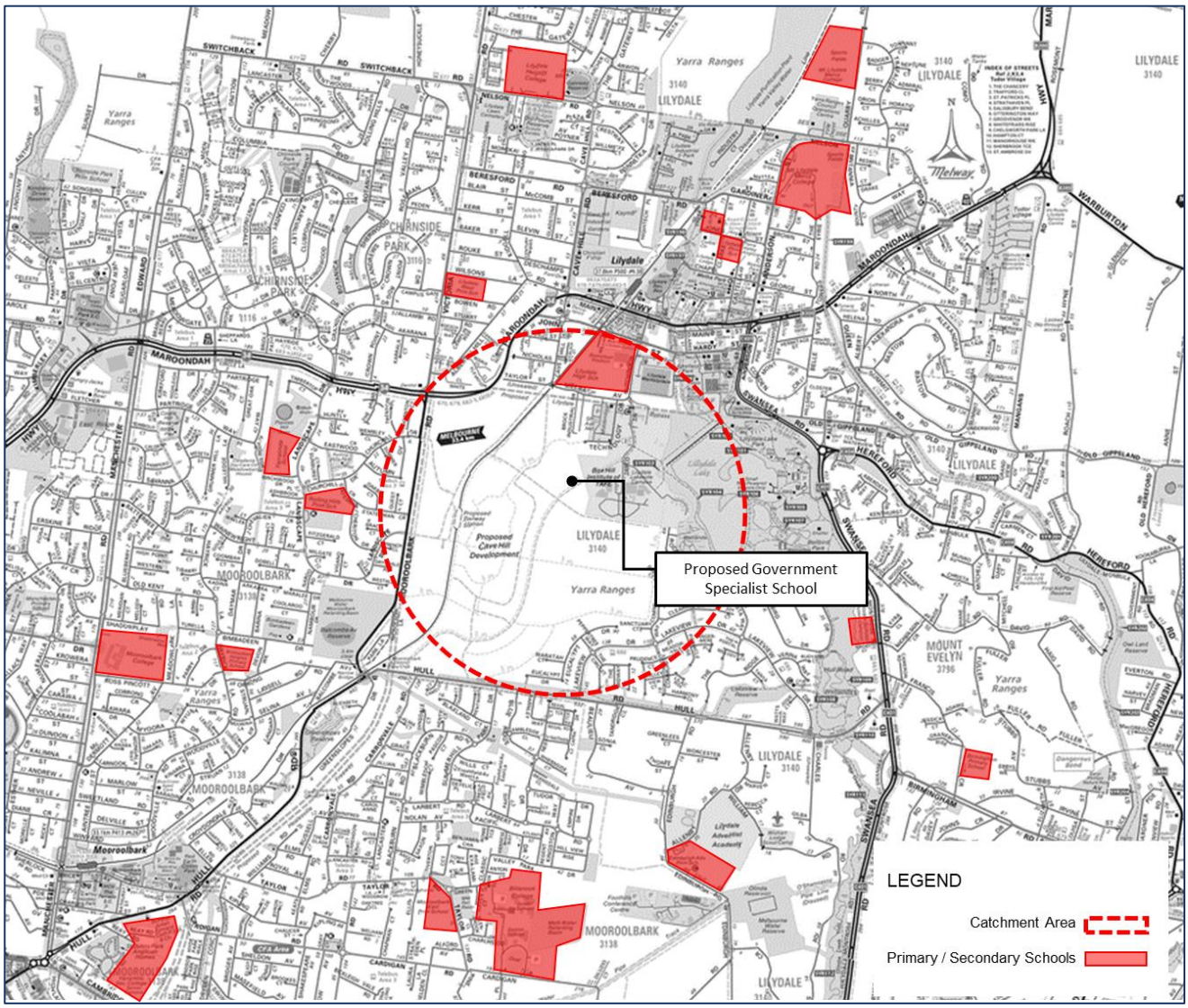
The local nature of the proposed Government Specialist School would encourage a significant portion of the trips to be made by active modes of transportation and a large portion of the trips to be multi-purpose trips (i.e. dropping children off on the way to work). It should be noted that the residential trip generation rates proposed take into consideration trips to/from the facility and work, thus adopting a conventional school trip generation rate would overestimate traffic generation.

The proposed Government Specialist School would also be located close to public transport services (trains and buses) and adjacent good bicycle and pedestrian networks. This encourages the use of active modes of transportation, further reducing the reliance on passenger vehicles.

Trip Generation

Case study data held by Cardno indicates that a traffic generation rate of 0.75 trips per student (approx.) is appropriate for a typical primary school during the peak hour periods associated with school drop-off and pick-up. However, given the local nature of the proposed Government Specialist School and its accessibility to the public transport and bicycle / pedestrian networks, a lower traffic generation rate of 0.4 trips per student during the morning peak hour (drop-off period) is considered more appropriate. During the evening peak hour, the school pick-up period is highly unlikely to coincide with the commuter peak hour of the adjacent road network, hence a lower traffic generation rate of 0.2 trips per student has been adopted.

Figure 5-4 Indicative Educational Facility Catchment Area



5.1.2.4 Town Centre

The anticipated development within the Kinley town centre will consist of commercial offices, retail facilities and a potential civic institution. The traffic generation for the town centre was determined based on the anticipated floor areas of the future land uses. Each land use within the town centre area is discussed in detail in the subsequent sections.

Civic Institution

It is anticipated that the peak traffic generation to / from the potential civic institution is likely to occur outside of the commuter peak hours. Therefore, for the purposes of preparing the traffic impact assessment it was assumed that a negligible peak hour traffic generation rate is appropriate to be assumed for the potential civic centre within Kinley.

Retail

Traffic generation rates for retail facilities are typically referenced from the Roads and Maritime Services (RMS) of NSW RTA 'Guide to Traffic Generation Developments' (2002) document and its RMS Technical Direction TDT 2013/04a update 'Guide to Traffic Generating Developments – Updated Traffic Surveys'. As per these documents an evening peak hour traffic generation rate of 12.5 trips per 100m2 gross leasable floor area (GLFA) rate is considered appropriate for retail facilities with less than 10,000m2 GLFA. However, it is anticipated that the proposed retail development within the Kinley town centre will generate lower traffic volumes due its local convenience and its proximity to the public transport network. A large portion of the patrons accessing the retail facility will likely be residents living in the area or employees / students / patrons accessing other land uses within the town centre. Therefore, majority of the patron trips generated by the

retail facility are expected to be either multi-purpose trips or trips made via alternative modes of transport (i.e. walking, cycling, public transport). Due to this a lower traffic generation rate has been adopted for the retail land use located within the Kinley town centre.

Based on previous traffic impact studies undertaken for similar retail facilities in similar transit oriented environments a traffic generation rate of 8 trips per 100m2 leasable floor area (LFA) is considered to be appropriate for the Kinley development.

Furthermore, whilst the traffic generation rates provided in the RTA Guide and the RMS update to the RTA Guide do not indicate a traffic generation rate for the AM peak period, Cardno has conservatively assumed that morning peak hour traffic will be approximately 10% of the traffic generated during the evening peak hour period. This will account for any traffic volumes generated by retail employees accessing the site during the morning peak period.

Commercial Office

The RTA Guide indicates a traffic generation rate of 2 trips per 100m^2 gross floor area (GFA) and the RMS update (TDT 2013/04a) to the RTA Guide rates indicates 1.2 – 1.6 trips per 100m^2 GFA for an office development. Given the transit-oriented nature of the Kinley development, it is anticipated that the traffic generation rate for the commercial office will be lower than the rates identified by RMS.

Therefore, the traffic generation rate for an office use was determined based on the statutory car parking rates listed in the Yarra Ranges Planning Scheme. As mentioned in Section 4 of this report, a lower car parking rate (listed in Column B of Table 1) is applicable to commercial development within the 400m of the PPTN. This results in a statutory car parking rate of 3 spaces per 100m^2 of net floor area (NFA).

Assuming one (1) car parking space typically generates 0.5 trips during the peak hour, a traffic generation rate of 1.5 trips per 100m^2 NFA is considered appropriate for the office land use located within the Kinley town centre.

Town Centre Traffic Generation Rate Summary

Refer to Table 5-6 for a summary of the endorsed traffic generation rates for the anticipated town centre land uses.

Table 5-6 Town Centre Traffic Generation Rates Endorsed by Yarra Ranges Shire Council for Kinley

Development Use	Peak Hour Trip Generation Rate
Civic Institution	N/A
Retail Opportunity	8 trips per 100m^2 LFA
Office Commercial	1.5 trips per 100m^2 NFA

5.1.2.5 Recreational Reserve

It is anticipated that the peak traffic generation to / from the proposed recreational reserves and open space areas are likely to occur outside of the commuter peak hours. Therefore, for the purposes of preparing the traffic impact assessment it was agreed that any traffic generated by recreational reserves or open space areas would be insignificant.

5.1.3 Summary of Traffic Generation Rates

On basis of the preceding discussions and analysis, we believe that the external trip generation rates summarised below in Table 5-7 are appropriate for use for the Kinley development, considering that it will be a TOD. These traffic generation rates are supported by the DoT, Yarra Ranges Shire Council and GTA Consultants along with various other documents (i.e. traffic survey data, the RTA Guide, VISTA trip data, TOD literature and trip generation rates adopted for other VPA strategic sites).

Table 5-7 Kinley Development Trip Generation Rates

Development Use		AM Peak Hour Generation	PM Peak Hour Generation
Low Density (Conventional Dwellings)		0.7 trips per dwelling	0.7 trips per dwelling
Large Medium Density		0.65 trips per dwelling	0.65 trips per dwelling
Medium Density (Townhouses)		0.5 trips per dwelling	0.5 trips per dwelling
High Density (Apartments)		0.3 trips per dwelling	0.3 trips per dwelling
Potential Future Train Station (Car Parking)		0.5 trips per space	0.5 trips per space
Proposed Government Specialist School		0.4 trips per student	0.2 trips per student
Town Centre	Civic Institution	N/A	N/A
	Retail Opportunity	10% of 8 trips per 100m^2 LFA	8 trips per 100m^2 LFA
	Office Commercial	1.5 trips per 100m^2 NFA	1.5 trips per 100m^2 NFA
Mixed Use Commercial (Super Lot)		2.2 trips per 100m^2 GFA	2.2 trips per 100m^2 GFA
Open Space		N/A	N/A

5.1.4 Traffic Generation

Based on the traffic generation rates summarised in Table 5-7, it is anticipated that overall Kinley development will ultimately generate 2,300 vehicles per hour (vph) during the morning commuter peak and 2,700 vph during the evening commuter peak. Refer to Table 5-8 for a summary of the traffic generation calculation for the Kinley development.

Table 5-8 Total Anticipated Traffic Generation for Kinley

Area	Land Use	Factor	Peak Hour	
			AM Generation	PM Generation
South	Conventional Dwellings	191 lots	134 vph	134 vph
West	Conventional Dwellings	287 lots	201 vph	201 vph
	Large Medium Density (3 or more bedrooms) Dwellings	233 lots	151 vph	151 vph
	Medium Density (1 – 2 bedrooms) Dwellings	100 lots	50 vph	50 vph
	High Density Dwellings	- lots	0 vph	0 vph
	Mixed Use - Super Lot [1]	6,250 m^2 GFA	69 vph	69 vph
	Potential Future Train Station Car Park	200 spaces	100 vph	100 vph
North, East & Central	Conventional Dwellings	486 lots	340 vph	340 vph
	Large Medium Density (3 or more bedrooms) Dwellings	787 lots	512 vph	512 Vph
	Medium Density (1 – 2 bedrooms) Dwellings	566 lots	283 vph	283 vph
	High Density Dwellings	600 lots	180 vph	180 vph
	Proposed Government Specialist School	250 students	100 vph	50 vph
	Office Commercial	12,300 m^2 GFA	185 vph	185 vph
	Retail Opportunity	5,300 m^2 GFA	42 vph	424 vph
	Multi Deck Car Park	900 spaces		
Total			**2,346 vph**	**2,678 vph**

Note 1: Only 50% of the traffic generated by the super lot is expected to utilise the internal road network

5.1.4.2 Internal Trips

The RMS Technical Direction 'Guide to Traffic Generating Developments: Updated Traffic Surveys' (TDT 2013/04a) identifies that (when referring to the trip generation rates specified for low density dwellings) "trips made internal to the subdivision … may add up to an additional 25%". If this percentage is expressed as a percentage of total trips (rather than external trips), it translates to a 20% trip reduction (i.e. if the percentage is expressed as per total trips rather than external trips, then external trips would be a minimum of 80% of the total trips generated by the development, with a maximum of total 20% of trips being internal only).

The Trip Generation Surveys: Low Density Residential Dwellings analysis report prepared by TEF Consulting in association with Gennaoui Consulting for the NSW Roads and Traffic Authority (RTA, now RMS) specifies that:

> *"It is important to note that the RTA (2002) Guide suggests that internal trips, involving trips to local shops, schools and social visits may account for up to 25% of trips. In this regard it is important to consider that half of the survey areas in the present study did not have internal trip generation attractors other than residential dwellings. On the other hand, it is noted that where such attractors exist, they generate not only internal, but also external trips."*

Thus, the analysis report references that the original traffic surveys included up to 25% of trips internal to the subdivision (involving local social visits and local trips to shops, schools, child care centres and recreational facilities). However, the traffic survey adopted from the Lakeview Heights Estate only refers to residential traffic generation volumes.

Given that Kinley is to be a mixed-use development with a town centre incorporating retail, office and educational facilities, additional traffic should be considered when assessing the overall development. However, the traffic impact assessment for the Kinley development has been undertaken taking into consideration the traffic generation of each land use within the development. Therefore, an application of the internal trip percentage would result in an over estimation of the total traffic generation to / from Kinley.

5.1.4.3 External Trips

There are limited north-south connections between the Maroondah Highway and Hull Road (east of Mooroolbark Road and west of Swansea Road). Construction of a new North-South Boulevard Connector Street within the Kinley development may provide an opportunity for northbound and southbound vehicles to 'cut through' Kinley in order to access local attractors like Box Hill Institute, the Lilydale Marketplace and Lilydale High School.

This would potentially increase the traffic volumes accessing the site, particularly at the Hull Road intersection (DI-RD-03), located to the south, and at the northern roundabouts to Box Hill Institute (DI-RD-04B) and Hutchinson Street / Melba Avenue (DI-RD-04A). While this may deteriorate the operation of the development access locations, it would improve the operation of some of the external intersections such as the Swansea Road / Hull Road intersection and the Maroondah Highway / Anderson Street intersection due to vehicles utilising the local road network. However, the net impact on the overall road network would be minimal as drivers tend to redistribute over time based on traffic conditions to avoid queues and delays.

It has been assumed that 150 additional vehicles would travel through the Kinley development (along Honour Avenue) in order to access the Box Hill Institute and the Lilydale High School during the morning and evening commuter peak hour traffic periods. These traffic volumes have not been redistributed from intersections external to the subject site for conservatism.

5.1.4.4 No Potential Future Train Station Scenario

A high-level traffic generation assessment was undertaken to determine the anticipated traffic generation volumes from the Kinley development if the potential future Kinley train station is not developed. It is understood that in this scenario, the Kinley town centre area will be replaced with more conventional residential development with significantly reduced mixed-use and commercial facilities. The potential reduced dwelling density based on not delivering the train station is likely to increase dwelling numbers, but result in less traffic generated across the development due to the removal of the non-residential uses in the urban core.

In the case where the potential future Kinley train station is not developed, the residential lots within Kinley will generate similar traffic volumes to the residential lots within the Lakeview Heights Estate. However, for the purposes of this assessment, slightly higher residential traffic generation rates have been adopted to provide a conservative assessment, following correspondence with DoT and the Yarra Ranges Shire Council on 17 September 2020, as set out overleaf:

- Conventional dwellings – 0.75 trips per dwelling;
- Large medium density (3 or more bedrooms) dwellings – 0.7 trips per dwelling
- Medium density (1 – 2 bedrooms) dwellings – 0.6 trips per dwelling; and
- High density dwellings – 0.4 trips per dwelling.

Refer to Table 5-9 below for a summary of the total traffic generation associated with the 'no train station' scenario.

Table 5-9 Total Anticipated Traffic Generation for Kinley – No Train Station Scenario

Precinct	Land Use	Factor	Peak Hour	
			AM Generation	PM Generation
South	Conventional Dwellings	191 lots	143 vph	143 vph
West	Conventional Dwellings	337 lots	253 vph	253 vph
	Medium Density Dwellings	173 lots	121 vph	121 vph
	High Density Dwellings	7 lots	3 vph	3 vph
	Mixed Use - Super Lot	6,250 m^2 GFA	69 vph	69 vph
Central & East	Conventional Dwellings	646 lots	485 vph	485 vph
	Medium Density Dwellings	657 lots	460 vph	460 vph
	High Density Dwellings	49 lots	20 vph	20 vph
Total			**1,553 vph**	**1,553 vph**

Note 1: As a conservative approach, all medium density lots are assumed to be 'large' medium density lots with 3 or more bedrooms, and accordingly, the peak period trip generation rate used is 0.7 trips/dwelling.

As detailed above, approximately 1,550 vehicles per hour will be generated by the Kinley development if a train station is not constructed. This is significantly below the anticipated traffic generation if the Kinley potential future train station is developed (refer to Table 5-8); and therefore, no further assessment has been undertaken for this alternative scenario.

5.2 Traffic Distribution

5.2.1 Traffic Split

The traffic split assumed for the purposes of this assessment are outlined in Table 5-10.

Table 5-10 Peak Hour Traffic Split per Development Use

Development Use	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
Residential	20%	80%	60%	40%
Proposed Government Specialist School	60%	40%	40%	60%
Urban Core Uses	70%	30%	40%	60%
Potential Future Train Station Car Park	90%	10%	10%	90%
Mixed Use Super Lot	70%	30%	40%	60%

5.2.2 External Trip Distribution

Trip distribution has been undertaken considering the various land use within and surrounding Lilydale, the survey data from the Victorian Integrated Survey of Travel and Activity (VISTA) and traffic surveys undertaken in the area.

The traffic distribution is broadly outlined in Table 5-11. The trip distribution to/from different areas of the subject site differs slightly due the provision of the North-South Boulevard Connector Street (Honour Avenue) provided through the eastern section of the development site. Refer to Appendix C for detailed discussion of the traffic distributions assumptions made.

Table 5-11 Traffic Distribution

Distribution Route	Stage 1		Stage 2 – Precinct 1		Stage 2 – Precincts 2-4	
	AM	PM	AM	PM	AM	PM
North via Victoria Road	5%	4%	6%	4%	5%	4%
West via Maroondah Highway	31%	30%	31%	31%	31%	30%
East via Maroondah Highway	10%	13%	18%	25%	10%	13%
West via Hull Road	30%	30%	26%	23%	30%	30%
East via Hull Road	24%	23%	19%	17%	24%	23%

5.3 Anticipated Traffic Volumes

It has been agreed with DoT that the traffic assessment will be based on existing traffic volumes (predicted 2019 volumes) plus the development traffic volumes to determine the impact of the urban renewal of the quarry site, thus establishing the overall volumes for any mitigation measures. Post development traffic volumes have been derived by adding the site generated traffic volumes to background traffic volumes and the morning and evening peak hour volumes are outlined in Appendix D.

Notably, assessment of post development volumes is based on ‘first principles’ and also assumes no major changes to the wider arterial road network (e.g. the Lilydale Bypass or extra lanes on Maroondah Highway), which would lessen the impact of the urban renewal of the quarry site on the wider road network.

6 Intersection Analysis

Intersection analysis has been undertaken to determine the existing operation of the road network and to determine the traffic impacts of the Kinley development. The following intersections have been taken into consideration:

- Mooroolbark Road / Site Access / Churchill Drive (DI-RD-01);
- Mooroolbark Road / Site Access / Landscape Drive (DI-RD-02);
- Honour Avenue / Hull Road (DI-RD-03);
- Hutchinson Street / Jarlo Drive / Melba Avenue (DI-RD-04A);
- Hutchinson Street / John Street (DI-RD-05);
- Victoria Road / Maroondah Highway / Mooroolbark Road (DI-RD-06);
- Mooroolbark Road / Hull Road (DI-RD-07A);
- Swansea Road / Hull Road (DI-RD-08);
- Anderson Street / Hardy Street;
- Anderson Street / Maroondah Highway; and
- Maroondah Highway / Hutchinson Street.

The intersections have been analysed using the SIDRA Intersection modelling program. This computer package, originally developed by the Australian Road Research Board (ARRB), provides information about the capacity of an intersection in terms of a range of parameters, as described below:

- ***Degree of Saturation (DoS)*** is the ratio of the volume of traffic observed making a particular movement compared to the maximum capacity for that movement. Various values of degree of saturation and their rating are shown in Table 6-1.

  Table 6-1 Rating of Degree of Saturation

DoS	Rating
Up to 0.6	Excellent
0.6 to 0.7	Very Good
0.7 to 0.8	Good
0.8 to 0.9	Fair
0.9 to 1.0	Poor
Above 1.0	Very Poor

  It is considered acceptable for some critical movements in an intersection to operate in the range of 0.9 to 1.0 during the high peak periods, reflecting actual conditions in a significant proportion of inner-city signalised intersections.

- The **95th Percentile (95%ile) Queue** represents the maximum queue length, in metres, that can be expected in 95% of observed queue lengths in the peak hour.
- **Average Delay** is the delay time, in seconds, which can be expected over all vehicles making a particular movement in the peak hour.

Discussion regarding the assessment for each intersection is provided in the following sections, with detailed output sheets (including lane summaries and phasing summaries) enclosed in Appendix E.

6.1 Site Access Intersections

Kinley is to be accessed via signalised intersections located on Mooroolbark Road, Hull Road and via a roundabout connection to Jarlo Drive (providing access to Melba Avenue and Hutchinson Street). The four major site access points that provide a linkage from Kinley to the external road network are detailed below.

6.1.1 Mooroolbark Road / Site Access / Churchill Drive Intersection (DI-RD-01)

The current configuration of the Mooroolbark Road / Site Access / Churchill Drive intersection is a three-way priority-controlled intersection. As part of the future Kinley development, the Mooroolbark Road / Churchill Drive intersection is proposed to form a four-way signalised intersection, as shown in Figure 6-1.

Intersection analysis was undertaken to determine the operation of the four-way intersection in in 2030 with the development traffic volumes and the underlying growth, of which the results are provided in Table 6-2. The assessment revealed that the intersection would operate below capacity (DoS 1) with minimal queues and delays.

Figure 6-1 Mooroolbark Road / Site Access / Churchill Drive Intersection – Proposed Layout

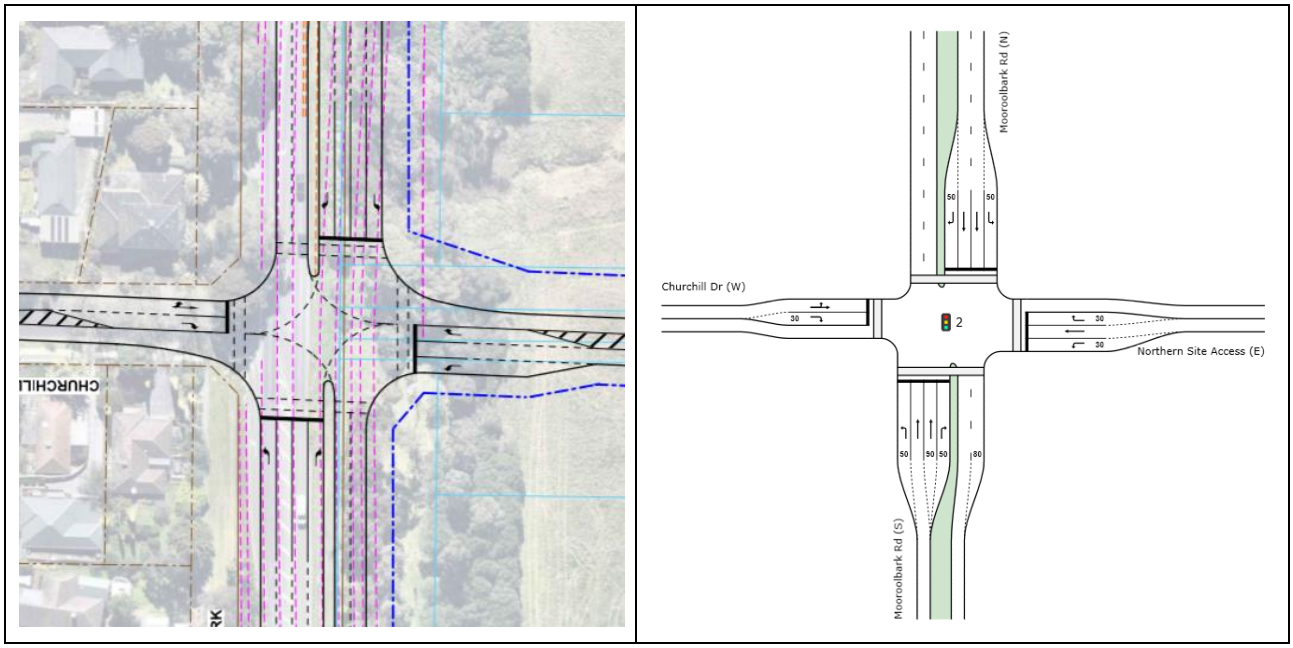


Table 6-2 Mooroolbark Road / Site Access / Churchill Drive Intersection – Proposed Layout Anticipated Operation: 2030 + Development Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Mooroolbark Rd (S)	0.684	25	124
	Site Access St (E)	0.619	40	36
	Mooroolbark Rd (N)	0.669	25	107
	Churchill Dr (W)	0.263	33	28
PM Peak Hour	Mooroolbark Rd (S)	0.458	21	78
	Site Access St (E)	0.766	45	32
	Mooroolbark Rd (N)	0.780	25	151
	Churchill Dr (W)	0.137	35	13

6.1.2 Mooroolbark Road / Site Access / Landscape Drive Intersection (DI-RD-02)

The current configuration of the Mooroolbark Road / Site Access / Landscape Drive intersection is a three-way sign controlled intersection. As part of the future Kinley development, the Mooroolbark Road / Landscape Drive intersection is proposed to form a four-way signalised intersection, as shown in Figure 6-2.

Intersection analysis was undertaken to determine the operation of the four-way intersection in in 2030 with the development traffic volumes and the underlying growth, of which the results are provided in Table 6-3. The assessment revealed that the intersection would operate below capacity (DoS 1) with minimal queues and delays.

Figure 6-2 Mooroolbark Road / Site Access / Landscape Drive Intersection – Proposed Layout

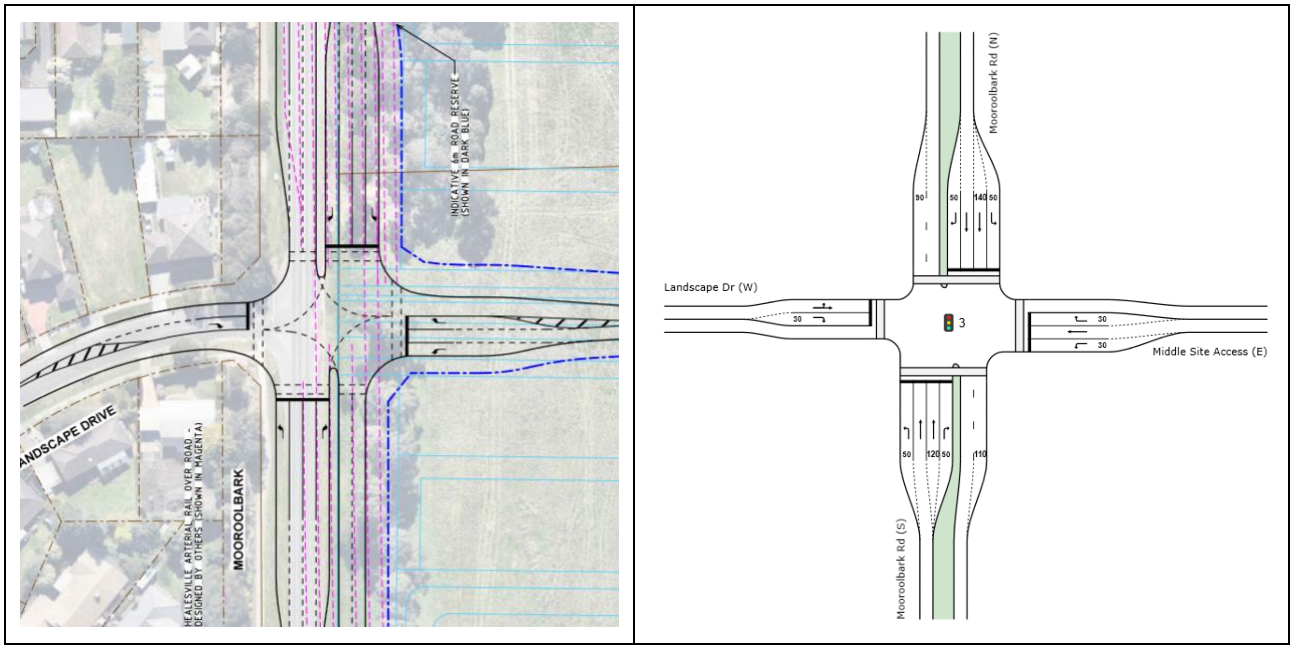


Table 6-3 Mooroolbark Road / Site Access / Landscape Drive Intersection – Proposed Layout Anticipated Operation: 2030 + Development Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Mooroolbark Rd (S)	0.747	23	145
	Site Access St (E)	0.754	44	37
	Mooroolbark Rd (N)	0.489	22	84
	Landscape Dr (W)	0.433	40	20
PM Peak Hour	Mooroolbark Rd (S)	0.628	22	109
	Site Access St (E)	0.607	42	28
	Mooroolbark Rd (N)	0.645	22	112
	Landscape Dr (W)	0.188	39	8

6.1.3 Honour Avenue / Hull Road Intersection (DI-RD-03)

A signalised three-way intersection is proposed to be located approximately 550-600 m east of the Mooroolbark Road / Hull Road intersection. This intersection is the southern connection of the main North-South Boulevard Connector Street (to be known as Honour Avenue), which is the primary access road within Kinley. The proposed intersection layout is shown in Figure 6-3.

Intersection analysis was undertaken to determine the operation of the intersection post full development in 2030. The SIDRA Intersection results are detailed in Table 6-4. The assessment revealed that the intersection is likely to operate below capacity with minimal queues and delays.

Figure 6-3 Honour Avenue / Hull Road Intersection – Proposed Layout

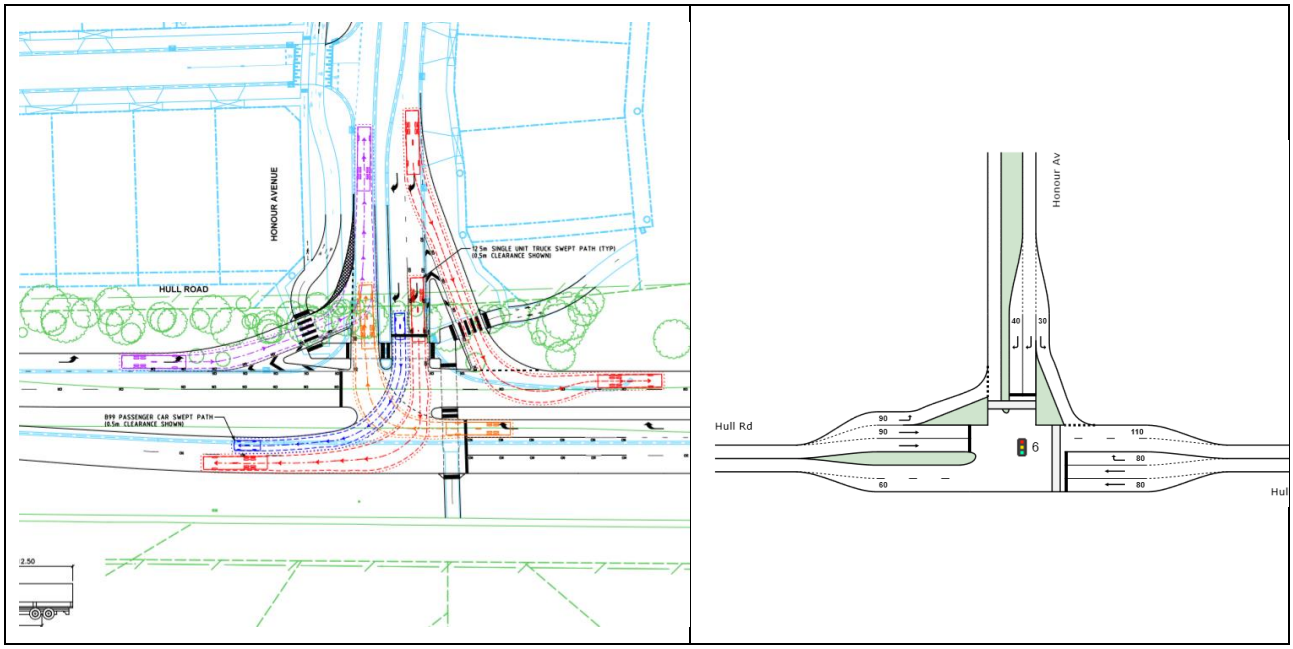


Table 6-4 Honour Avenue / Hull Road Intersection – Proposed Layout Anticipated Operation: 2030 Volumes + Development

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Hull Rd (E)	0.854	14	107
	Honour Ave (N)	0.907	28	96
	Hull Rd (W)	0.895	23	159
PM Peak Hour	Hull Rd (E)	0.756	16	70
	Honour Ave (N)	0.745	22	64
	Hull Rd (W)	0.742	17	76

6.1.4 Hutchinson Street / Jarlo Drive / Melba Avenue Intersection (DI-RD-04A)

A three-way roundabout is proposed to be introduced at the Melba Avenue / Jarlo Drive / Hutchinson Street intersection, as shown in Figure 6-4.

Intersection analysis was undertaken to determine the anticipated operation of the intersection post full development of Kinley. The SIDRA Intersection results are summarised in Table 6-5. The assessment revealed that the intersection is currently operating below capacity with minimal queues and delays.

Figure 6-4 Hutchinson Street / Jarlo Drive / Melba Avenue Intersection – Proposed Layout

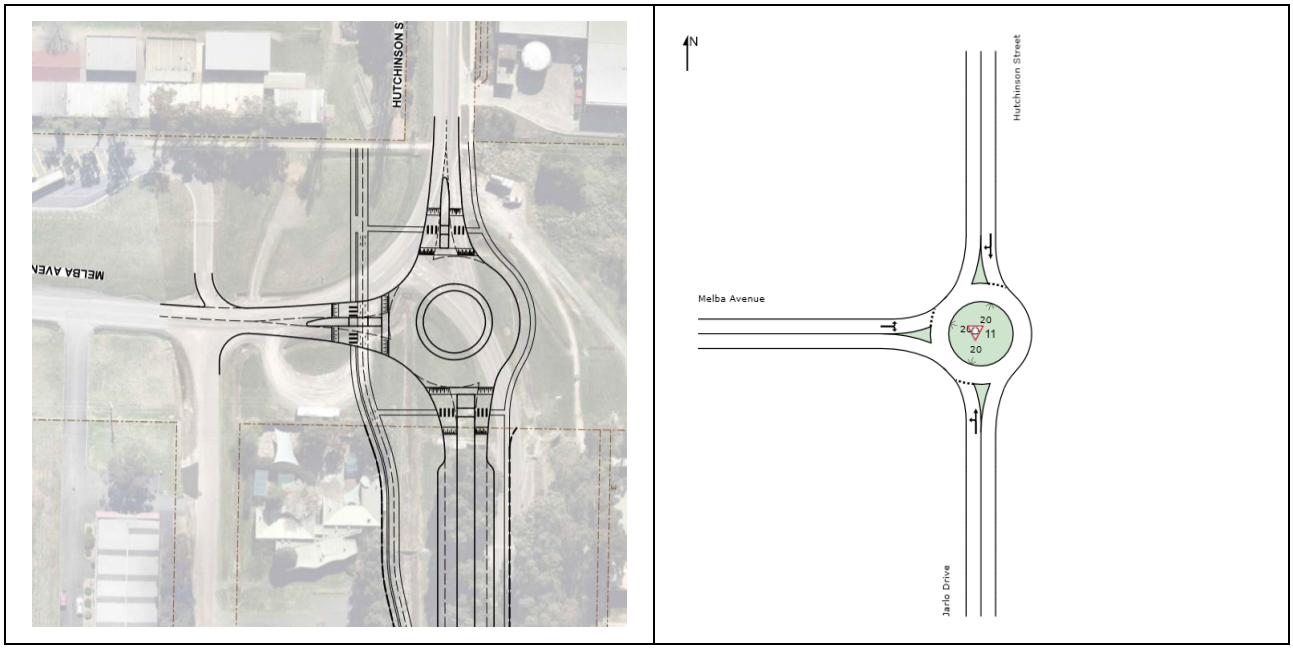


Table 6-5 Hutchinson Street / Jarlo Drive / Melba Avenue Intersection – Proposed Layout Anticipated Operation: 2030 + Development Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Jarlo Dr (S)	0.512	5	36
	Hutchinson St (N)	0.364	10	18
	Melba Ave (W)	0.567	10	35
PM Peak Hour	Jarlo Dr (S)	0.453	4	29
	Hutchinson St (N)	0.083	10	3
	Melba Ave (W)	0.400	9	21

A similar three-way roundabout is proposed to be located to the south of the Melba Avenue / Hutchinson Street / Jarlo Drive intersection to facilitate access to the Box Hill Institute and connect into Kinley (via Honour Avenue). Given the lower traffic volumes that are expected to traverse through this interaction in comparison to the Melba Avenue / Jarlo Drive intersection, it is anticipated that it will operate satisfactorily with minimal delays and queues.

6.2 Existing External Intersections

The development of Kinley will result in an increase in traffic volumes on the external road network. As such, the traffic impact at seven key existing external intersections has been analysed and detailed below.

6.2.1 Hutchinson Street / John Street Intersection (DI-RD-05)

The current configuration of the Hutchinson Street / John Street intersection is a four-way signalised intersection, as shown in Figure 6-5.

Intersection analysis was undertaken using the existing peak hour phasing and cycle times to determine the current operation of the intersection. The SIDRA Intersection results are detailed in Table 6-6. The assessment revealed that the intersection is currently operating below capacity with minimal queues and delays. Notwithstanding this, Council has advised us that this intersection does have capacity issues on occasion and asked us to investigate potential minor mitigation option(s) that would help ease congestion.

Figure 6-5 Hutchinson Street / John Street Intersection – Existing Layout

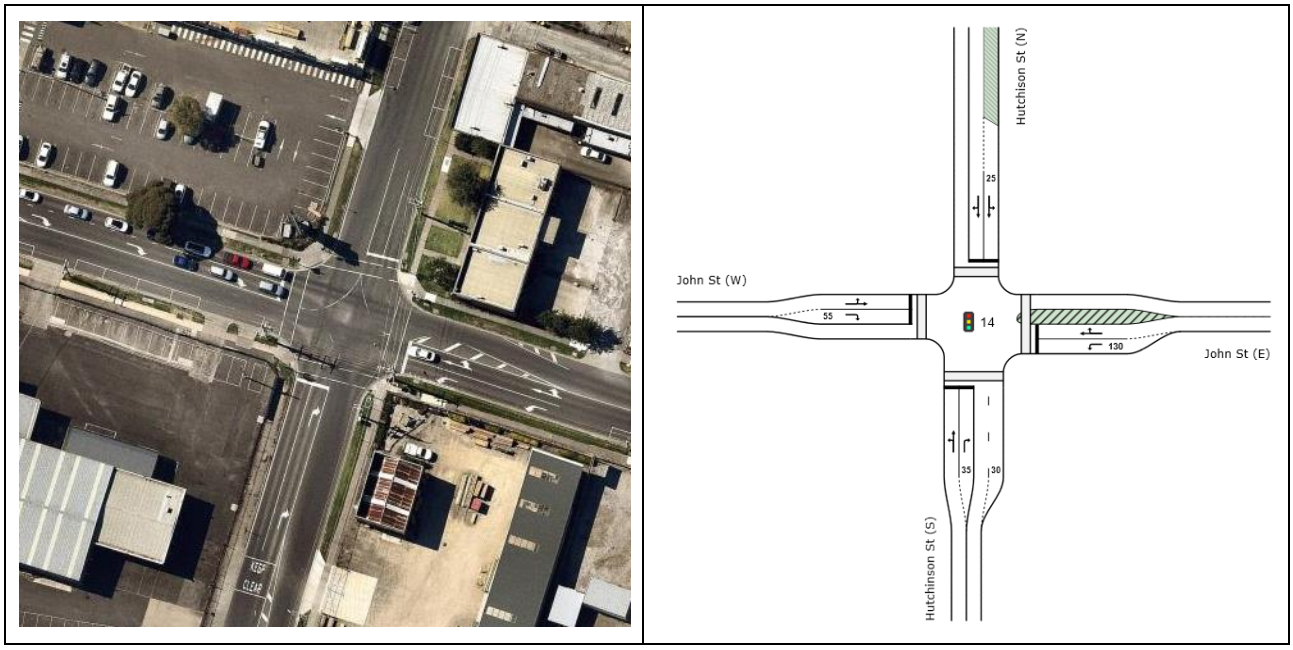


Table 6-6 Hutchinson Street / John Street Intersection – Existing Layout Operation: 2020 Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Hutchinson St (S)	0.760	35	86
	John St (E)	0.748	41	104
	Hutchinson St (N)	0.547	44	55
	John St (W)	0.486	34	89
PM Peak Hour	Hutchinson St (S)	0.523	34	70
	John St (E)	0.765	47	98
	Hutchinson St (N)	0.363	38	33
	John St (W)	0.702	31	133

Intersection analysis was undertaken to determine the anticipated operation of the intersection if the development traffic was added to the existing intersection volumes. The assessment revealed that the intersection operation would exceed capacity, particularly during the evening commuter peak hour period.

Further assessment was undertaken to determine the likely intersection treatments that will be required to maintain the current operating conditions of the intersection. The assessment revealed that adopting the following minor intersection treatments would improve the operating conditions:

- Provision of a dedicated right turn lane on the eastern approach;
- Review and alteration of the peak hour parking restrictions on the northern approach;

- Extension of the right turn lane on the western approach;
- Extension of the right turn lane on the southern approach; and
- Review and alteration of the signal phasing and/or timing.

Refer to Figure 6-6 for an illustration of the proposed treatments and Table 6-7 for a summary of the anticipated operating conditions of the intersection.

Figure 6-6 Hutchinson Street / John Street Intersection – Proposed Layout

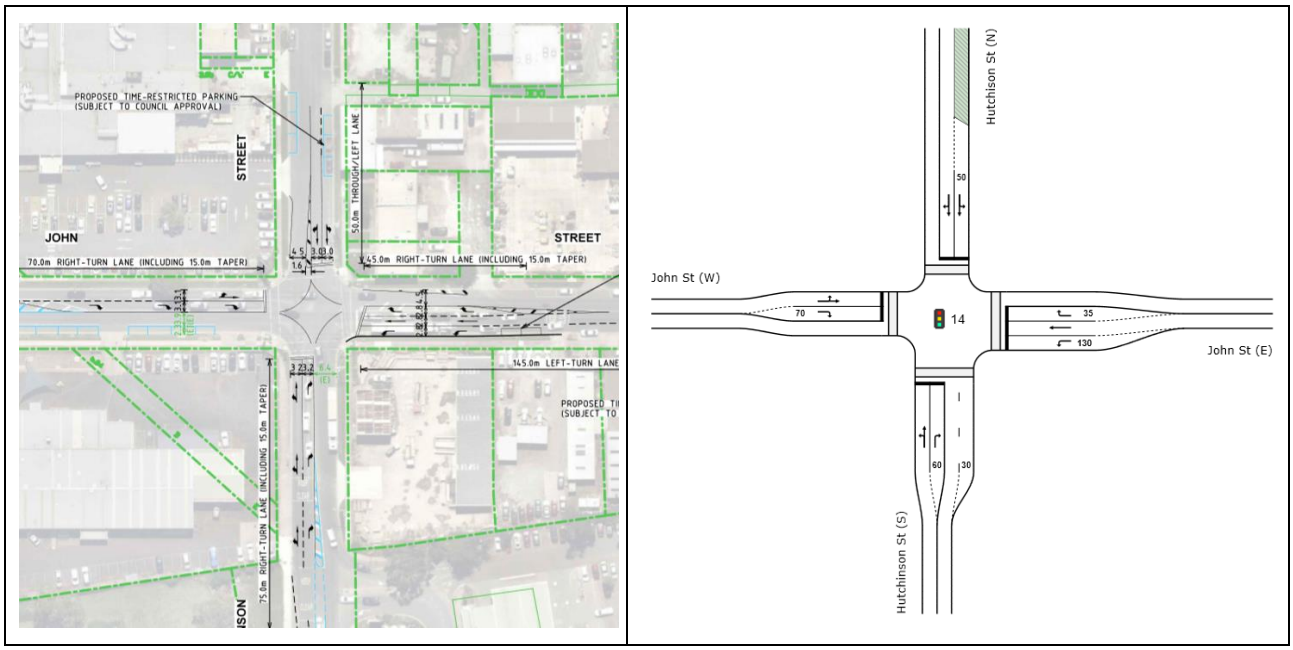


Table 6-7 Hutchinson Street / John Street Intersection – Anticipated Operation with Proposed Treatments: 2020 + Development Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Hutchinson St (S)	0.916	34	212
	John St (E)	0.876	33	81
	Hutchinson St (N)	0.773	36	69
	John St (W)	0.860	43	91
PM Peak Hour	Hutchinson St (S)	0.942	44	240
	John St (E)	0.923	44	77
	Hutchinson St (N)	0.869	39	95
	John St (W)	0.915	48	147

6.2.2 Victoria Road / Maroondah Highway / Mooroolbark Road Intersection (DI-RD-06)

The current configuration of the Maroondah Highway / Mooroolbark Road intersection is a four-way signalised intersection, as shown in Figure 6-1.

Intersection analysis was undertaken to determine the current operation of the intersection. The SIDRA Intersection results are provided in Table 6-8. The assessment revealed that the intersection is currently operating below capacity (DoS 1) with some queuing on the western approach of the intersection.

Figure 6-1 Victoria Road / Maroondah Highway / Mooroolbark Road Intersection – Existing Layout

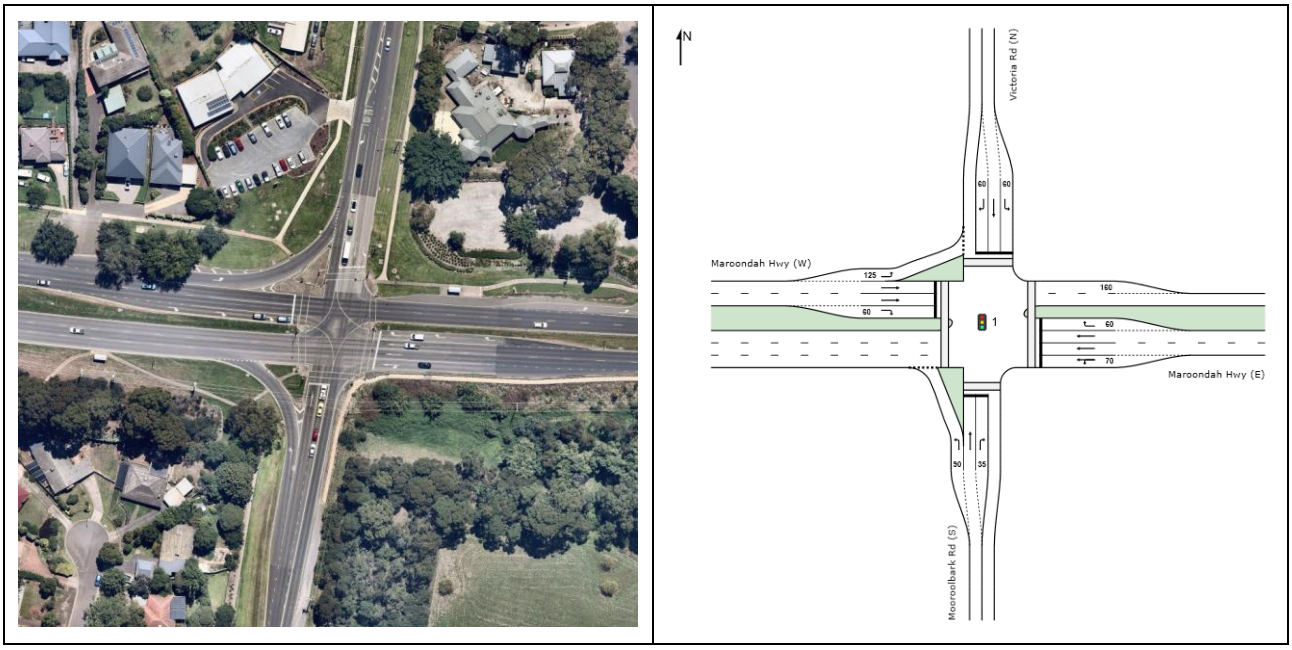


Table 6-8 Victoria Road / Maroondah Highway / Mooroolbark Road Intersection – Existing Layout Operation: 2020 Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Mooroolbark Rd (S)	0.912	52	99
	Maroondah Hwy (E)	0.714	38	177
	Victoria Rd (N)	0.892	52	175
	Maroondah Hwy (W)	0.929	48	272
PM Peak Hour	Mooroolbark Rd (S)	0.564	38	61
	Maroondah Hwy (E)	0.668	35	119
	Victoria Rd (N)	0.965	73	152
	Maroondah Hwy (W)	0.983	47	314

Intersection analysis was undertaken to determine the anticipated operation of the intersection if the development traffic was added to the existing intersection volumes. The assessment revealed that the intersection would exceed capacity.

Further assessment was undertaken to determine the likely intersection treatments that will be required to maintain the current operating conditions of the intersection. The assessment revealed that adopting the following intersection treatments would improve the operating conditions of the intersection and maintain its current performance:

- Provision of a full length left turn lane on the southern approach;
- Extension of the existing right turn lane on the southern approach;
- Provision of a full length departure lane on the southern leg;
- Extension of the existing short departure lane on the eastern leg;
- Shortening of the left turn slip lane on the western approach to match into the ultimate intersection layout;

> Provision of double right turns on the western approach; and

> Review and alteration of the signal phasing and/or timing.

Refer to Figure 6-2 below for an illustration of the proposed treatments and Table 6-9 summary of the anticipated operating conditions of the intersection.

Figure 6-2 Maroondah Highway / Mooroolbark Road Intersection – Proposed Layout

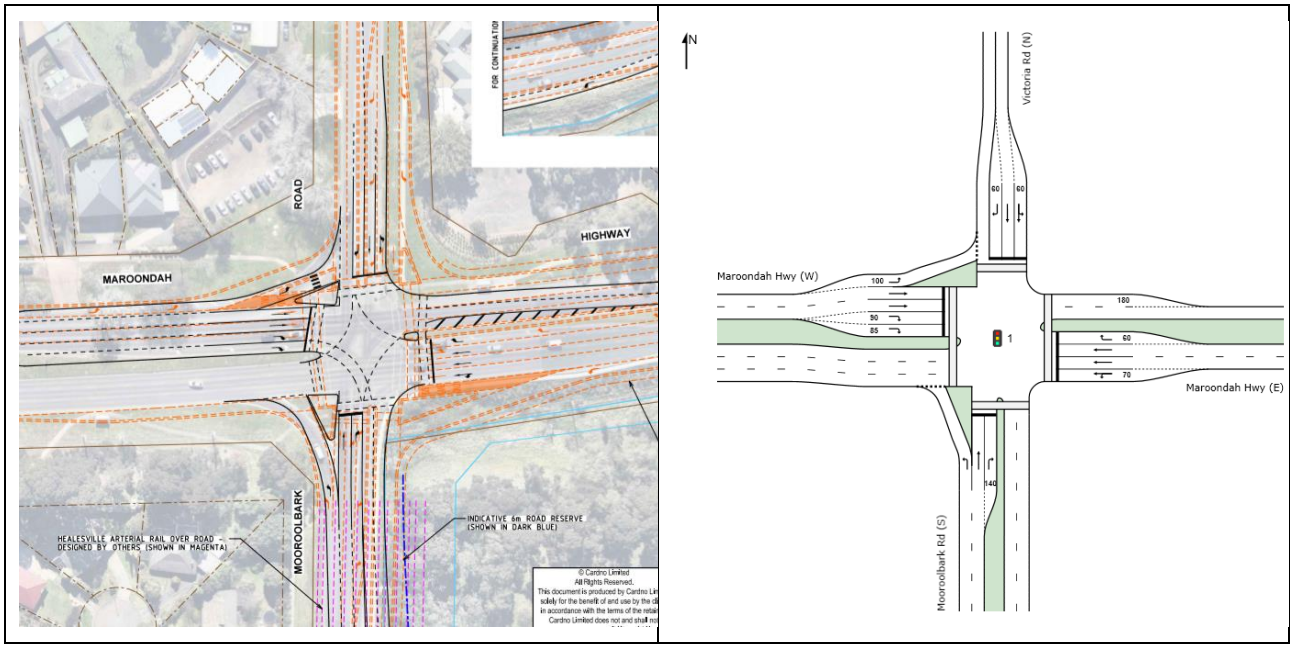


Table 6-9 Victoria Road / Maroondah Highway / Mooroolbark Road Intersection – Anticipated Operation with Proposed Treatments: 2020 + Development Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Mooroolbark Rd (S)	0.829	50	130
	Maroondah Hwy (E)	0.963	76	372
	Victoria Rd (N)	0.982	81	222
	Maroondah Hwy (W)	0.963	63	385
PM Peak Hour	Mooroolbark Rd (S)	0.913	51	107
	Maroondah Hwy (E)	0.803	41	219
	Victoria Rd (N)	0.988	89	198
	Maroondah Hwy (W)	0.902	44	329

6.2.3 Mooroolbark Road / Hull Road Intersection (DI-RD-07A)

The current configuration of the Mooroolbark Road / Hull Road intersection is a three-way signalised intersection, as shown in Figure 6-3.

Intersection analysis was undertaken to determine the current operation of the intersection. The SIDRA Intersection results are detailed in Table 6-10. The assessment revealed that the intersection is currently operating above capacity with significant queuing occurring on the north western approach to the intersection.

Figure 6-3 Mooroolbark Road / Hull Road Intersection – Existing Layout

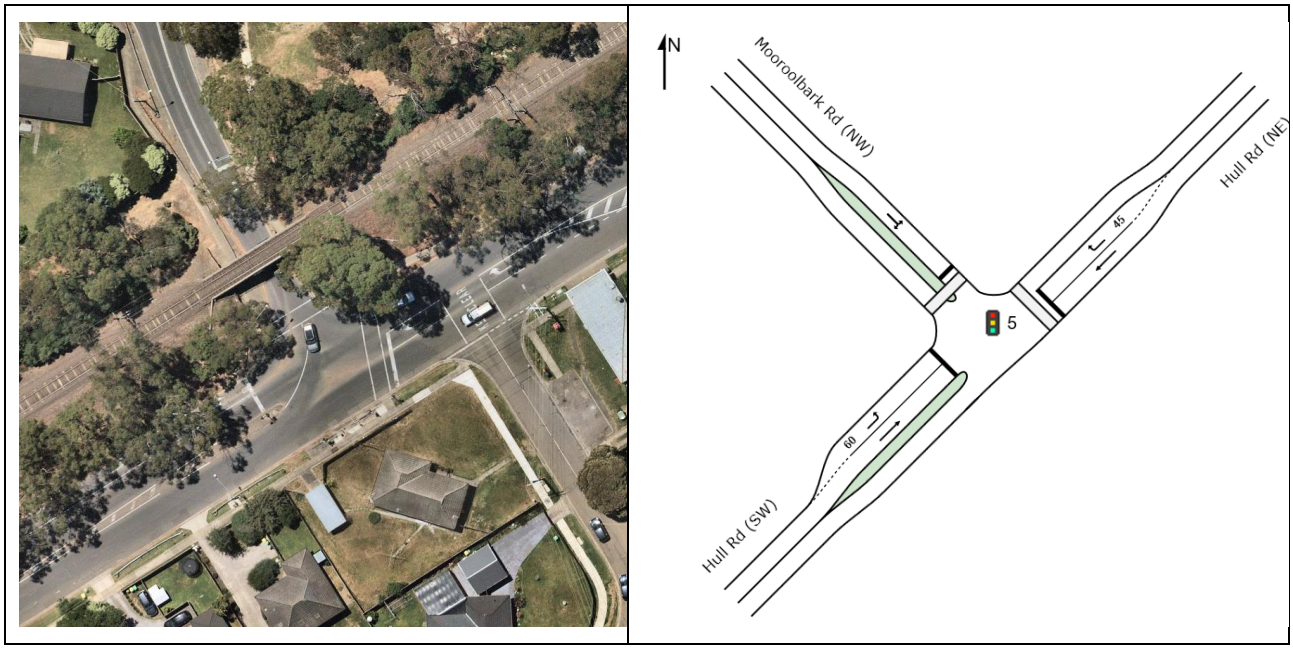


Table 6-10 Mooroolbark Road / Hull Road Intersection – Existing Layout Operation: 2020 Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Hull Rd (NE)	0.994	43	198
	Mooroolbark Rd (NW)	1.122	168	454
	Hull Rd (SW)	1.093	95	170
PM Peak Hour	Hull Rd (NE)	0.970	40	95
	Mooroolbark Rd (NW)	0.962	67	290
	Hull Rd (SW)	0.945	47	200

Intersection analysis was undertaken to determine the anticipated operation of the intersection if the development traffic was added to the existing intersection volumes. The assessment revealed that the intersection operation would deteriorate with significant queuing on all approaches of the intersection.

Further assessment was undertaken to determine the likely intersection treatments that will be required to maintain the current operating conditions of the intersection with minimal impact to the existing rail bridge and abutting properties. Importantly, this will be an interim treatment until such time that the Healesville Bypass and Healesville Arterial are delivered in the future, for which Kinley has reserved land to accommodate.

The assessment revealed that adopting the following intersection treatments would reduce the queue lengths and maintain its current performance:

- Extension of the existing right turn lane on the northeast approach;
- Provision of an additional short through traffic lane on the northeast approach;
- Provision of an additional short departure lane on the northeast leg;
- Provision of an additional right turn lane on the northwest approach;
- Extension of the existing left turn lane and conversion to a shared left/through lane on the southwest approach;
- Provision of an additional short departure lane on the southwest leg; and
- Review and alteration of the signal phasing and/or timing.

Consideration was given to providing a pedestrian footpath on both sides of the north western carriageway, however, due to bridge and road reserve constraints, the pedestrian footpath had to be limited to the eastern side only.

Refer to Figure 6-4 for an illustration of the proposed treatments and Table 6-11 for a summary of the anticipated operating conditions of the intersection.

Figure 6-4 Mooroolbark Road / Hull Road Intersection – Proposed Layout

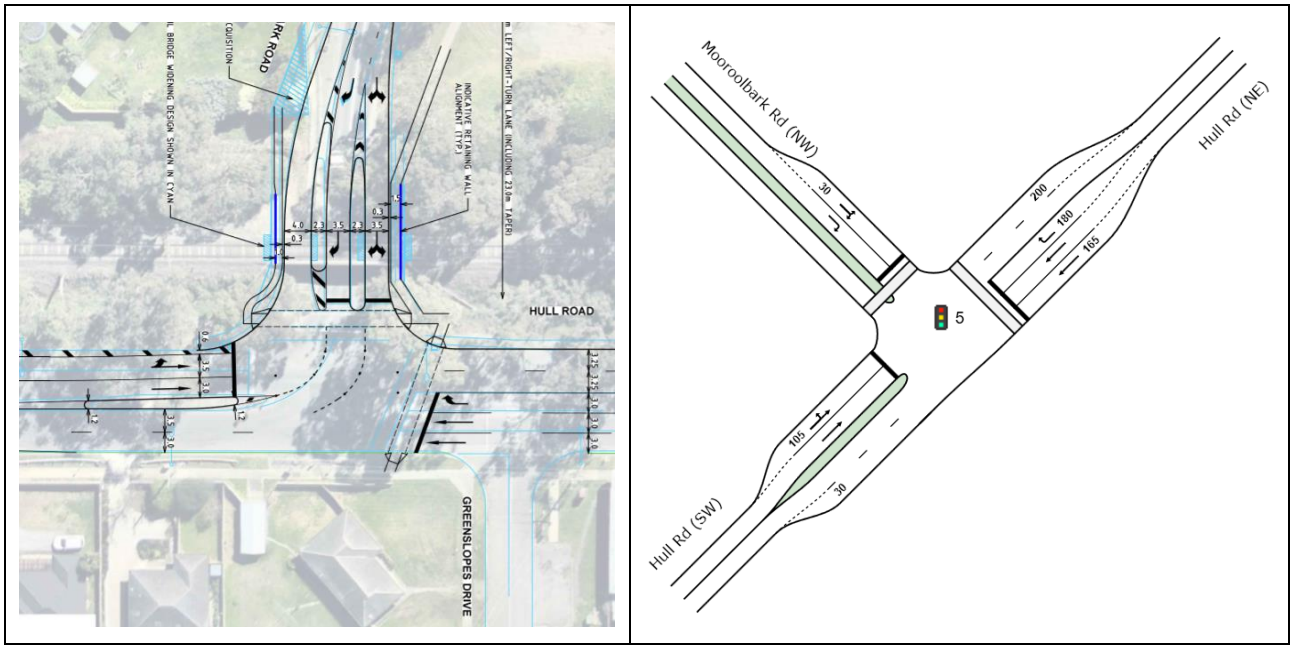


Table 6-11 Mooroolbark Road / Hull Road Intersection – Anticipated Operation with Proposed Treatments: 2020 + Development Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Hull Rd (NE)	1.056	62	404
	Mooroolbark Rd (NW)	1.059	112	320
	Hull Rd (SW)	1.024	111	260
PM Peak Hour	Hull Rd (NE)	1.013	37	153
	Mooroolbark Rd (NW)	1.055	66	195
	Hull Rd (SW)	1.023	91	340

6.2.4 Swansea Road / Hull Road Intersection (DI-RD-08)

The current configuration of the Swansea Road / Hull Road intersection is a three-way signalised intersection, as shown in Figure 6-5.

Intersection analysis was undertaken to determine the current operation of the intersection. The SIDRA Intersection analysis results are summarised in Table 6-12. The assessment revealed that the intersection is currently operating below capacity with minimal queues and delays.

Figure 6-5 Swansea Road / Hull Road Intersection – Existing Layout

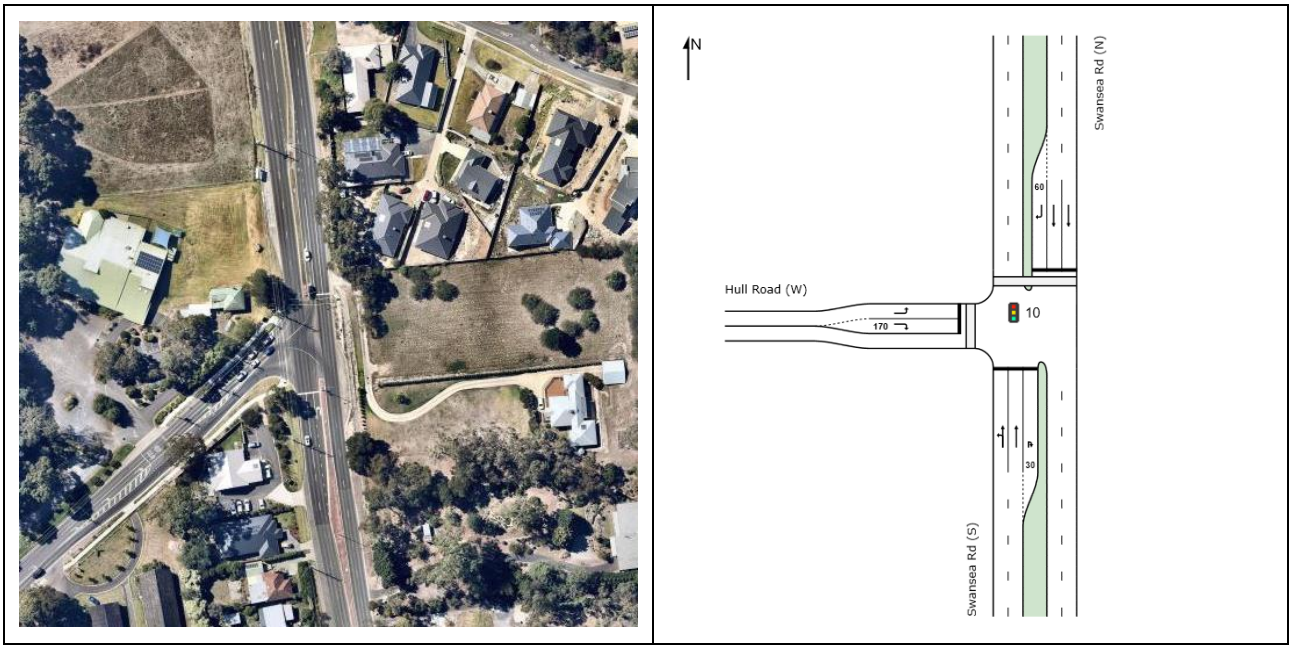


Table 6-12 Swansea Road / Hull Road Intersection – Existing Layout Operation: 2020 Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Swansea Rd (S)	0.841	35	178
	Swansea Rd (N)	0.823	31	111
	Hull Rd (W)	0.846	36	125
PM Peak Hour	Swansea Rd (S)	0.819	27	171
	Swansea Rd (N)	0.833	25	83
	Hull Rd (W)	0.826	33	76

Intersection analysis was undertaken to determine the anticipated operation of the intersection if the development traffic was added to the existing intersection volumes. The assessment revealed that the intersection operation would exceed capacity.

Further assessment was undertaken to determine the likely intersection treatments that would be required to maintain the current operating conditions of the intersection. The assessment revealed that adopting the following intersection treatments would improve the operating conditions of the intersection and maintain its current performance level:

- Conversion of the existing dedicated left turn lane on the western approach to a left / through lane; and
- Review and alteration of the signal phasing and/or timing.

Refer to Figure 6-6 for an illustration of the proposed treatments and Table 6-13 for a summary of the anticipated operating conditions of the intersection.

Figure 6-6 Swansea Road / Hull Road Intersection – Proposed Layout

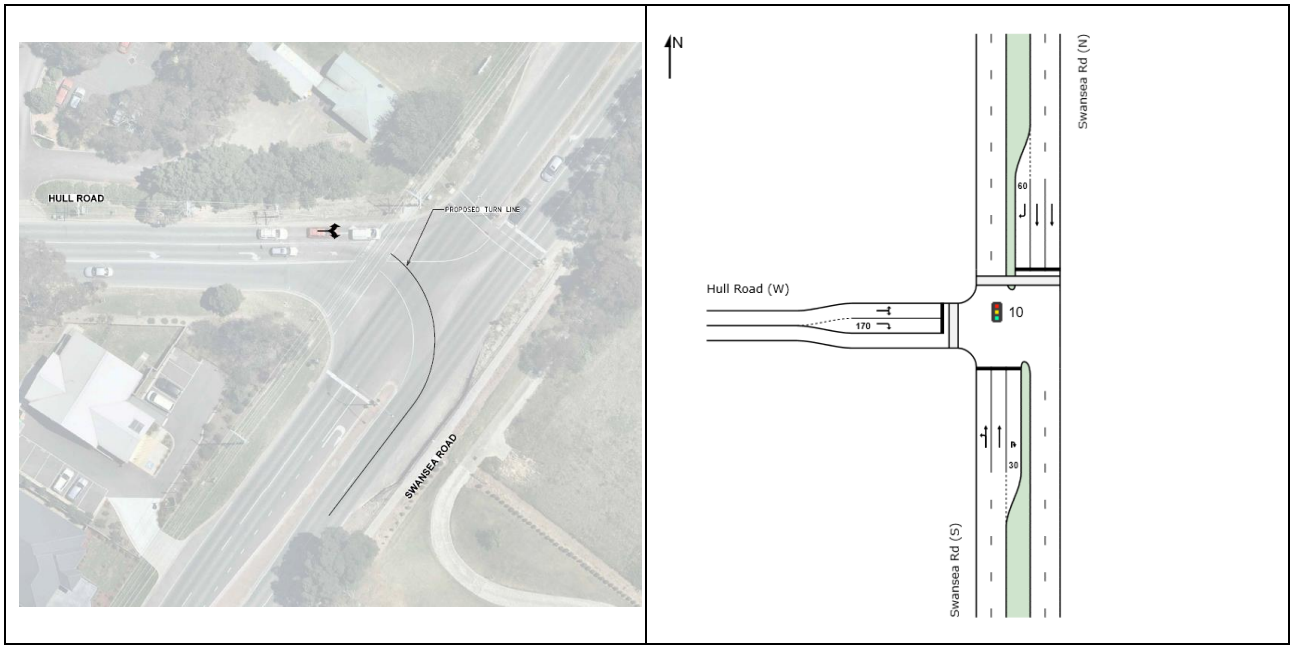


Table 6-13 Swansea Road / Hull Road Intersection – Anticipated Operation with Proposed Treatments (2020 + Development Volumes)

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Swansea Rd (S)	0.947	62	337
	Swansea Rd (N)	0.957	42	146
	Hull Rd (W)	0.965	78	281
PM Peak Hour	Swansea Rd (S)	0.957	63	439
	Swansea Rd (N)	0.934	37	126
	Hull Rd (W)	0.964	81	255

6.2.5 Anderson Street / Hardy Street Intersection

The current configuration of the Anderson Street / Hardy Street intersection is a three-way signalised intersection, as shown in Figure 6-7.

Intersection analysis was undertaken to determine the current operation of the intersection. The SIDRA Intersection results are provided in Table 6-14. The assessment revealed that the intersection is currently operating at capacity significant queues on the southern approach of the intersection.

Figure 6-7 Anderson Street / Hardy Street Intersection – Existing Layout

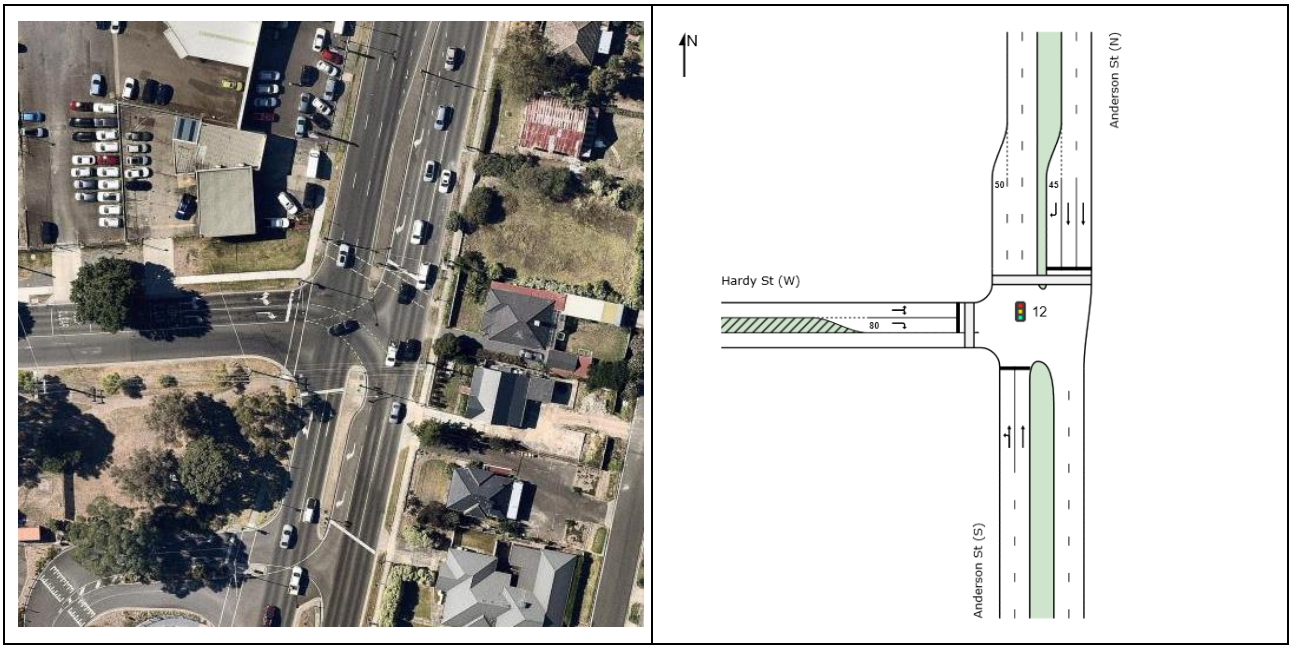


Table 6-14 Anderson Street / Hardy Street Intersection – Existing Layout Operation: 2020 Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Anderson St (S)	1.021	56	538
	Anderson St (N)	0.959	22	107
	Hardy St (W)	0.835	50	107
PM Peak Hour	Anderson St (S)	1.064	89	538
	Anderson St (N)	1.035	22	73
	Hardy St (W)	1.042	108	306

Intersection analysis was undertaken to determine the anticipated operation of the intersection if the development traffic was added to the existing intersection volumes. The assessment revealed that the intersection will continue to operate at similar conditions; hence, no treatments are proposed as part of the Kinley development. The SIDRA Intersection results are provided in Table 6-15.

Table 6-15 Anderson Street / Hardy Street Intersection – Existing Layout Anticipated Operation: 2020 + Development Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Anderson St (S)	1.045	104	581
	Anderson St (N)	1.036	111	151
	Hardy St (W)	0.876	55	96
PM Peak Hour	Anderson St (S)	1.099	143	616
	Anderson St (N)	1.037	107	103
	Hardy St (W)	1.106	157	356

6.2.6 Anderson Street / Maroondah Highway Intersection

The current configuration of the Anderson Street / Maroondah Highway intersection is a four-way signalised intersection, as shown in Figure 6-8.

Intersection analysis was undertaken to determine the current operation of the intersection. The SIDRA Intersection results are detailed in Table 6-16. The assessment revealed that the intersection is currently operating below capacity with some queueing on the eastern and the western approaches to the intersection.

Figure 6-8 Anderson Street / Maroondah Highway Intersection – Existing Layout

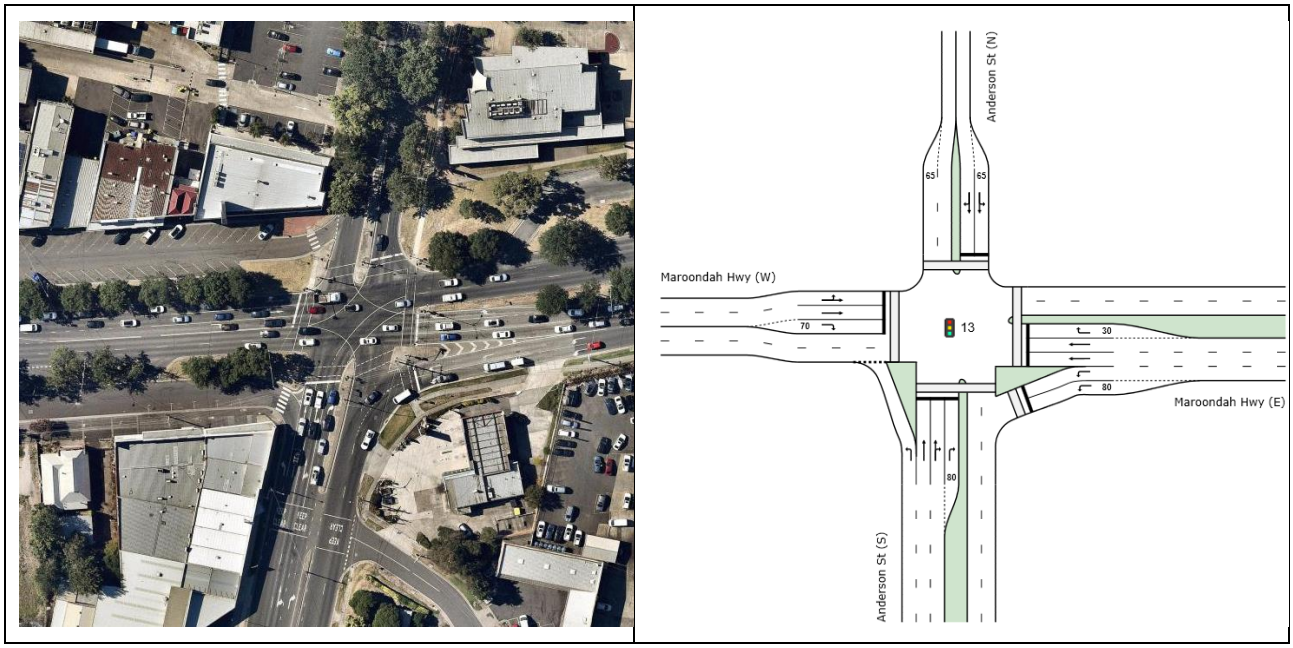


Table 6-16 Anderson Street / Maroondah Highway Intersection – Existing Layout Operation: 2020 Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Anderson St (S)	0.920	55	172
	Maroondah Hwy (E)	0.919	42	337
	Anderson St (N)	0.549	56	56
	Maroondah Hwy (W)	0.549	28	56
PM Peak Hour	Anderson St (S)	0.920	53	205
	Maroondah Hwy (E)	0.836	40	185
	Anderson St (N)	0.629	56	68
	Maroondah Hwy (W)	0.933	73	245

Intersection analysis was undertaken to determine the anticipated operation of the intersection if the development traffic was added to the existing intersection volumes. The assessment revealed that the intersection will continue to operate at similar conditions, and hence no treatments are proposed as part of the Kinley development. The SIDRA Intersection results are provided in Table 6-17.

Table 6-17 Anderson Street / Maroondah Highway Intersection – Existing Layout Anticipated Operation: 2020 + Development Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Anderson St (S)	0.817	45	156
	Maroondah Hwy (E)	0.921	40	366
	Anderson St (N)	0.878	72	66
	Maroondah Hwy (W)	0.861	24	71
PM Peak Hour	Anderson St (S)	0.877	45	193
	Maroondah Hwy (E)	0.874	40	234
	Anderson St (N)	0.972	91	92
	Maroondah Hwy (W)	0.955	78	309

6.2.7 Maroondah Highway / Hutchinson Street Intersection

The current configuration of the Maroondah Highway / Hutchinson Street intersection is a three-leg priority-controlled intersection, as shown in Figure 6-9.

Intersection analysis was undertaken using the existing peak hour phasing and cycle times to determine the current operation of the intersection. The SIDRA Intersection analysis results are provided in Table 6-18. The assessment revealed that the intersection is currently operating below capacity with minimal queues and delays.

Figure 6-9 Maroondah Highway / Hutchinson Street Intersection – Existing Layout

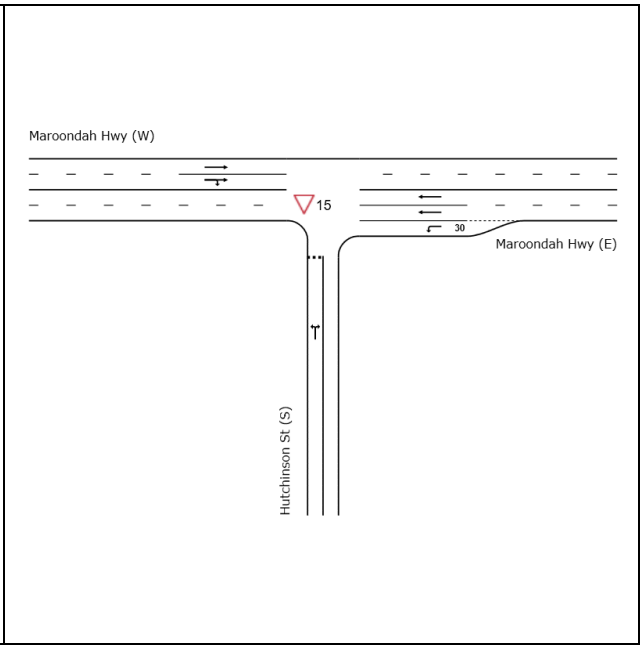


Table 6-18 Maroondah Highway / Hutchinson Street Intersection – Existing Operation

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Hutchinson St (S)	0.257	17	5
	Maroondah Hwy (E)	0.241	1	0
	Maroondah Hwy (W)	0.223	2	8
PM Peak Hour	Hutchinson St (S)	0.277	21	6
	Maroondah Hwy (E)	0.237	1	0
	Maroondah Hwy (W)	0.271	1	7

It is understood that the Maroondah Highway / Hutchinson Road intersection will ultimately be upgraded to a signalised intersection as part of the Yarra Ranges Shire's Lilydale Integrated Transport Plan. Intersection

analysis was undertaken for the Maroondah Highway / Hutchinson Street intersection with a possible signalised intersection layout and total anticipated traffic post full development. Intersection analysis revealed that the proposed signalised intersection is likely to operate satisfactorily with minimal queues and delays.

Refer to Figure 6-10 for an illustration of the proposed treatments and Table 6-19 for a summary of the anticipated operating conditions of the intersection.

Figure 6-10 Maroondah Highway / Hutchinson Street Intersection – Possible Signalised Layout

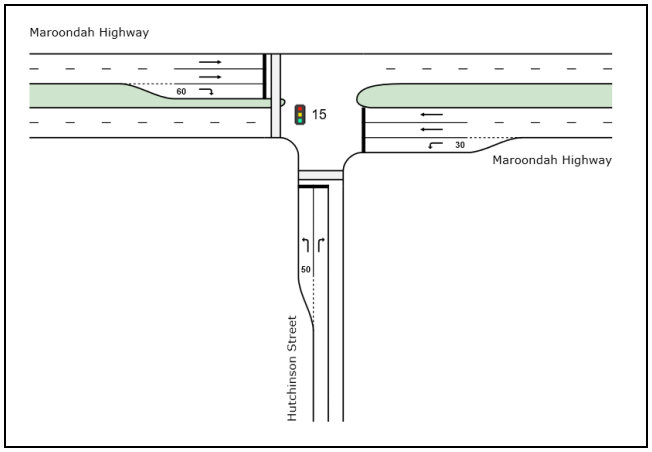


Table 6-19 Maroondah Highway / Hutchinson Street Intersection – Signals Anticipated Operation: 2030 + Development Volumes

Peak	Approach	Degree of Saturation	Average Delay (sec)	95%ile Queue (m)
AM Peak Hour	Hutchinson St (S)	0.484	53	72
	Maroondah Hwy (E)	0.515	14	153
	Maroondah Hwy (W)	0.509	12	52
PM Peak Hour	Hutchinson St (S)	0.506	51	53
	Maroondah Hwy (E)	0.543	16	166
	Maroondah Hwy (W)	0.546	12	76

7 Conclusion

Based on the analysis and discussions outlined within this report, the following conclusions are made regarding the urban renewal of the former Lilydale Quarry site:

- The development is anticipated to ultimately comprise approximately 3,250 dwellings, a commercial precinct, a potential future train station, proposed Government Specialist School and a mixed-use site.
- The Stage 2 development is proposed to be completed in several precinct stages under separate planning applications. Stage 1 of the project has already been approved under the Permit Number YR-2014/932.
- The car parking requirement for the town centre component of the development is likely to be in the order of 593 car parking spaces. The anticipated car parking provision of 600 off-street spaces is considered appropriate to service the town centre precinct.
- The overall development is likely to generate approximately 2,300 vph during the weekday morning commuter peak and 2,700 vph during the weekday evening commuter peak.
- Intersection analysis was undertaken at the key intersections in the vicinity of the subject site to determine the impact on the external road network. The assessment revealed that majority of the intersections are presently operating at capacity or are approaching capacity. Introduction of the development traffic volumes will result in further deterioration of operating conditions at some intersections; and therefore, several mitigation measures have been outlined to restore the operation of these intersections back to their current Level of Service.
- Further intersection analysis was undertaken at the proposed development access locations. Assessment revealed that all access locations are expected to operate satisfactorily, hence no further treatment are required to be undertaken.

The recommendations of this assessment are as summarised below.

- Provide signalised intersections at the Churchill Drive and Landscape Drive intersections along Mooroolbark Road; and at the proposed Hull Road / Honour Avenue intersection as part of the development.
- Provide roundabouts at the Hutchinson Street / Honour Avenue / Melba Avenue intersection and at the Honour Avenue / Jarlo Drive intersection.
- The following road upgrade works are to be considered to improve the anticipated operating conditions of the existing intersections:
  - At the Maroondah Highway / Mooroolbark Road intersection:
    - Provision of a full length left turn lane on the southern approach;
    - Extension of the existing right turn lane on the southern approach;
    - Provision of a full length departure lane on the southern leg;
    - Extension of the existing short departure lane on the eastern leg;
    - Shortening of the left turn slip lane on the western approach to match into the ultimate intersection layout;
    - Provision of double right turns on the western approach; and,
    - Review and alteration of the signal phasing and timing.
  - At the Mooroolbark Road / Hull Road intersection:
    - Extension of the existing right turn lane on the northeast approach;
    - Provision of an additional short through traffic lane on the northeast approach;
    - Provision of an additional short departure lane on the northeast leg;
    - Provision of an additional right turn lane on the northwest approach;
    - Extension of the existing left turn lane and conversion to a shared left/through lane on the southwest approach;

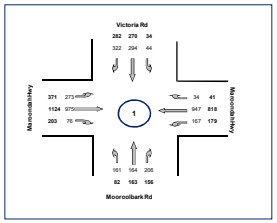
    - Provision of an additional short departure lane on the southwest leg; and,
    - Review and alteration of the signal phasing and/or timing.
  - At the Swansea Road / Hull Road intersection:
    - Conversion of the existing dedicated left turn lane on the western approach to a left / through lane; and,
    - Review and alteration of the signal phasing and/or timing.
  - At the John Street / Hutchinson Street intersection:
    - Provision of a dedicated right turn lane on the eastern approach;
    - Review and alteration of the peak hour parking restrictions on the northern approach;
    - Extension of the right turn lane on the western approach;
    - Extension of the right turn lane on the southern approach; and,
    - Review and alteration of the signal phasing and/or timing.
- Signalisation of the Maroondah Highway / Hutchinson Street intersection as per the Yarra Ranges Shire's Integrated Transport Plan.

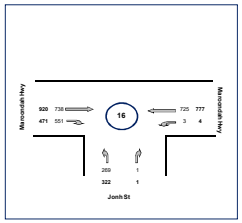
APPENDIX

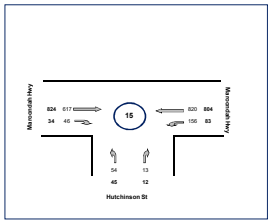
A

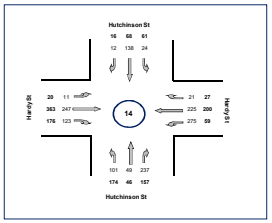
EXISTING TRAFFIC VOLUMES

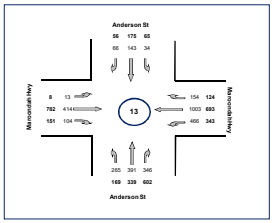
2015 TRAFFIC VOLUMES

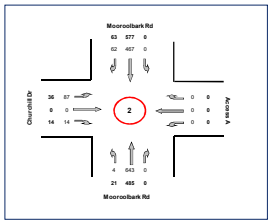


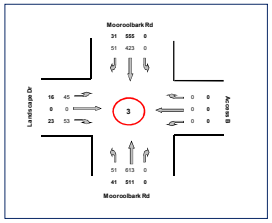


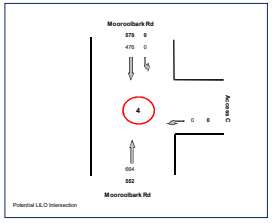


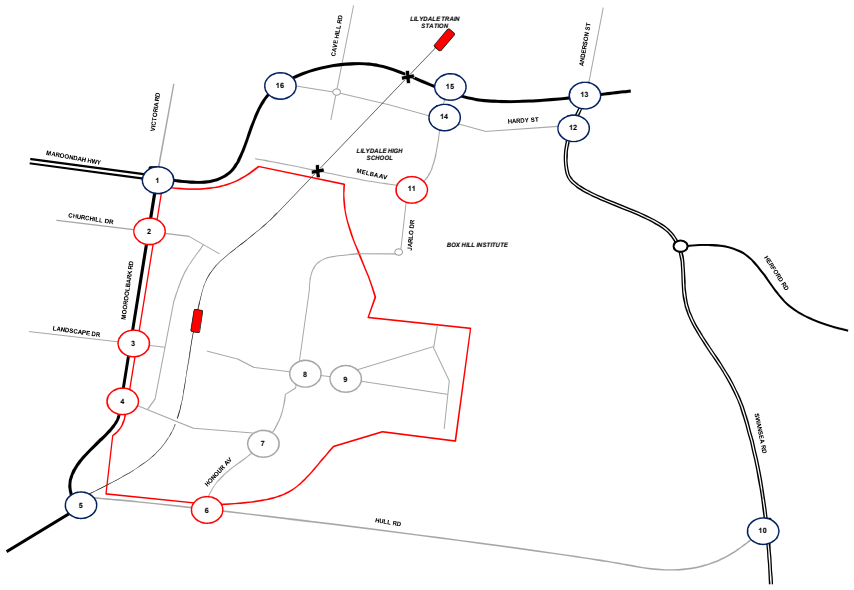


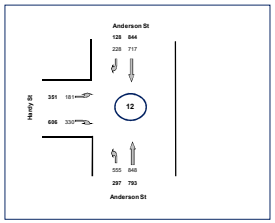


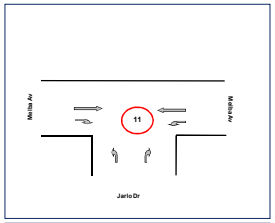


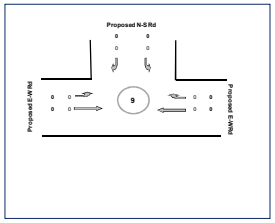


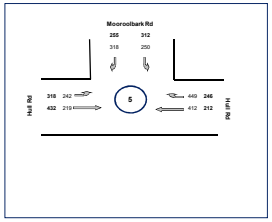


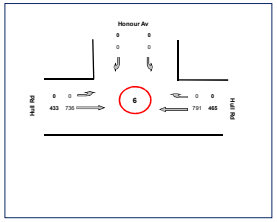


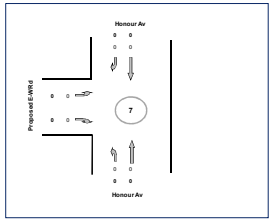


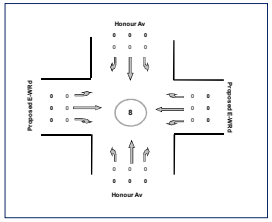


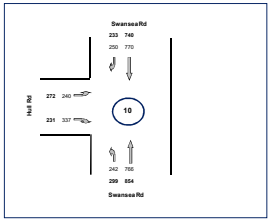












LEGEND

Internal road layout is only indicative in this map

- Subject Site
- Arterial Roads
- Local Roads

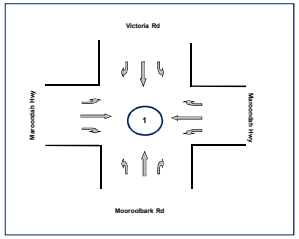
North

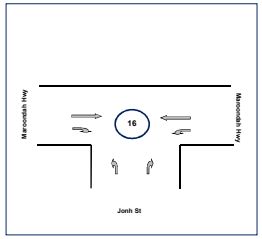
XXX: AM Peak Volumes

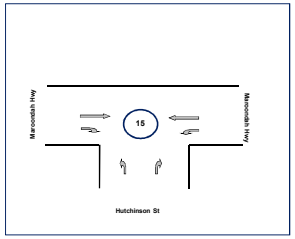
XXX: PM Peak Volumes

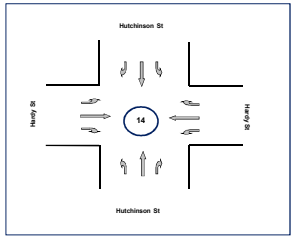
- External Development Access Locations
- Internal Intersections
- External Intersections

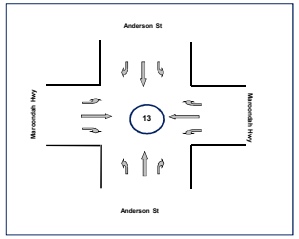
2019 SURVEY TRAFFIC VOLUMES

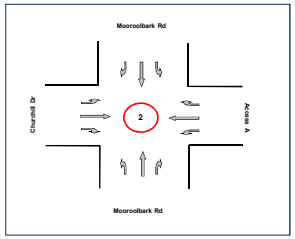


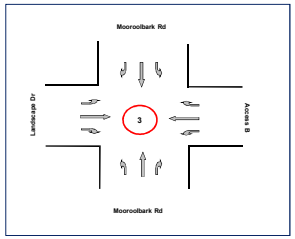


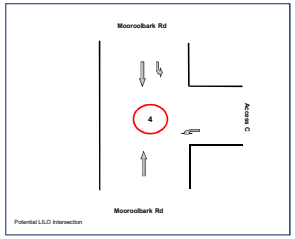


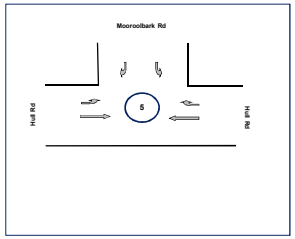


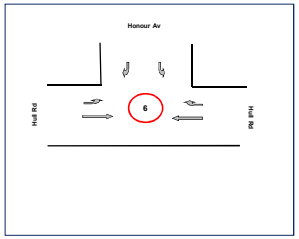


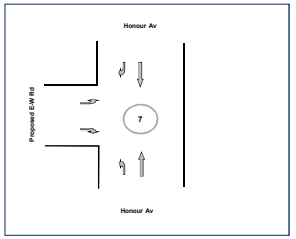


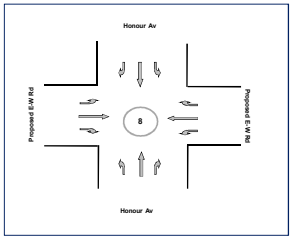


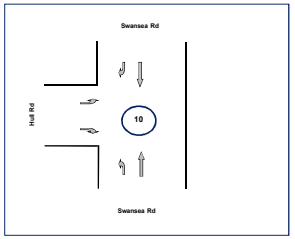


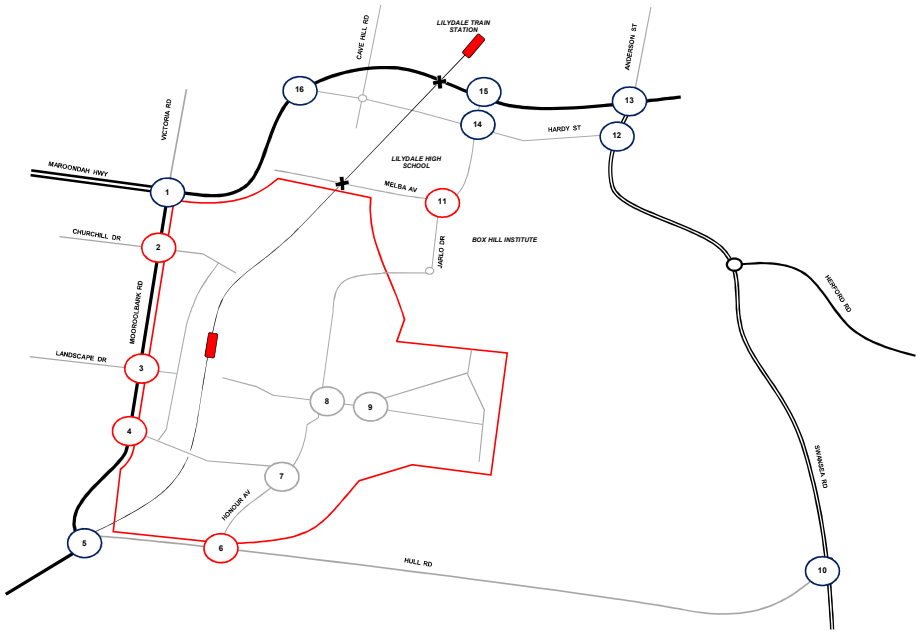


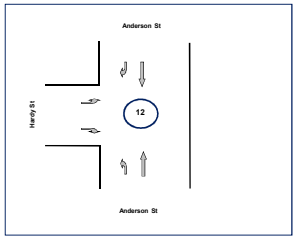


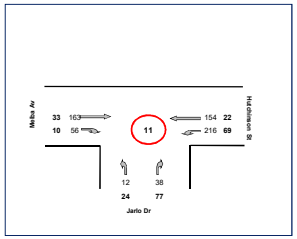


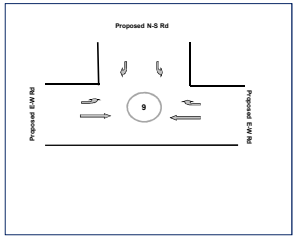












LEGEND

Internal road layout is only indicative in this map

- Subject Site
- Arterial Roads
- Local Roads
- North

XXX: AM Peak Volumes

XXX: PM Peak Volumes

- External Development Access Locations
- Internal Intersections
- External Intersections

APPENDIX

B

CONCEPT LAYOUT PLANS

Cardno
Shaping the Future

PROPOSED TIME-RESTRICTED PARKING
(SUBJECT TO COUNCIL APPROVAL)

JOHN STREET

70.0m RIGHT-TURN LANE (INCLUDING 15.0m TAPER)

4.5 3.0 3.0 1.6

50.0m THROUGH/LEFT LANE

STREET

45.0m RIGHT-TURN LANE (INCLUDING 15.0m TAPER)

PROPOSED TIME-RESTRICTED PARKING
(SUBJECT TO COUNCIL APPROVAL)

2.3 3.3 3.3 3.1 (E)(E)

2.8 2.8 4.5

3.1 3.3 3.9 2.3 (E)(E)

145.0m LEFT-TURN LANE (INCLUDING 15.0m TAPER)

PROPOSED TIME-RESTRICTED PARKING
(SUBJECT TO COUNCIL APPROVAL)

75.0m RIGHT-TURN LANE (INCLUDING 15.0m TAPER)

3.2 3.2 6.4 (E)

KEEP CLEAR

HUTCHINSON STREET

3.0 4.0 2.0 3.6 (E)(E)(E)(E)(E)

N

MELWAY MAP REF 38 E5

CG150284SK02 P3 - JOHN STREET / HUTCHISON STREET, LILYDALE

CONCEPT JOHN STREET / HUTCHISON STREET INTERSECTION RECONFIGURATION - OPTION 1 (FOR DISCUSSION PURPOSES ONLY)

SCALE - 1:1000 @ A3 DATE - 24.07.2017

DATE PLOTTED:03/13/20 14:18:33

CAD FILE:O:\DRATRAFFX\2015\CG150284\Drawings\CG150284-SK02P3.dgn

BY: User:luke.simpson

DATE PLOTTED: 28/01/2020 2:45:42 PM

SIGN SCHEDULE

#2	GIVE WAY	R1-2	#3	KEEP LEFT	R2-3(L)	#15	R2-5	#16	D4-2-3
#17	D4-1-1	#18	D4-1-1	#20	70	R4-1-70	#21	FORM 1 LANE	G9-15
#22	R5-35-1(LR)	#23	R8-2	#24	ONLY ONLY	R8-3(R)	#25	CYCLISTS DISMOUNT	G9-58
#26	R3-1								

CIVIL DETATILED DESIGN SUPPLIED BY REEDS CONSULTING, REF No. 22835E/1 REV. H (SHOWN IN BLUE)

HONOUR AVENUE

HULL ROAD

PROPOSED FULLY MOUNTABLE APRON

100m LEFT-TURN SLIP LANE

55m RIGHT-TURN LANE

40m LEFT-TURN SLIP LANE

VACANT

100m MERGE TAPER PRIOR TO DOWNSTREAM INTERSECTION

MATCH INTO EXISTING 3.0m SHARED USER PATH

100m RIGHT-TURN LANE

60m ADDITIONAL THROUGH LANE

RESIDENTIAL

FOR CONTINUATION REFER TO CARDNO DRAWING V161623-TR-DG-2502

FOR CONTINUATION REFER TO CARDNO DRAWING V161623-TR-DG-2503

MELWAY MAP REF 38 B10

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\04 Drawings\01 CAD\V161623-TR-DG-2501.dgn

Rev	Date	Description	Drawn	Appr.
4	28.01.2020	CLIENT COMMENTS	LS	MS
3	16.01.2020	SIGNAGE AND PAVEMENT MARKING DETAIL	LS	MS
2	08.08.2019	CLIENT COMMENTS	EC	MS
1	26.04.2017	ISSUED FOR INFORMATION	COB	DH

0 2.5 5 10
1:500 @ A3

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATIONS OF UNDERGROUND SERVICES SHOWN ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE.

1. BASE INFORMATION SUPPLIED BY REEDS CONSULTING, REF No. 22835/FL rev. C
2. ALL DIMENSIONS TO FACE OF KERB AND CHANNEL U.N.O.
3. LOCAL ROAD - HULL ROAD (SPEED ZONE 70KM/H)
   - HONOUR AVENUE (SPEED ZONE 50KM/H)
4. INSTALL ALL SIGNS AND LINE MARK IN ACCORDANCE WITH AUSTROADS GUIDE TO TRAFFIC MANAGEMENT VOLUME 10 AS 1742 AND RELEVANT VICROADS SUPPLEMENTS AND REMOVE ALL REDUNDANT SIGNS.
5. PUBLIC LIGHTING AND TRAFFIC SIGNAL DESIGN SUBJECT TO DETAIL DESIGN STAGE

Cardno
Shaping the Future
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Drawn	C. BOWEN
Designed	C. BOWEN
Checked	S. McKENZIE
Authorised	D. HO

Client	REEDS CONSULTING
Project	LILYDALE QUARRY REDEVELOPMENT HULL ROAD, LILYDALE YARRA RANGES COUNCIL
Title	SITE ACCESS - ULTIMATE LAYOUT FUNCTIONAL LAYOUT PLAN SIGNAGE & PAVEMENT MARKING
Status	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
Date	26.04.2017
Scale	1:500
Size	A3
Drawing Number	V161623-TR-DG-2501
Revision	4

BY: User:luke.simpson

DATE PLOTTED: 28/01/2020 2:46:03 PM

SIGN SCHEDULE

#1 STOP R1-1 #3 KEEP LEFT R2-3(L)

VACANT

CIVIL DETAILED DESIGN SUPPLIED BY REEDS CONSULTING, REF No. 22835E/1 REV. H (SHOWN IN BLUE)

VACANT

100m LEFT-TURN SLIP LANE

HULL ROAD

MATCH INTO EXISTING

100.0R

100.0R

4.7

50.0R

#3

2.5

500.0R

12.5R

3.5

50.0R

4.3 (E)

3.2 (E)

4.1 (E)

MATCH INTO EXISTING

RETAIN #1(E) SIGN

#1(E)

3.8 (E)

3.4 (E)

70m LEFT-TURN LANE

CARRONVALE ROAD

CAMELOT COURT

RESIDENTIAL

RESIDENTIAL

N

MELWAY MAP REF 38 A10

FOR CONTINUATION REFER TO CARDNO DRAWING V161623-TR-DG-2501

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\04 Drawings\01 CAD\V161623-TR-DG-2502.dgn

Rev	Date	Description	Drawn	Appr.
4	24.01.2020	CLIENT COMMENTS	LS	MS
3	16.01.2020	SIGNAGE AND PAVEMENT MARKING DETAIL	LS	MS
2	08.08.2019	CLIENT COMMENTS	EC	MS
1	26.04.2017	ISSUED FOR INFORMATION	COB	DH

0 2.5 5 10
1:500 @ A3

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATIONS OF UNDERGROUND SERVICES SHOWN ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE.

1. BASE INFORMATION SUPPLIED BY REEDS CONSULTING, REF No. 22835/FL rev. C
2. ALL DIMENSIONS TO FACE OF KERB AND CHANNEL U.N.O.
3. LOCAL ROAD - HULL ROAD (SPEED ZONE 70KM/H)
   - CARRONVALE ROAD (SPEED ZONE 50KM/H)
   - CAMELOT COURT (SPEED ZONE 50KM/H)
4. INSTALL ALL SIGNS AND LINE MARK IN ACCORDANCE WITH AUSTROADS GUIDE TO TRAFFIC MANAGEMENT VOLUME 10, AS 1742 AND RELEVANT VICROADS SUPPLEMENTS AND REMOVE ALL REDUNDANT SIGNS.
5. PUBLIC LIGHTING SUBJECT TO DETAIL DESIGN STAGE.

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Drawn	C. BOWEN
Designed	C. BOWEN
Checked	S. McKENZIE
Authorised	D. HO

Client: REEDS CONSULTING

Project: LILYDALE QUARRY REDEVELOPMENT
HULL ROAD, LILYDALE
YARRA RANGES COUNCIL

Title: SITE ACCESS - ULTIMATE LAYOUT
FUNCTIONAL LAYOUT PLAN
SIGNAGE & PAVEMENT MARKING

Status: **PRELIMINARY**
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Date	Scale	Size
26.04.2017	1:500	A3

Drawing Number: V161623-TR-DG-2502

Revision: 4

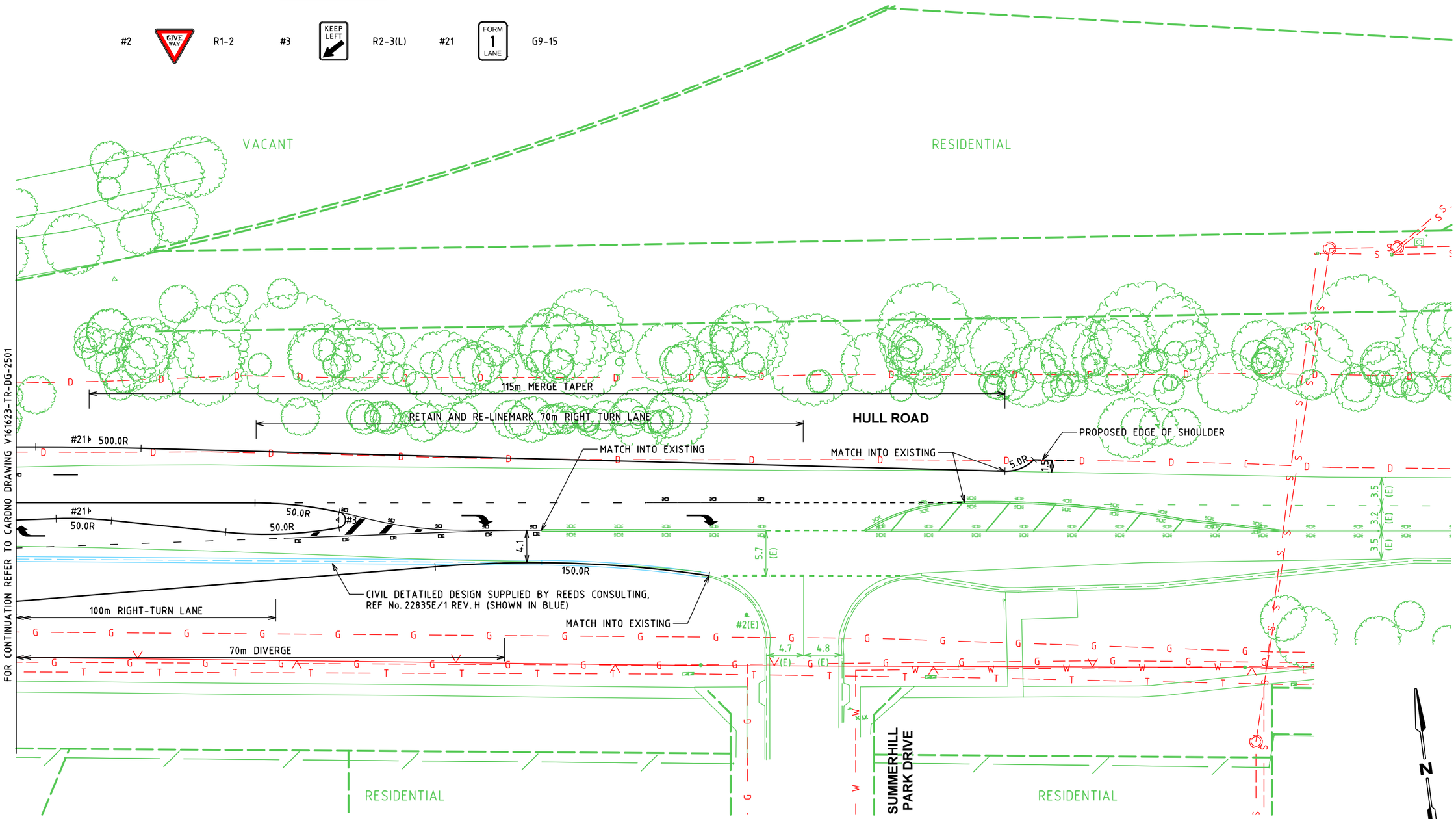
BY: User:luke.simpson

DATE PLOTTED: 28/01/2020 2:46:20 PM

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\04 Drawings\01 CAD\V161623-TR-DG-2503.dgn

SIGN SCHEDULE

#2 GIVE WAY R1-2 #3 KEEP LEFT R2-3(L) #21 FORM 1 LANE G9-15



MELWAY MAP REF 38 B10

Rev	Date	Description	Drawn	Appr.
4	24.01.2020	CLIENT COMMENTS	LS	MS
3	16.01.2020	SIGNAGE AND PAVEMENT MARKING DETAIL	LS	MS
2	08.08.2019	CLIENT COMMENTS	EC	MS
1	26.04.2017	ISSUED FOR INFORMATION	COB	DH

0 2.5 5 10
1:500 @ A3

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2. ALL DIMENSIONS TO FACE OF KERB AND CHANNEL U.N.O.
3. LOCAL ROAD - HULL ROAD (SPEED ZONE 70KM/H)
   - SUMMERHILL PARK DR (SPEED ZONE 50KM/H
4. INSTALL ALL SIGNS AND LINE MARK IN ACCORDANCE WITH AUSTROADS GUIDE TO TRAFFIC MANAGEMENT VOLUME 10, AS 1742 AND RELEVANT VICROADS SUPPLEMENTS AND REMOVE ALL REDUNDANT SIGNS.
5. PUBLIC LIGHTING SUBJECT TO DETAIL DESIGN STAGE.

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Drawn: C. BOWEN
Designed: C. BOWEN
Checked: S. McKENZIE
Authorised: D. HO

Client: REEDS CONSULTING
Project: LILYDALE QUARRY REDEVELOPMENT
HULL ROAD, LILYDALE
YARRA RANGES COUNCIL
Title: SITE ACCESS - ULTIMATE LAYOUT
FUNCTIONAL LAYOUT PLAN
SIGNAGE & PAVEMENT MARKING

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
Date: 26.04.2017
Scale: 1:500
Size: A3
Drawing Number: V161623-TR-DG-2503
Revision: 4

BY: User:luke.simpson

DATE PLOTTED: 29/01/2020 11:46:09 AM

SIGN SCHEDULE

#2	GIVE WAY	R1-2	#3	KEEP LEFT	R2-3(L)	#16	D4-2-3	#17	D4-1-1
#18	D4-1-1	#20	70	R4-1-70	#21	FORM 1 LANE	G9-15	#22	R5-35-1(LR)
#23	R8-2	#24	ONLY ONLY	R8-3(R)	#25	CYCLISTS DISMOUNT	G9-58	#26	R3-1

CIVIL DETATILED DESIGN SUPPLIED BY REEDS CONSULTING, REF No. 22835E/1 REV. H (SHOWN IN BLUE)

PROPOSED TEMPORARY SPIKE-DOWN KERB (TYP.)

HONOUR AVENUE

HULL ROAD

PROPOSED FULLY MOUNTABLE APRON

100m LEFT-TURN SLIP LANE

40m LEFT-TURN SLIP LANE

VACANT

VACANT

100m MERGE TAPER PRIOR TO DOWNSTREAM INTERSECTION

107m RIGHT-TURN LANE

122m ADDITIONAL THROUGH LANE

MATCH INTO EXISTING 3.0m SHARED USER PATH

RESIDENTIAL

FOR CONTINUATION REFER TO CARDNO DRAWING V161623-TR-DG-2505

FOR CONTINUATION REFER TO CARDNO DRAWING V161623-TR-DG-2506

MELWAY MAP REF 38 B10

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\04 Drawings\01 CAD\V161623-TR-DG-2504.dgn

Rev	Date	Description	Drawn	Appr.
2	28.01.2020	CLIENT COMMENTS	LS	MS
1	16.01.2020	ISSUED FOR INFORMATION	LS	MS

0 2.5 5 10
1:500 @ A3

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2. ALL DIMENSIONS TO FACE OF KERB AND CHANNEL U.N.O.
3. LOCAL ROAD - HULL ROAD (SPEED ZONE 70KM/H)
   - HONOUR AVENUE (SPEED ZONE 50KM/H)
4. INSTALL ALL SIGNS AND LINE MARK IN ACCORDANCE WITH AUSTROADS GUIDE TO TRAFFIC MANAGEMENT VOLUME 10 AS 1742 AND RELEVANT VICROADS SUPPLEMENTS AND REMOVE ALL REDUNDANT SIGNS.
5. PUBLIC LIGHTING AND TRAFFIC SIGNAL DESIGN SUBJECT TO DETAIL DESIGN STAGE

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Designed	L. SIMPSON
Checked	C. SANSTOUPET
Authorised	M. SALDANHA

Client	REEDS CONSULTING
Project	LILYDALE QUARRY REDEVELOPMENT HULL ROAD, LILYDALE YARRA RANGES COUNCIL
Title	SITE ACCESS - ULTIMATE LAYOUT (UNSIGNALISED) FUNCTIONAL LAYOUT PLAN SIGNAGE & PAVEMENT MARKING
Status	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
Date	16.01.2020
Scale	1:500
Size	A3
Drawing Number	V161623-TR-DG-2504
Revision	2

BY: User:luke.simpson

DATE PLOTTED: 29/01/2020 11:46:55 AM

SIGN SCHEDULE

#1 STOP R1-1 #3 KEEP LEFT R2-3(L)

VACANT

CIVIL DETAILED DESIGN SUPPLIED BY REEDS CONSULTING, REF No. 22835E/1 REV. H (SHOWN IN BLUE)

VACANT

100m LEFT-TURN SLIP LANE

HULL ROAD

MATCH INTO EXISTING

100.0R

100.0R

4.3 (E)

3.2 (E)

4.1 (E)

4.7

50.0R

#3

2.5

500.0R

12.5R

3.5

50.0R

MATCH INTO EXISTING

RETAIN #1(E) SIGN

#1(E)

3.8 (E)

3.4 (E)

70m LEFT-TURN LANE

CARRONVALE ROAD

RESIDENTIAL

CAMELOT COURT

RESIDENTIAL

N

MELWAY MAP REF 38 A10

FOR CONTINUATION REFER TO CARDNO DRAWING V161623-TR-DG-2504

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\04 Drawings\01 CAD\V161623-TR-DG-2505.dgn

Rev	Date	Description	Drawn	Appr.
2	28.01.2020	CLIENT COMMENTS	LS	MS
1	16.01.2020	ISSUED FOR INFORMATION	LS	MS

0 2.5 5 10
1:500 @ A3

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Drawn: L. SIMPSON
Designed: L. SIMPSON
Checked: C. SANSTOUPET
Authorised: M. SALDANHA

Client: REEDS CONSULTING
Project: LILYDALE QUARRY REDEVELOPMENT
HULL ROAD, LILYDALE
YARRA RANGES COUNCIL
Title: SITE ACCESS - ULTIMATE LAYOUT (UNSIGNALISED)
FUNCTIONAL LAYOUT PLAN
SIGNAGE & PAVEMENT MARKING

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Date	Scale	Size
16.01.2020	1:500	A3

Drawing Number: V161623-TR-DG-2505
Revision: 2

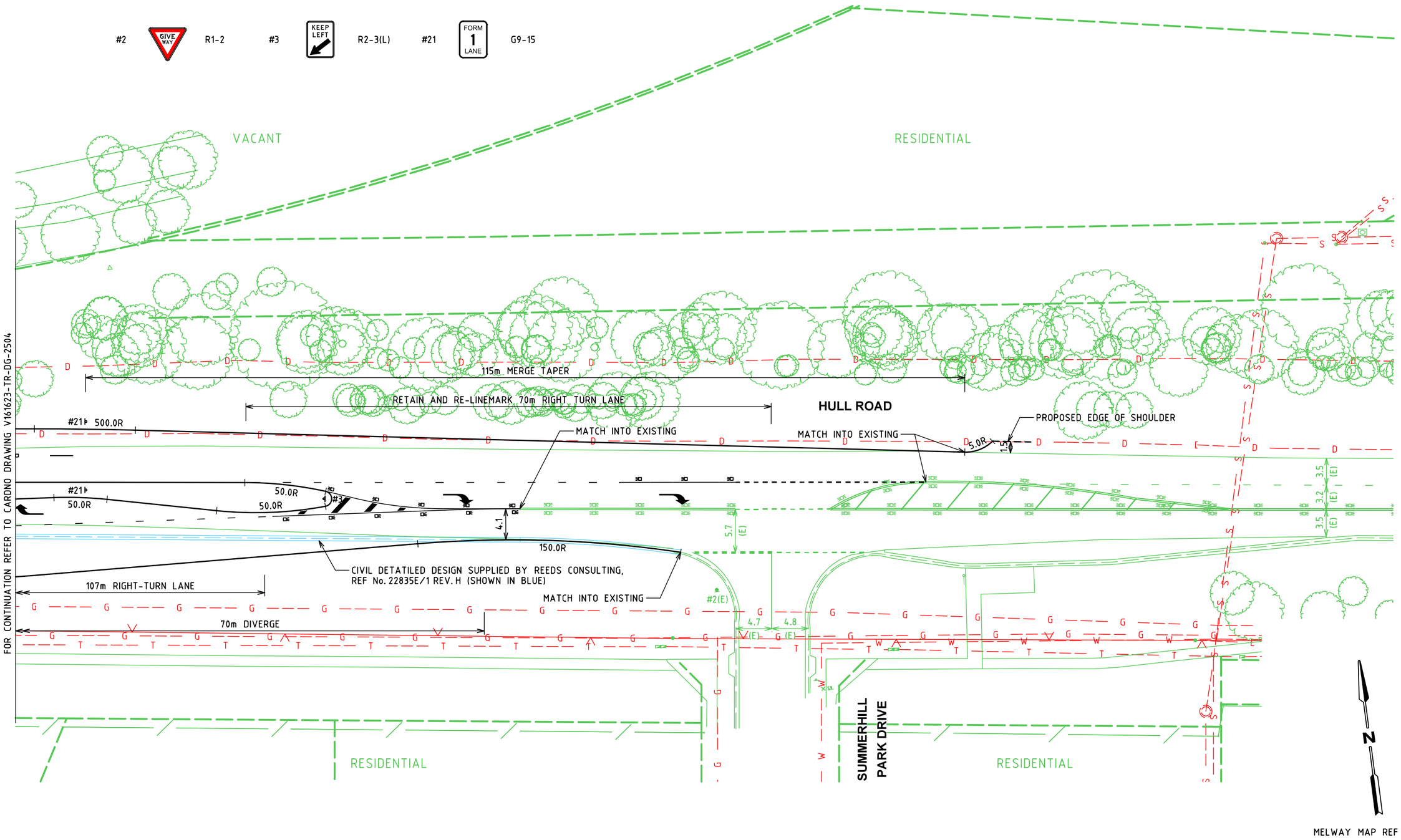
BY: User:luke.simpson

DATE PLOTTED: 16/01/2020 12:47:06 PM

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\04 Drawings\01 CAD\V161623-TR-DG-2506.dgn

SIGN SCHEDULE

#2 GIVE WAY R1-2 #3 KEEP LEFT R2-3(L) #21 FORM 1 LANE G9-15



MELWAY MAP REF 38 B9

Rev	Date	Description	Drawn	Appr.
3	15.01.2020	SIGNAGE AND PAVEMENT MARKING DETAIL	LS	MS
2	08.08.2019	CLIENT COMMENTS	EC	MS
1	16.01.2020	ISSUED FOR INFORMATION	LS	MS

0 2.5 5 10
1:500 @ A3

WARNING
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1. BASE INFORMATION SUPPLIED BY REEDS CONSULTING, REF No. 22835/E1 rev. C
2. ALL DIMENSIONS TO FACE OF KERB AND CHANNEL U.N.O.
3. LOCAL ROAD - HULL ROAD (SPEED ZONE 70KM/H)
   LOCAL ROAD - SUMMERHILL PARK DR (SPEED ZONE 50KM/H)
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Drawn: L. SIMPSON
Designed: L. SIMPSON
Checked: C. SANSTOUPET
Authorised: M. SALDANHA

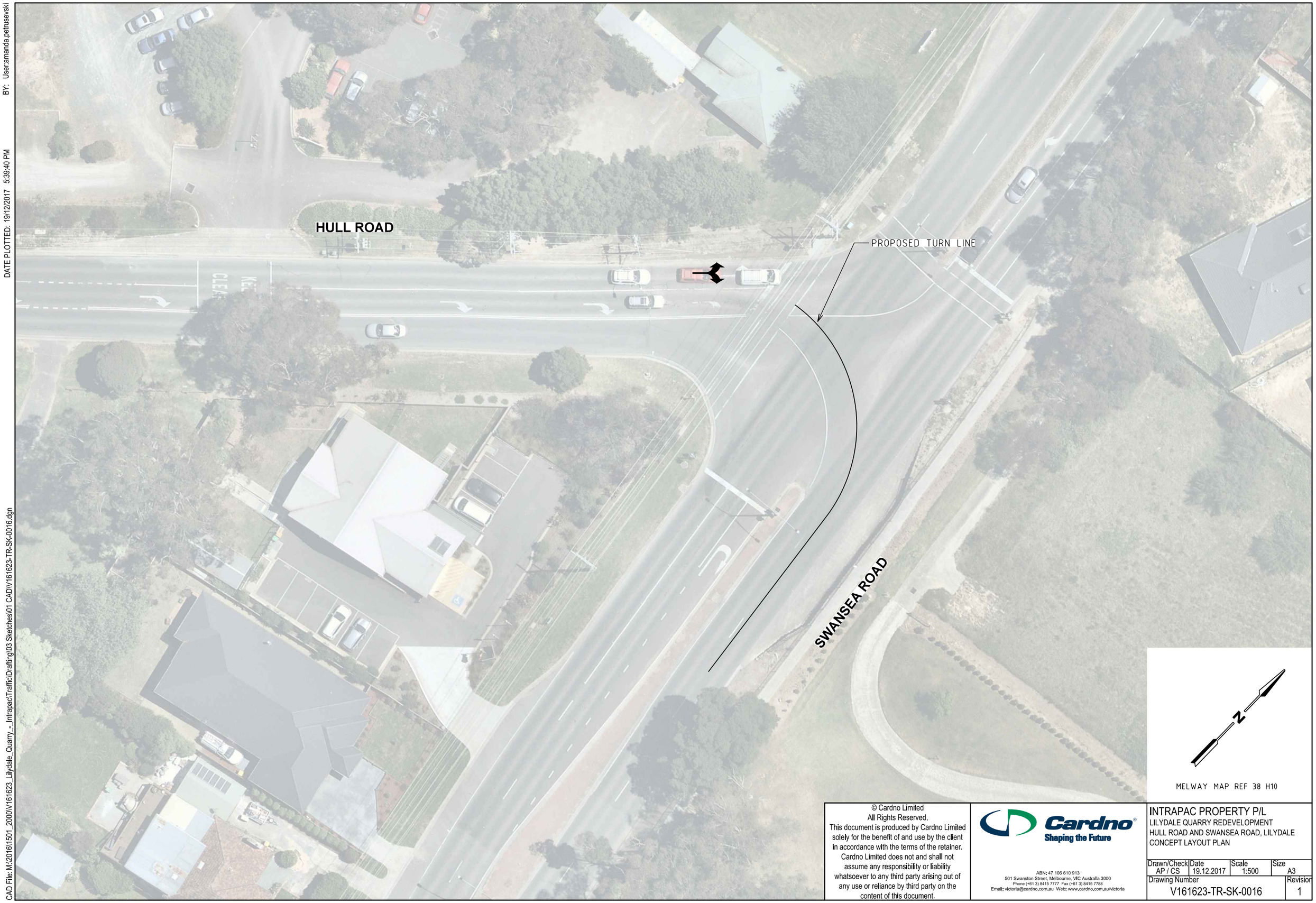
Client: REEDS CONSULTING
Project: LILYDALE QUARRY REDEVELOPMENT
HULL ROAD, LILYDALE
YARRA RANGES COUNCIL
Title: SITE ACCESS - ULTIMATE LAYOUT (UNSIGNALISED)
FUNCTIONAL LAYOUT PLAN
SIGNAGE & PAVEMENT MARKING

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
Date: 16.01.2020
Scale: 1:500
Size: A3
Drawing Number: V161623-TR-DG-2506
Revision: 1

BY: User:amanda.petrusevski

DATE PLOTTED: 19/12/2017 5:39:40 PM

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\03 Sketches\01 CAD\V161623-TR-SK-0016.dgn



N

MELWAY MAP REF 38 H10

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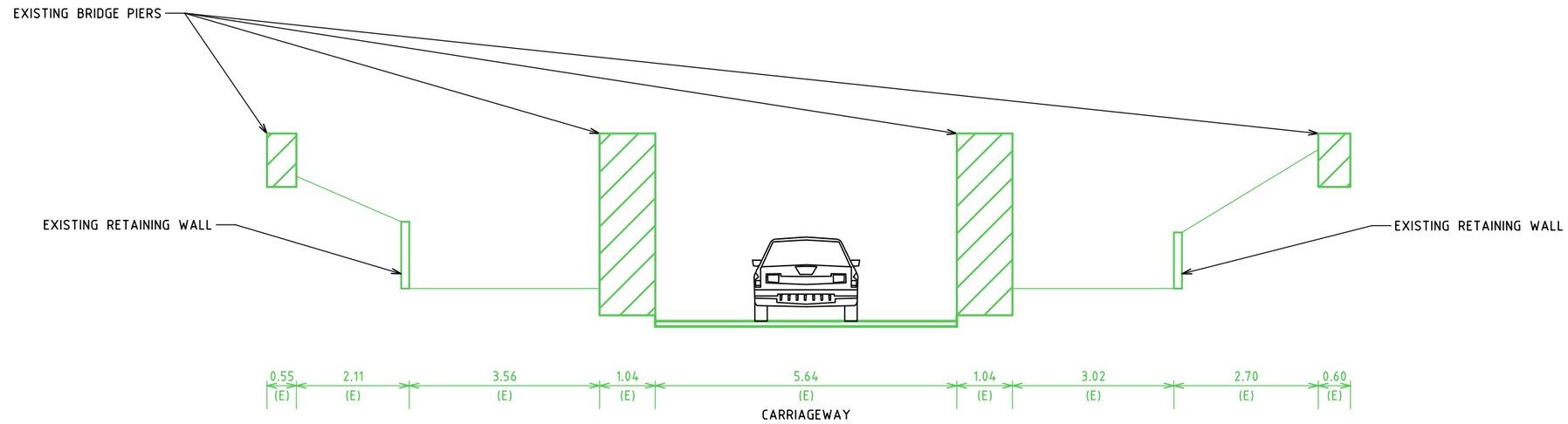
INTRAPAC PROPERTY P/L
LILYDALE QUARRY REDEVELOPMENT
HULL ROAD AND SWANSEA ROAD, LILYDALE
CONCEPT LAYOUT PLAN

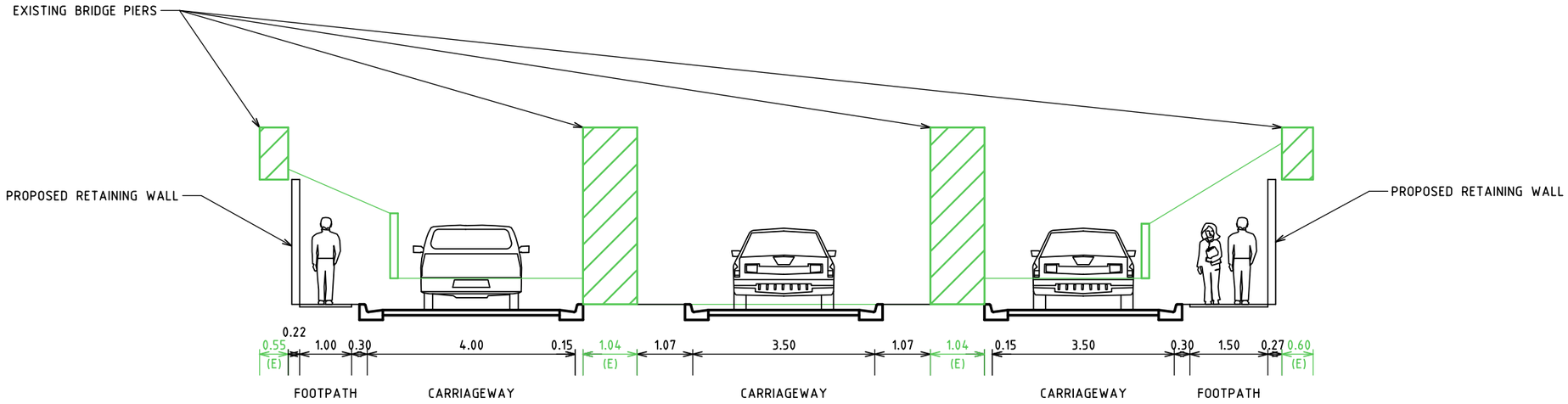
Drawn/Check	Date	Scale	Size
AP / CS	19.12.2017	1:500	A3

Drawing Number	Revision
V161623-TR-SK-0016	1



EXISTING CONDITIONS

EXISTING CROSS SECTION BASED ON MTA STANDARD DRAWING No. 2393-89 PROVIDED BY LEVEL CROSSING REMOVAL AUTHORITY



PROPOSED DESIRABLE LAYOUT

(FOOTPATH ON EASTERN SIDE)

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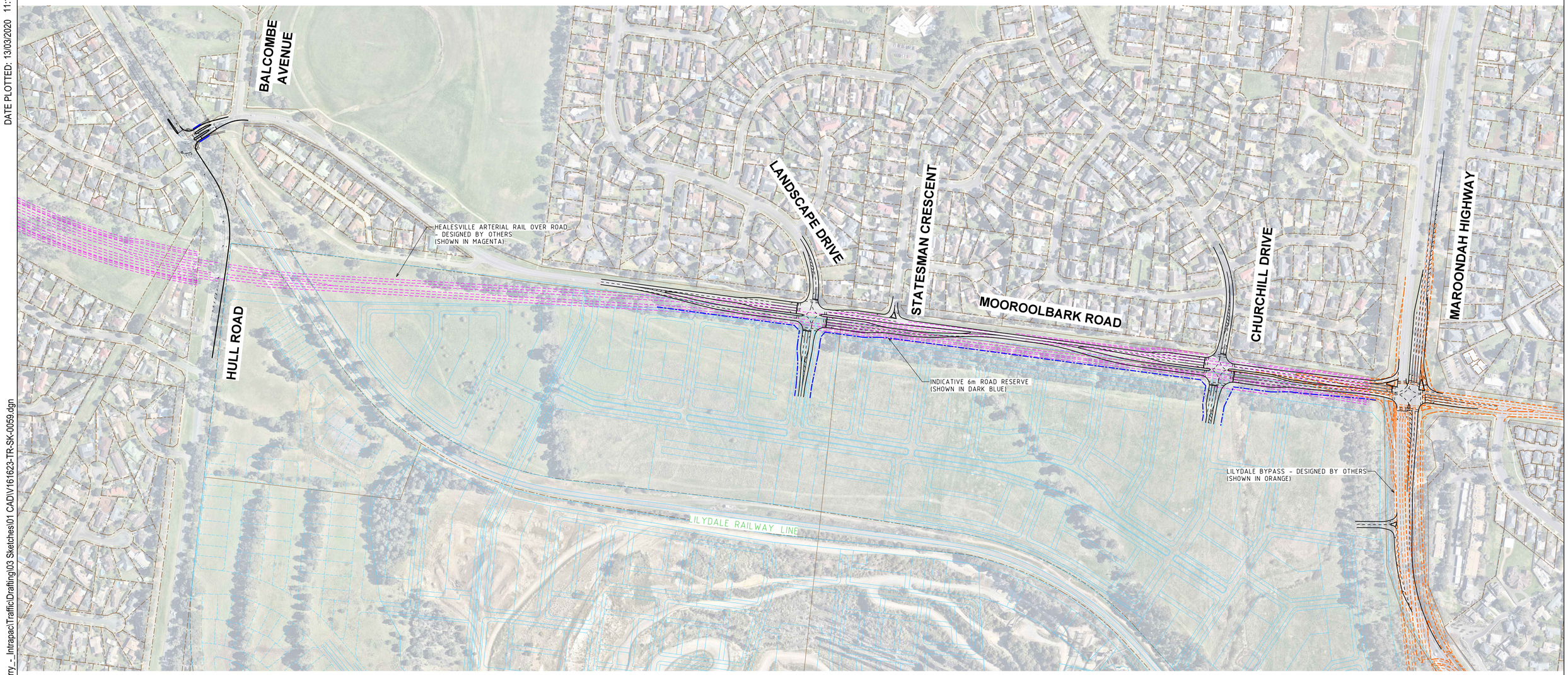
INTRAPAC PROPERTY P/L
LILYDALE QUARRY REDEVELOPMENT
MOOROOLBARK ROAD, LILYDALE
INDICATIVE CROSS SECTIONS
EXISTING RAIL BRIDGE

Drawn/Check	Date	Scale	Size
EC / CB	15.10.2019	N.T.S.	A3

Drawing Number	Revision
V161623-TR-SK-0053	3

DATE PLOTTED: 13/03/2020 11:18:38 AM BY: Userrluke.simpson



N

MELWAY MAP REF 38 D6

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INTRAPAC PROPERTY P/L
LILYDALE QUARRY REDEVELOPMENT
MOOROOLBARK ROAD, LILYDALE
CONCEPT LAYOUT PLAN
OPTION 7 - MERGE TO SINGLE CARRIAGEWAY

Drawn/Check	Date	Scale	Size
EC / CS	18.02.2020	1:2500	A1

Drawing Number	Revision
V161623-TR-SK-0059	2

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\03 Sketches\01 CAD\V161623-TR-SK-0059.dgn

BY: User:luke.simpson

DATE PLOTTED: 13/03/2020 11:17:56 AM

PREVIOUS HULL ROAD CONCEPT DESIGN
(BASED ON AERIAL)

HULL ROAD

3.25 3.25 3.0 3.0 3.0

53.0m LEFT/RIGHT-TURN LANE (INCLUDING 23.0m TAPER)

INDICATIVE RETAINING WALL
ALIGNMENT (TYP.)

GREENSLOPES DRIVE

1.5
0.3
3.5
2.3
3.5
2.3
4.0
0.3
1.0

MOOROOLBARK ROAD

PROPOSED LAND ACQUISITION

CIVIL BRIDGE WIDENING DESIGN SHOWN IN CYAN

1.2
0.6
3.5
3.0
3.5
3.0
1.2

BALCOMBE AVENUE

N

MELWAY MAP REF 37 K9

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INTRAPAC PROPERTY P/L
LILYDALE QUARRY REDEVELOPMENT
MOOROOLBARK ROAD, LILYDALE
HULL ROAD INTERSECTION
CONCEPT LAYOUT

Drawn/Check	Date	Scale	Size
LS / CS	13.03.2020	1:500	A3

Drawing Number	Revision
V161623-TR-SK-0060	1

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\03 Sketches\01 CAD\V161623-TR-SK-0060.dgn

AUTUMN GROVE

THORNTON COURT

CHURCHILL DRIVE

HEALESVILLE ARTERIAL RAIL OVER ROAD -
DESIGNED BY OTHERS (SHOWN IN MAGENTA)

MOOROOLBARK ROAD

INDICATIVE 6m ROAD RESERVE
(SHOWN IN DARK BLUE)

LILYDALE BYPASS - DESIGNED BY OTHERS
(SHOWN IN ORANGE)

FOR CONTINUATION REFER TO CARDNO DRAWING No. V161623-TR-SK-0063

MELWAY MAP REF 38 A6

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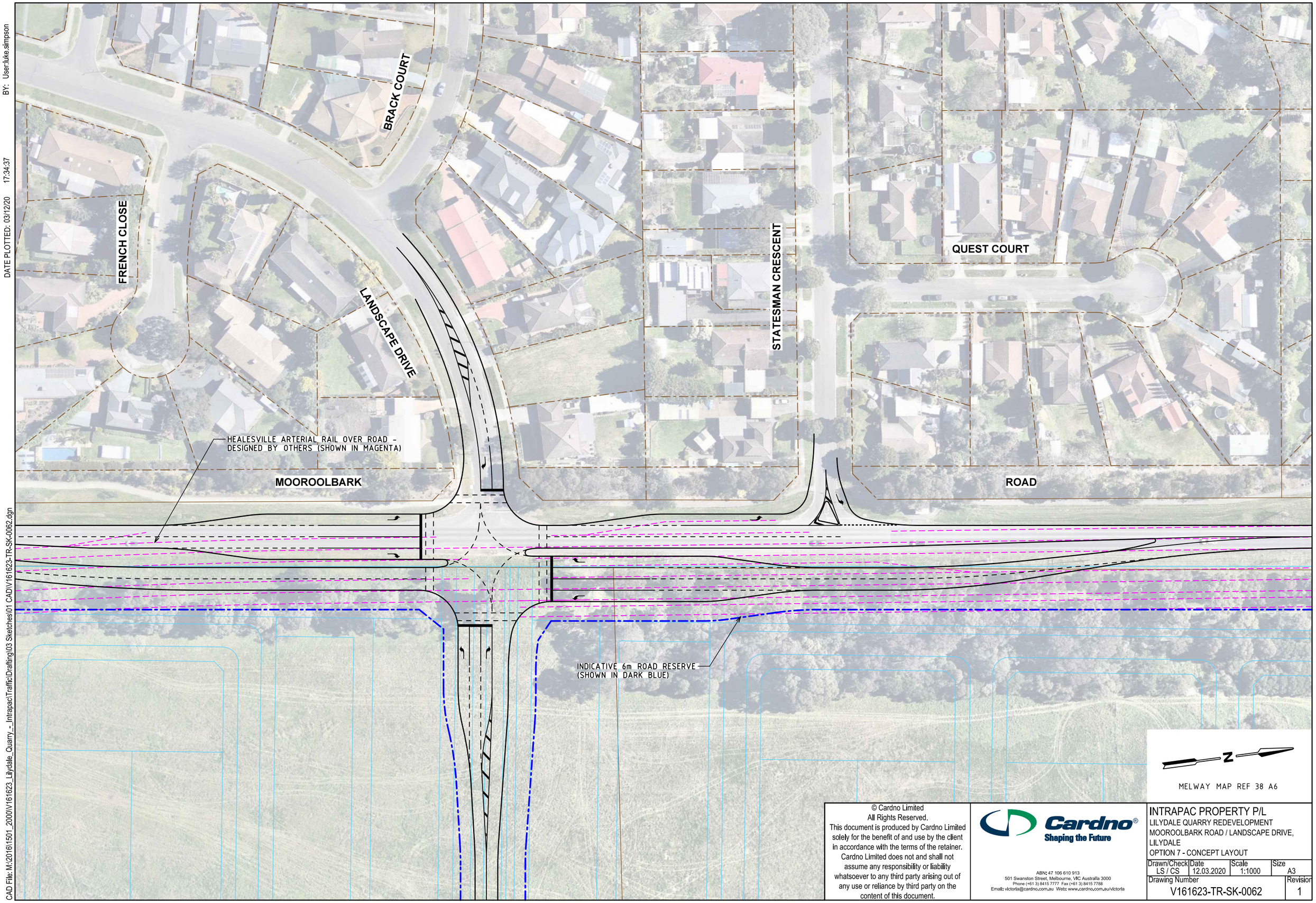
INTRAPAC PROPERTY P/L
LILYDALE QUARRY REDEVELOPMENT
MOOROOLBARK ROAD / CHURCHILL DRIVE,
LILYDALE
OPTION 7 - CONCEPT LAYOUT

Drawn/Check	Date	Scale	Size
LS / CS	12.03.2020	1:1000	A3

Drawing Number	Revision
V161623-TR-SK-0061	1

BY: User:luke.simpson
DATE PLOTTED: 13/03/2020 11:06:02 AM
CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\03 Sketches\01 CAD\V161623-TR-SK-0061.dgn



MELWAY MAP REF 38 A6

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INTRAPAC PROPERTY P/L
LILYDALE QUARRY REDEVELOPMENT
MOOROOLBARK ROAD / LANDSCAPE DRIVE, LILYDALE
OPTION 7 - CONCEPT LAYOUT

Drawn/Check	Date	Scale	Size
LS / CS	12.03.2020	1:1000	A3

Drawing Number	Revision
V161623-TR-SK-0062	1

DATE PLOTTED: 03/12/20 17:34:37 BY: User:luke.simpson
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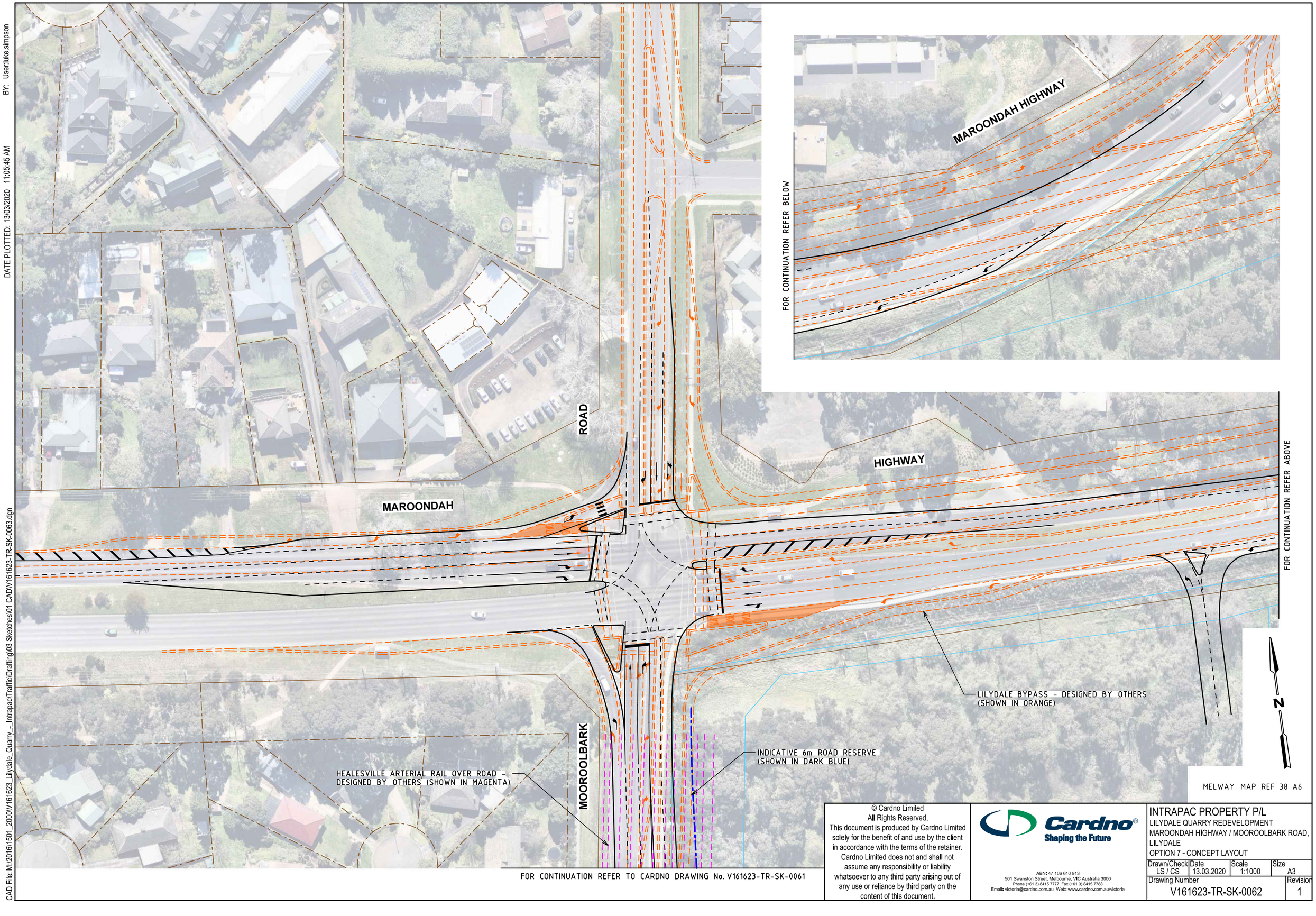

DATE PLOTTED: 13/03/2020 11:05:45 AM BY: User:luke.simpson

CAD File: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Drafting\03 Sketches\01 CAD\V161623-TR-SK-0063.dgn

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INTRAPAC PROPERTY P/L
LILYDALE QUARRY REDEVELOPMENT
MAROONDAH HIGHWAY / MOOROOLBARK ROAD, LILYDALE
OPTION 7 - CONCEPT LAYOUT

Drawn/Check	Date	Scale	Size
LS / CS	13.03.2020	1:1000	A3

Drawing Number	Revision
V161623-TR-SK-0062	1

APPENDIX

C

DETAILS OF THE TRAFFIC DISTRIBUTION ASSUMPTIONS

Stage 2 – Precinct 1: AM Peak Hour Trip Distribution

Distribution Route	Shopping	Education	Work	Recreation	Other	Total
North via Victoria Road	0%	4%	0%	0%	2%	6%
East via Maroondah Highway	2%	4%	7%	1%	4%	18%
West via Hull Road	1%	7%	17%	0%	1%	26%
West via Maroondah Highway	3%	8%	15%	1%	4%	31%
East via Hull Road	0%	5%	13%	0%	1%	19%
Total	**6%**	**28%**	**52%**	**2%**	**12%**	**100%**

Stage 2 – Precinct 1: PM Peak Hour Trip Distribution

Distribution Route	Shopping	Education	Work	Recreation	Other	Total
North via Victoria Road	0%	2%	0%	0%	2%	4%
East via Maroondah Highway	6%	2%	6%	3%	8%	25%
West via Hull Road	3%	2%	15%	0%	3%	23%
West via Maroondah Highway	8%	3%	12%	2%	6%	31%
East via Hull Road	1%	2%	12%	0%	2%	17%
Total	**18%**	**11%**	**45%**	**5%**	**21%**	**100%**

Stage 2 – Precinct 1: AM and PM Peak Hour Trip Distribution (Left and Right, Respectively)

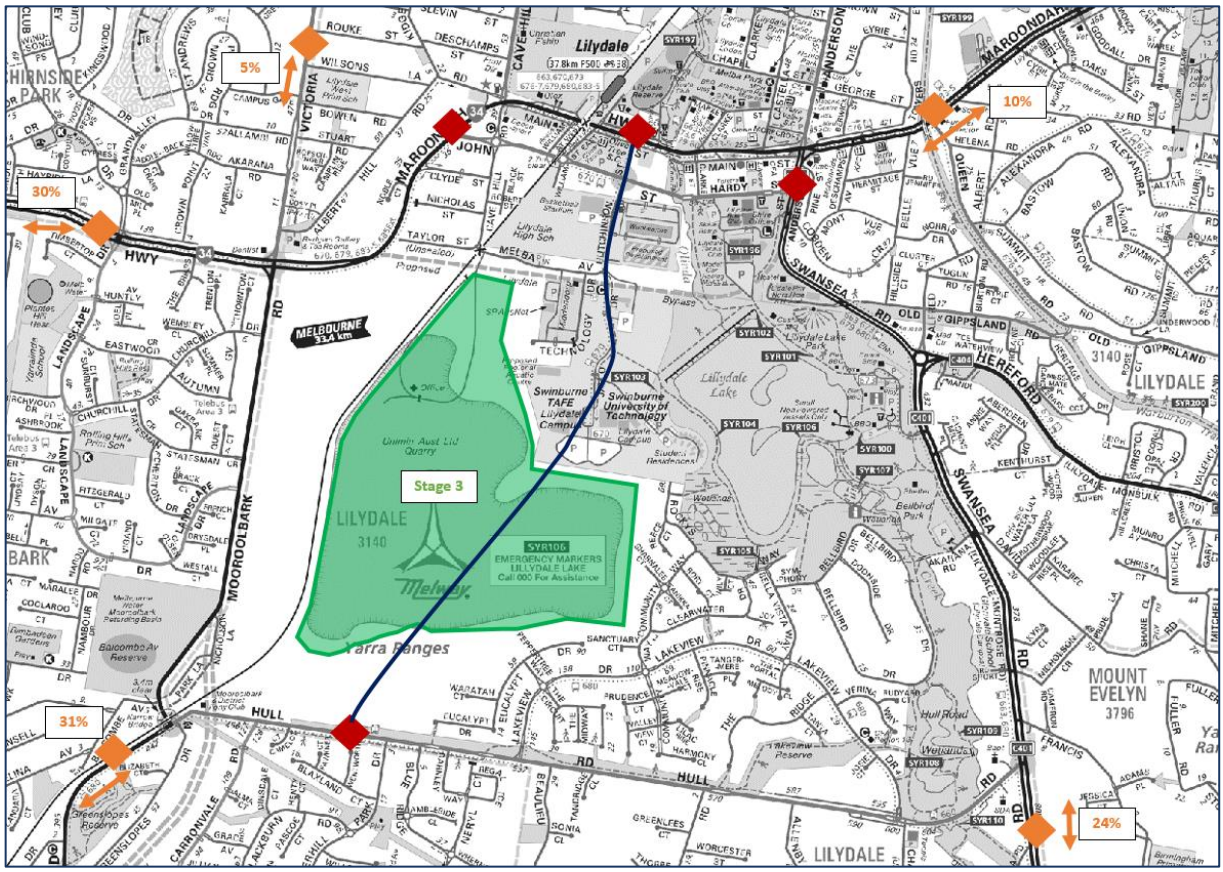
Stage 2 – Precincts 2, 3 & 4: AM Peak Hour Trip Distribution

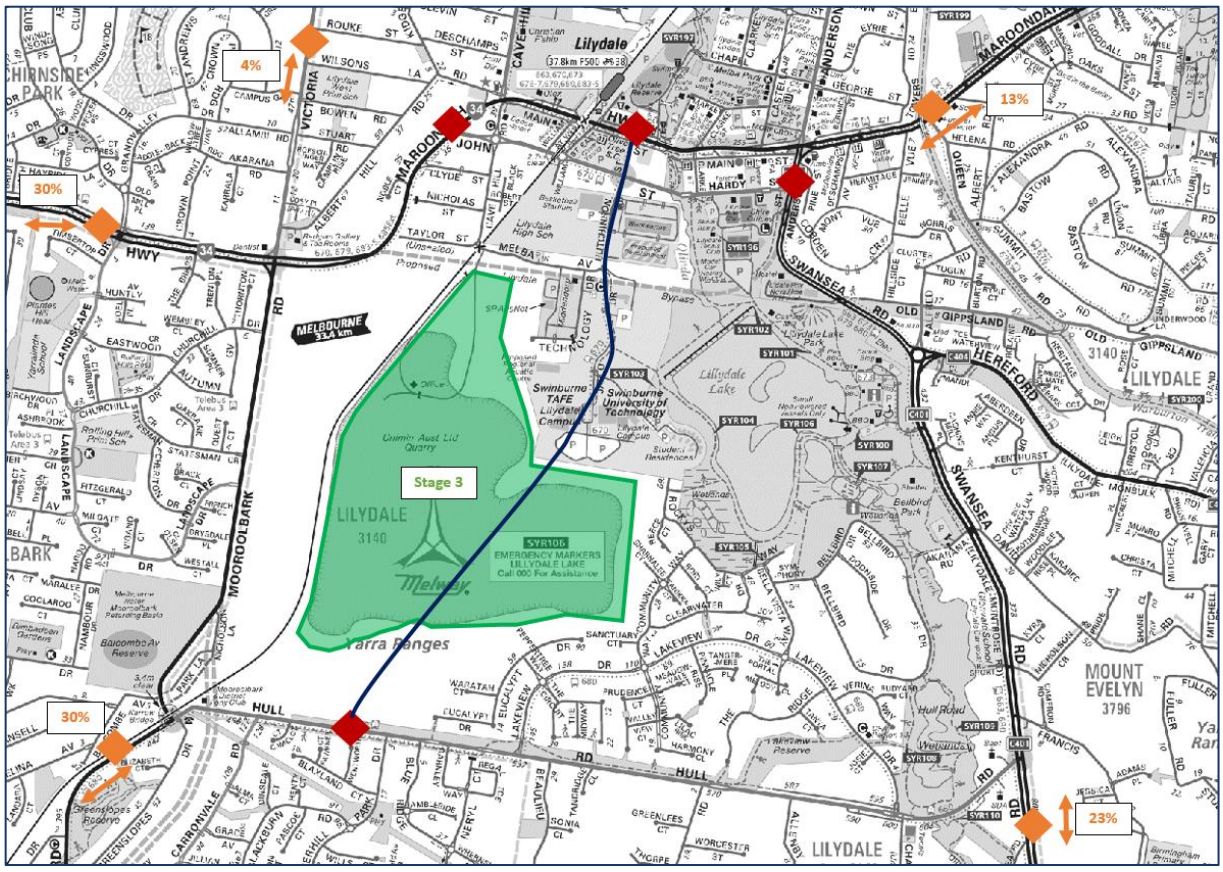
Distribution Route	Shopping	Education	Work	Recreation	Other	Total
North via Victoria Road	0%	3%	0%	0%	2%	5%
East via Maroondah Highway	2%	2%	3%	1%	2%	10%
West via Hull Road	1%	9%	17%	0%	3%	30%
West via Maroondah Highway	3%	9%	15%	1%	3%	31%
East via Hull Road	0%	5%	17%	0%	2%	24%
Total	**6%**	**28%**	**52%**	**2%**	**12%**	**100%**

Stage 2 – Precincts 2,3 & 4: PM Peak Hour Trip Distribution

Distribution Route	Shopping	Education	Work	Recreation	Other	Total
North via Victoria Road	0%	2%	0%	0%	2%	4%
East via Maroondah Highway	6%	1%	2%	2%	2%	13%
West via Hull Road	3%	3%	17%	0%	7%	30%
West via Maroondah Highway	8%	3%	10%	3%	6%	30%
East via Hull Road	1%	2%	16%	0%	4%	23%
Total	**18%**	**11%**	**45%**	**5%**	**21%**	**100%**

Stage 2 – Precinct 2, 3 & 4: AM and PM Peak Hour Trip Distribution (Top and Bottom, Respectively)





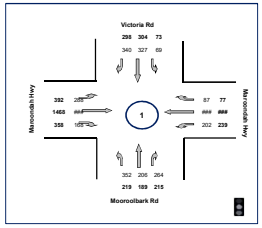
APPENDIX

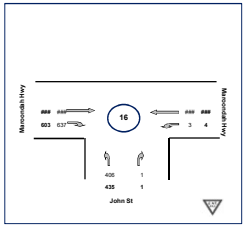
D

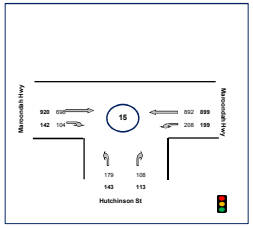
ANTICIPATED FUTURE TRAFFIC VOLUMES

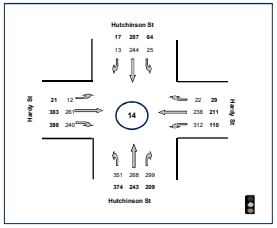
ANTICIPATED TRAFFIC VOLUMES

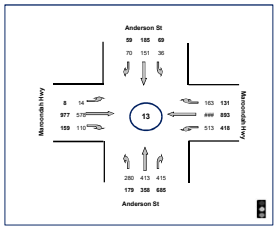
Design Year: 2020
Compounded Growth Rate: 1.1%
Developed Stages: 1, 2 & 3

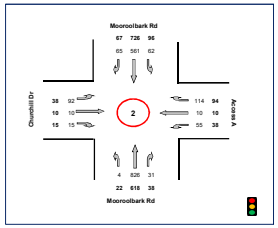


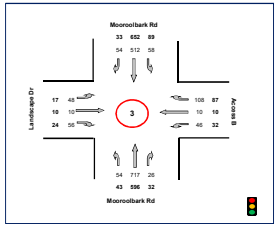


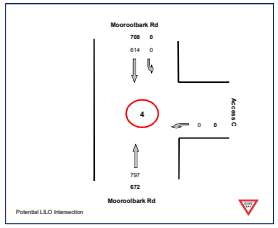


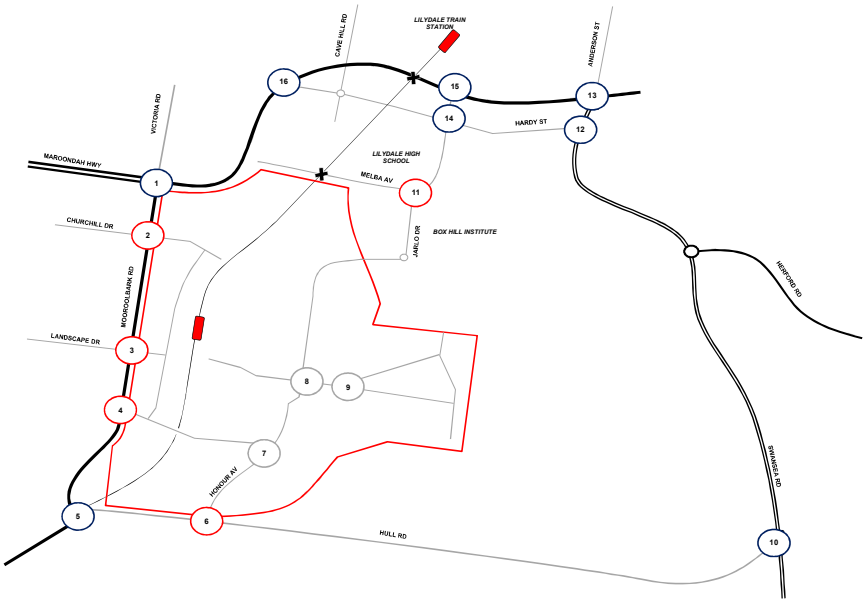


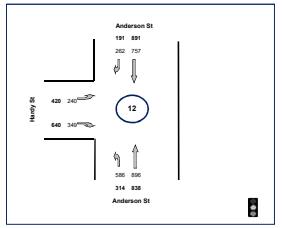


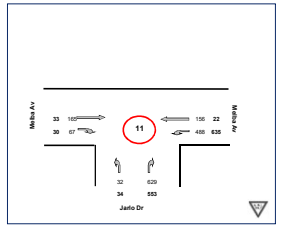


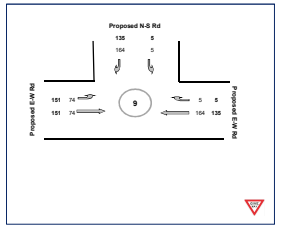


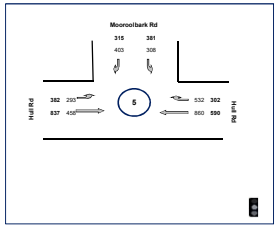


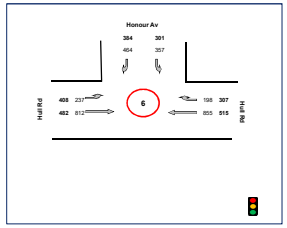


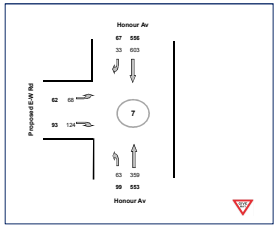


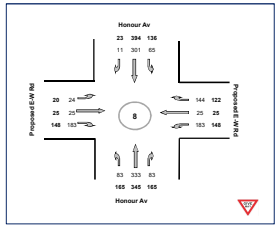


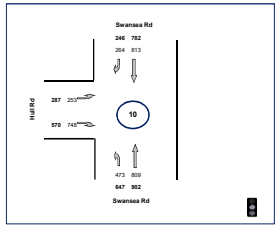












LEGEND

Internal road layout is only indicative in this map

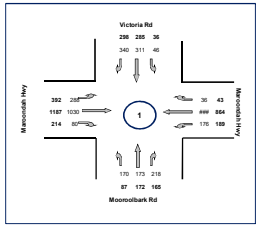
- Subject Site
- Arterial Roads
- Local Roads
- North

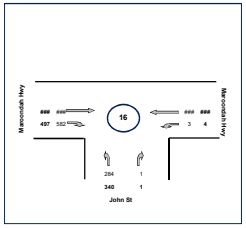
XXX: AM Peak Volumes
XXX: PM Peak Volumes

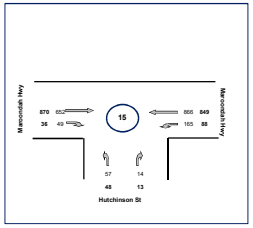
- External Development Access Locations
- Internal Intersections
- External Intersections

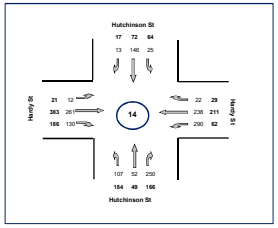
PROJECTED VOLUMES

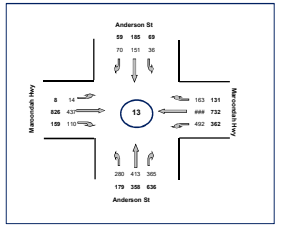
Projected Year: 2020
Number of Years: 5
Growth Rate: 1.10%

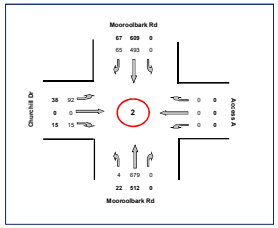


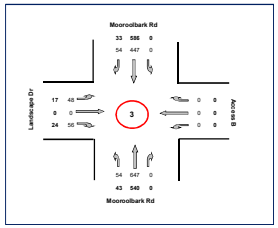


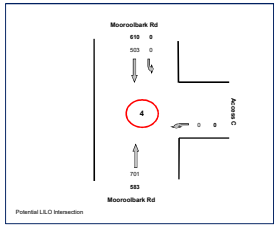


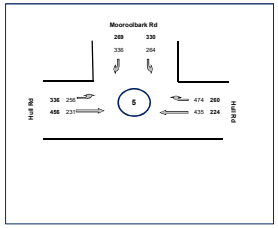


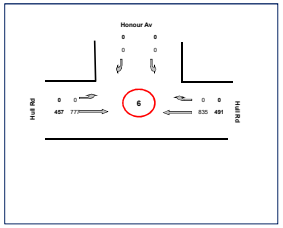


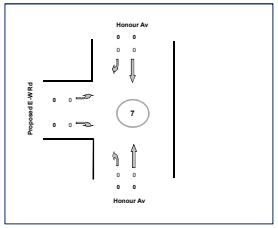


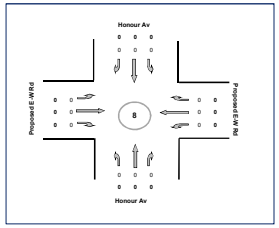


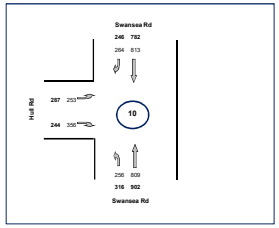


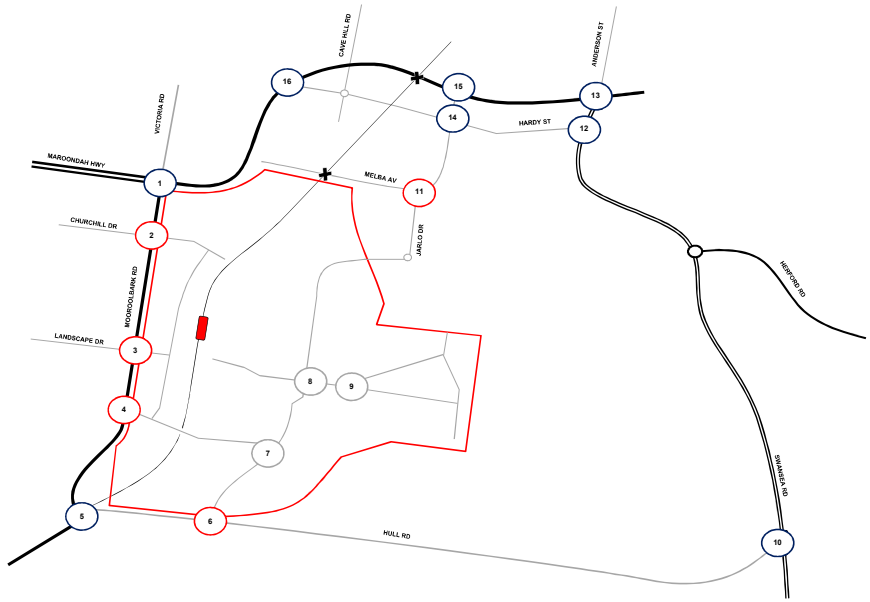


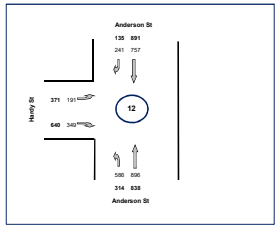


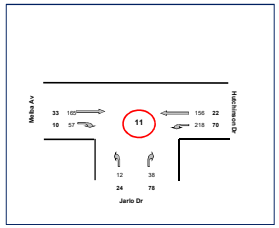


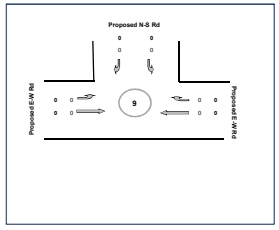












LEGEND

Internal road layout is only indicative in this map

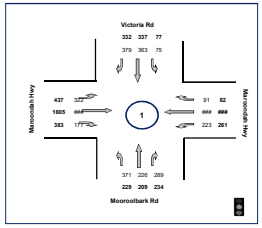
- Subject Site
- Arterial Roads
- Local Roads
- North

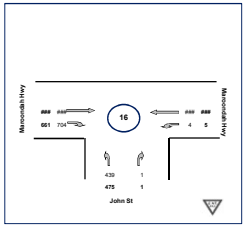
XXX: AM Peak Volumes
XXX: PM Peak Volumes

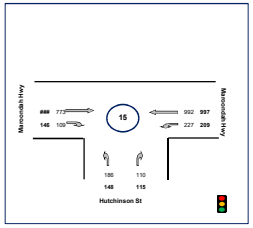
- External Development Access Locations
- Internal Intersections
- External Intersections

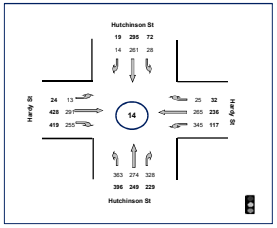
ANTICIPATED TRAFFIC VOLUMES

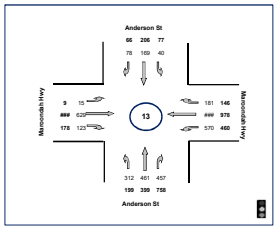
Design Year: 2030
Compounded Growth Rate: 1.1%
Developed Stages: 1, 2 & 3

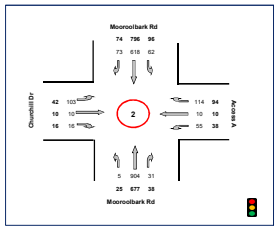


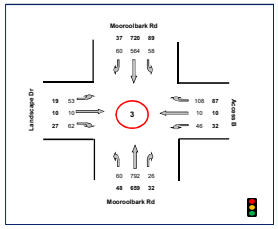


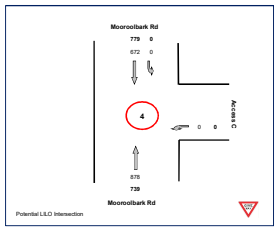


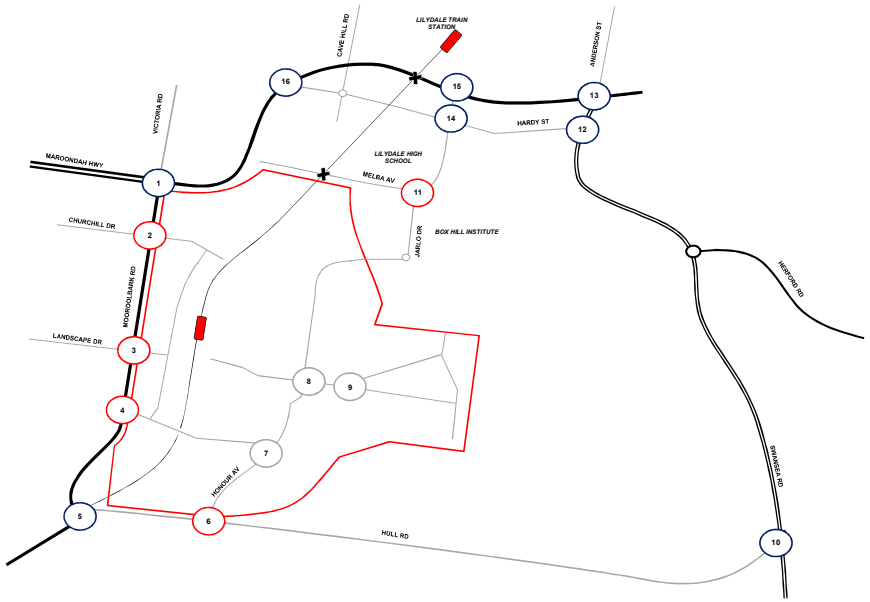


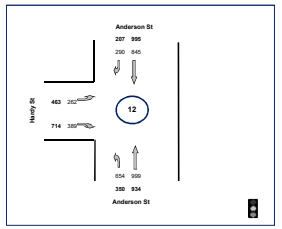


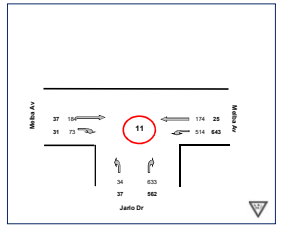


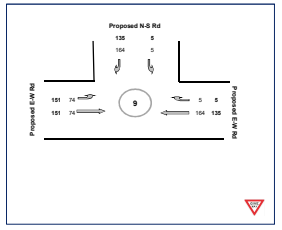


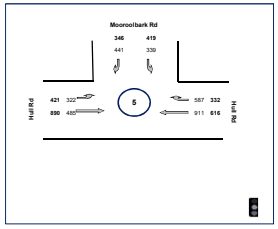


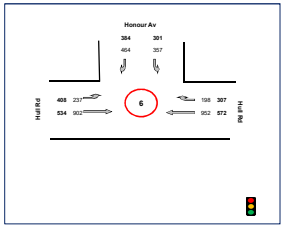


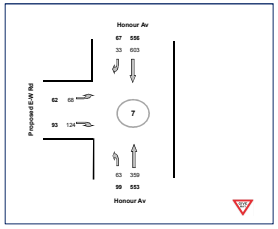


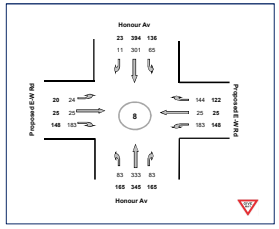


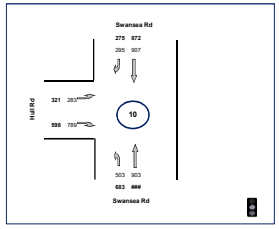












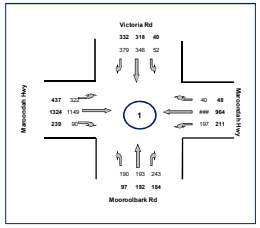
LEGEND

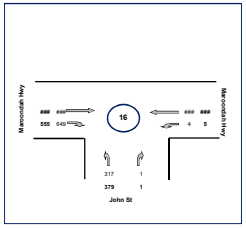
Internal road layout is only indicative in this map

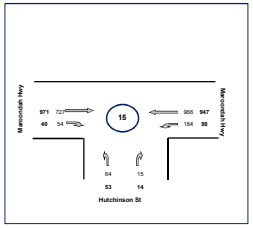
- Subject Site
- Arterial Roads
- Local Roads
- North
- XXX: AM Peak Volumes
- **XXX: PM Peak Volumes**
- External Development Access Locations
- Internal Intersections
- External Intersections

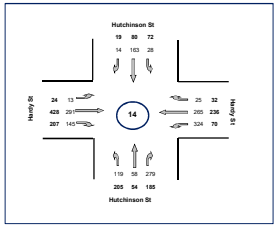
PROJECTED VOLUMES

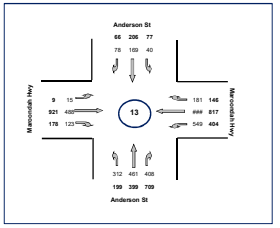
Projected Year: 2030
Number of Years: 15
Growth Rate: 1.10%

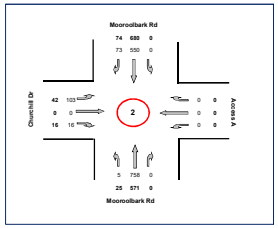


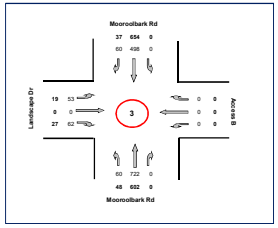


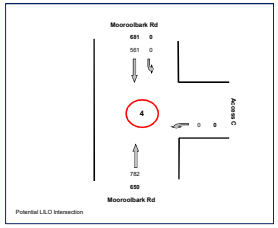


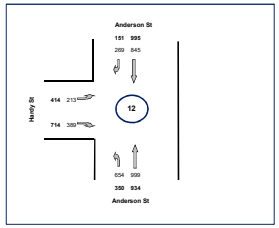


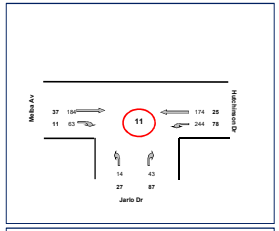


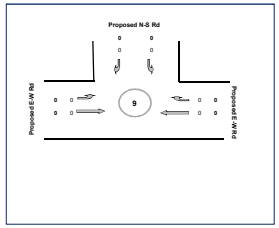


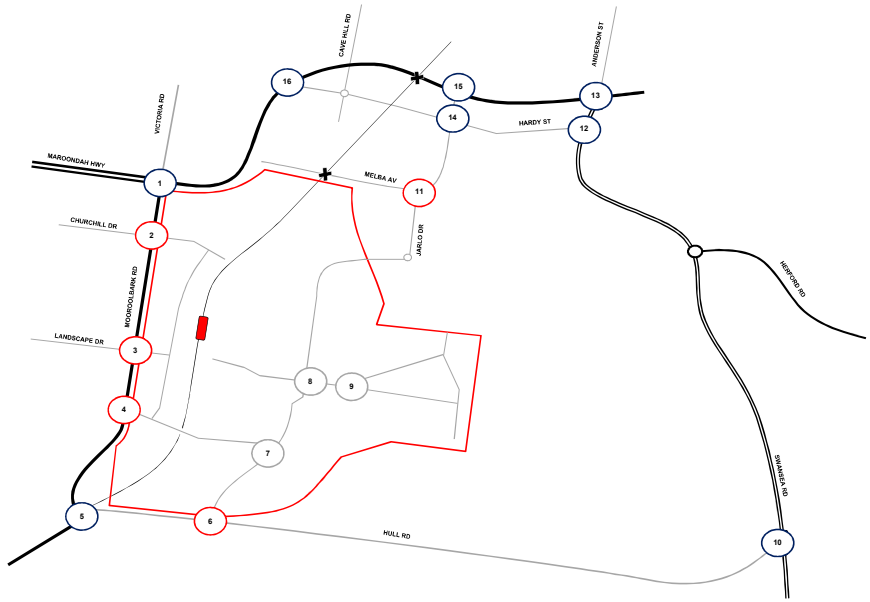


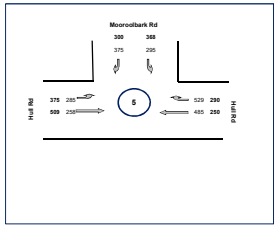


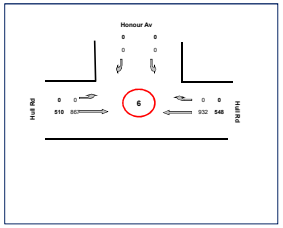


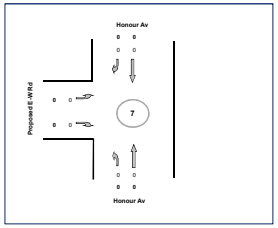


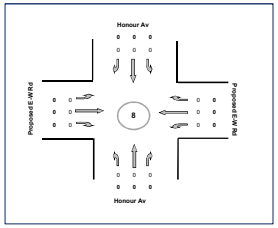


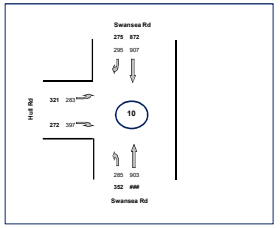












LEGEND

Internal road layout is only indicative in this map

- Subject Site
- Arterial Roads
- Local Roads
- North

XXX: AM Peak Volumes
XXX: PM Peak Volumes

- External Development Access Locations
- Internal Intersections
- External Intersections

APPENDIX

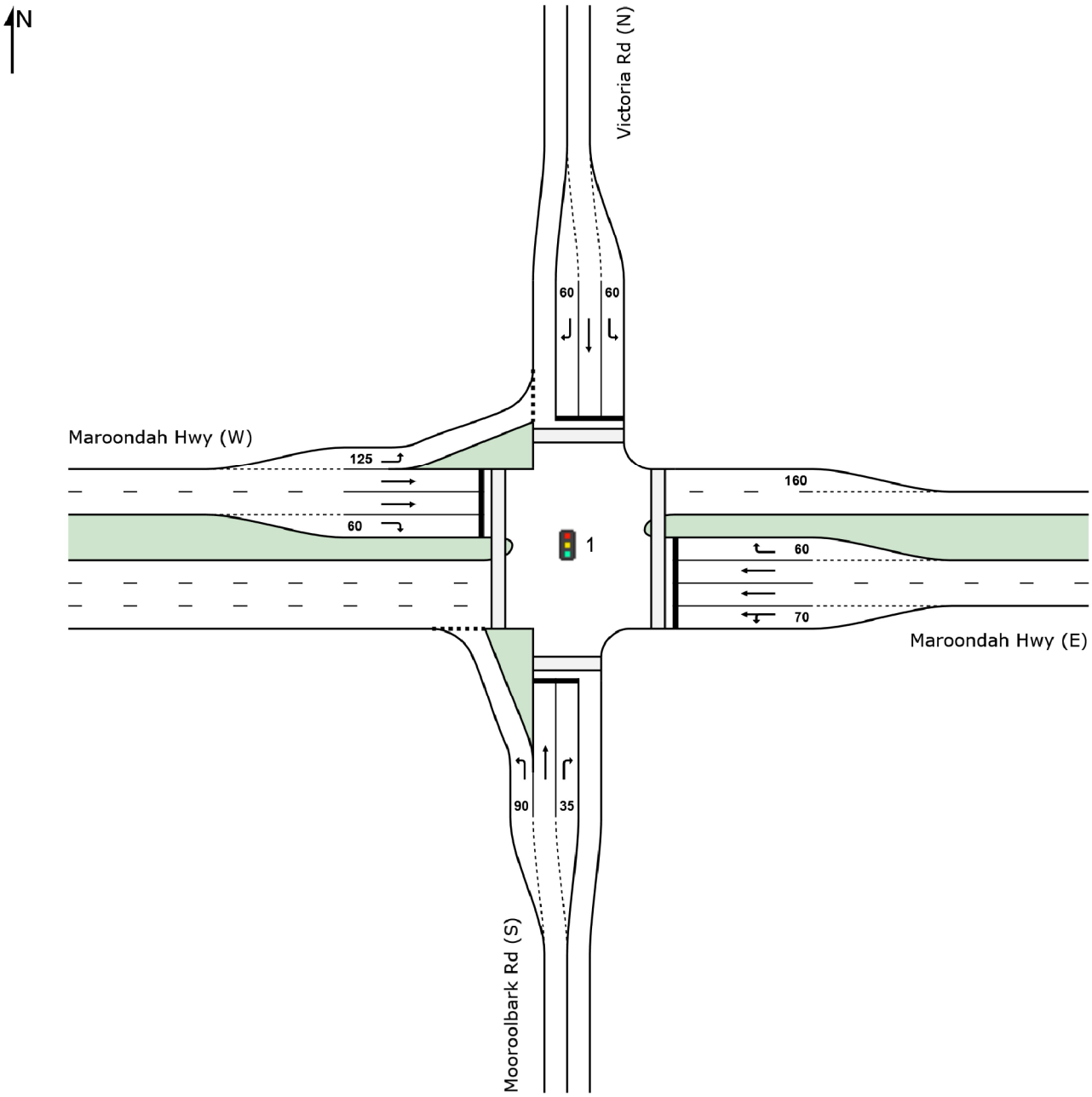
E

SIDRA INTERSECTION ANALYSIS RESULTS

SITE LAYOUT

Site: 1 [MaMoViAM - Existing - 2020Vol]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated



Project: M:\2016\1501_2000\V161623_Lilydale_Quarry_-_Intrapac\Traffic\Engineering\SIDRA\Spreadsheet V12 Vols\V161623SID004 - Victoria-Maroondah-Mooroolbark - Spreadsheet V12 Vols.sip8

LANE SUMMARY

Site: 1 [MaMoViAM - Existing - 2020Vol]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Phase Times)

Lane Use and Performance

	Demand 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 %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mooroolbark Rd (S)													
Lane 1	179	5.0	826	0.217	100	19.1	LOS B	5.2	38.0	Short	90	0.0	NA
Lane 2	182	5.0	200[1]	0.912	100	75.0	LOS E	13.2	96.1	Full	210	0.0	0.0
Lane 3	229	5.0	306[1]	0.750	100	58.1	LOS E	13.6	99.4	Short	35	0.0	NA
Approach	591	5.0		0.912		51.5	LOS D	13.6	99.4				
East: Maroondah Hwy (E)													
Lane 1	427	5.0	599	0.714	100	36.6	LOS D	21.0	153.5	Short	70	0.0	NA
Lane 2	359	5.0	502[1]	0.714	100	35.8	LOS D	18.0	131.5	Full	500	0.0	0.0
Lane 3	452	5.0	633[1]	0.714	100	38.2	LOS D	24.2	176.8	Full	500	0.0	0.0
Lane 4	38	5.0	97	0.392	100	75.3	LOS E	2.5	18.1	Short	60	0.0	NA
Approach	1276	5.0		0.714		38.1	LOS D	24.2	176.8				
North: Victoria Rd (N)													
Lane 1	48	5.0	193	0.251	100	37.9	LOS D	1.8	12.9	Short	60	0.0	NA
Lane 2	327	5.0	421	0.777	100	39.1	LOS D	13.8	100.7	Full	500	0.0	0.0
Lane 3	358	5.0	401[1]	0.892	100	65.2	LOS E	23.9	174.6	Short	60	0.0	NA
Approach	734	5.0		0.892		51.7	LOS D	23.9	174.6				
West: Maroondah Hwy (W)													
Lane 1	303	5.0	1498	0.202	100	9.1	LOS A	3.3	23.8	Short	125	0.0	NA
Lane 2	504	5.0	625	0.807	87[6]	45.3	LOS D	24.1	175.6	Full	510	0.0	0.0
Lane 3	580	5.0	625	0.929	100	65.2	LOS E	37.3	272.3	Full	510	0.0	0.0
Lane 4	84	5.0	97	0.872	100	84.5	LOS F	6.0	44.1	Short	60	0.0	NA
Approach	1472	5.0		0.929		47.9	LOS D	37.3	272.3				
Intersection	4072	5.0		0.929		46.1	LOS D	37.3	272.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

PHASING SUMMARY

Site: 1 [MaMoViAM - Existing - 2020Vol]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Phase Times)

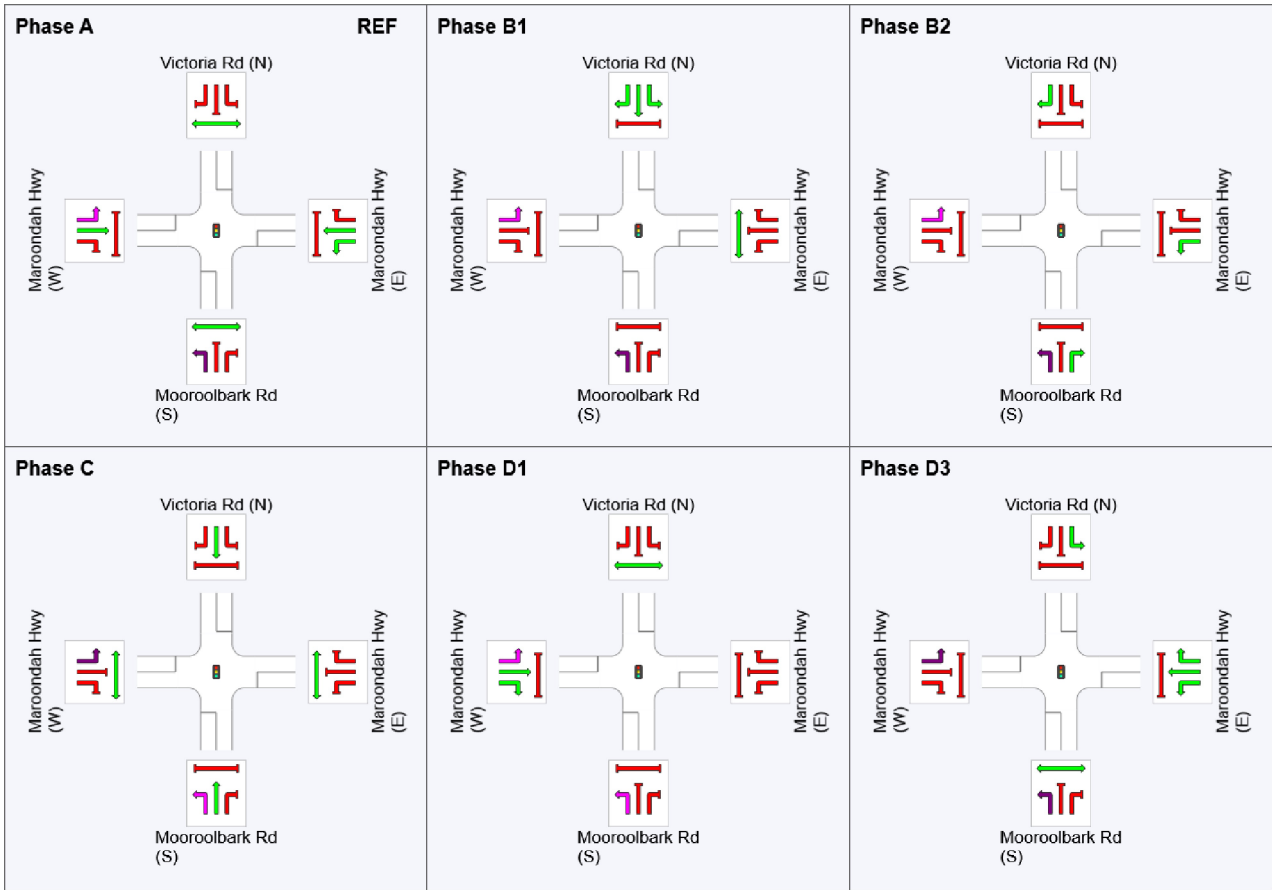
Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Opsheets - SD
Reference Phase: Phase A
Input Phase Sequence: A, B1, B2, C, D1, D3
Output Phase Sequence: A, B1, B2, C, D1, D3

Phase Timing Summary

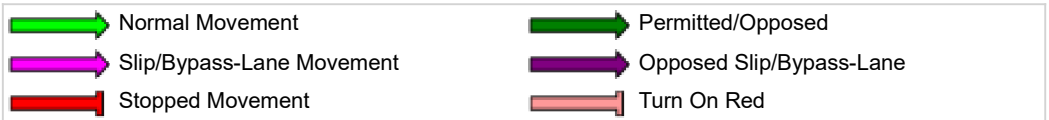
Phase	A	B1	B2	C	D1	D3
Phase Change Time (sec)	0	39	55	85	108	120
Green Time (sec)	36	10	29	19	7	7
Phase Time (sec)	42	11	33	24	10	10
Phase Split	32%	8%	25%	18%	8%	8%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



LANE SUMMARY

Site: 1 [MaMoViPM - Existing - 2020Vol]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Lane Use and Performance

	Demand 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 %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mooroolbark Rd (S)													
Lane 1	92	5.0	920	0.100	100	15.0	LOS B	1.8	13.4	Short	90	0.0	NA
Lane 2	181	5.0	321	0.564	100	42.1	LOS D	8.3	60.8	Full	210	0.0	0.0
Lane 3	174	5.0	341	0.510	100	46.6	LOS D	7.8	56.9	Short	35	0.0	NA
Approach	446	5.0		0.564		38.3	LOS D	8.3	60.8				
East: Maroondah Hwy (E)													
Lane 1	373	5.0	559	0.668	100	35.7	LOS D	15.9	116.1	Short	70	0.0	NA
Lane 2	378	5.0	567	0.668	100	33.3	LOS C	16.3	119.0	Full	500	0.0	0.0
Lane 3	357	5.0	535[1]	0.668	100	32.8	LOS C	15.2	110.7	Full	500	0.0	0.0
Lane 4	45	5.0	108	0.421	100	59.7	LOS E	2.3	16.8	Short	60	0.0	NA
Approach	1154	5.0		0.668		34.9	LOS C	16.3	119.0				
North: Victoria Rd (N)													
Lane 1	38	5.0	108	0.352	100	58.7	LOS E	1.9	13.9	Short	60	0.0	NA
Lane 2	301	5.0	319[1]	0.944	100	66.6	LOS E	18.9	137.8	Full	500	0.0	0.0
Lane 3	314	5.0	325[1]	0.965	100	80.0	LOS F	20.9	152.4	Short	60	0.0	NA
Approach	653	5.0		0.965		72.6	LOS E	20.9	152.4				
West: Maroondah Hwy (W)													
Lane 1	413	5.0	1431	0.288	100	9.5	LOS A	4.5	33.2	Short	125	0.0	NA
Lane 2	581	5.0	680	0.855	87[6]	38.6	LOS D	24.3	177.1	Full	510	0.0	0.0
Lane 3	668	5.0	680	0.983	100	74.3	LOS E	43.0	314.1	Full	510	0.0	0.0
Lane 4	225	5.0	269	0.837	100	59.4	LOS E	12.1	88.1	Short	60	0.0	NA
Approach	1887	5.0		0.983		47.4	LOS D	43.0	314.1				
Intersection	4140	5.0		0.983		46.9	LOS D	43.0	314.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

PHASING SUMMARY

Site: 1 [MaMoViPM - Existing - 2020Vol]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Opsheets - SD
Reference Phase: Phase A
Input Phase Sequence: A, B2, C, D1, D2
Output Phase Sequence: A, B2, C, D1, D2

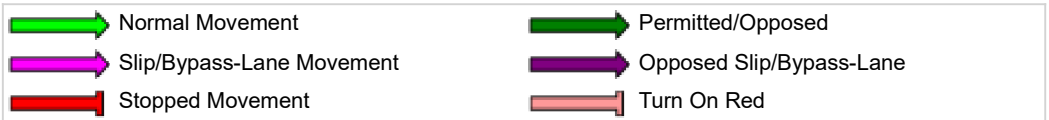
Phase Timing Summary

Phase	A	B2	C	D1	D2
Phase Change Time (sec)	0	33	58	81	91
Green Time (sec)	30	19	17	6	6
Phase Time (sec)	36	25	21	9	9
Phase Split	36%	25%	21%	9%	9%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence

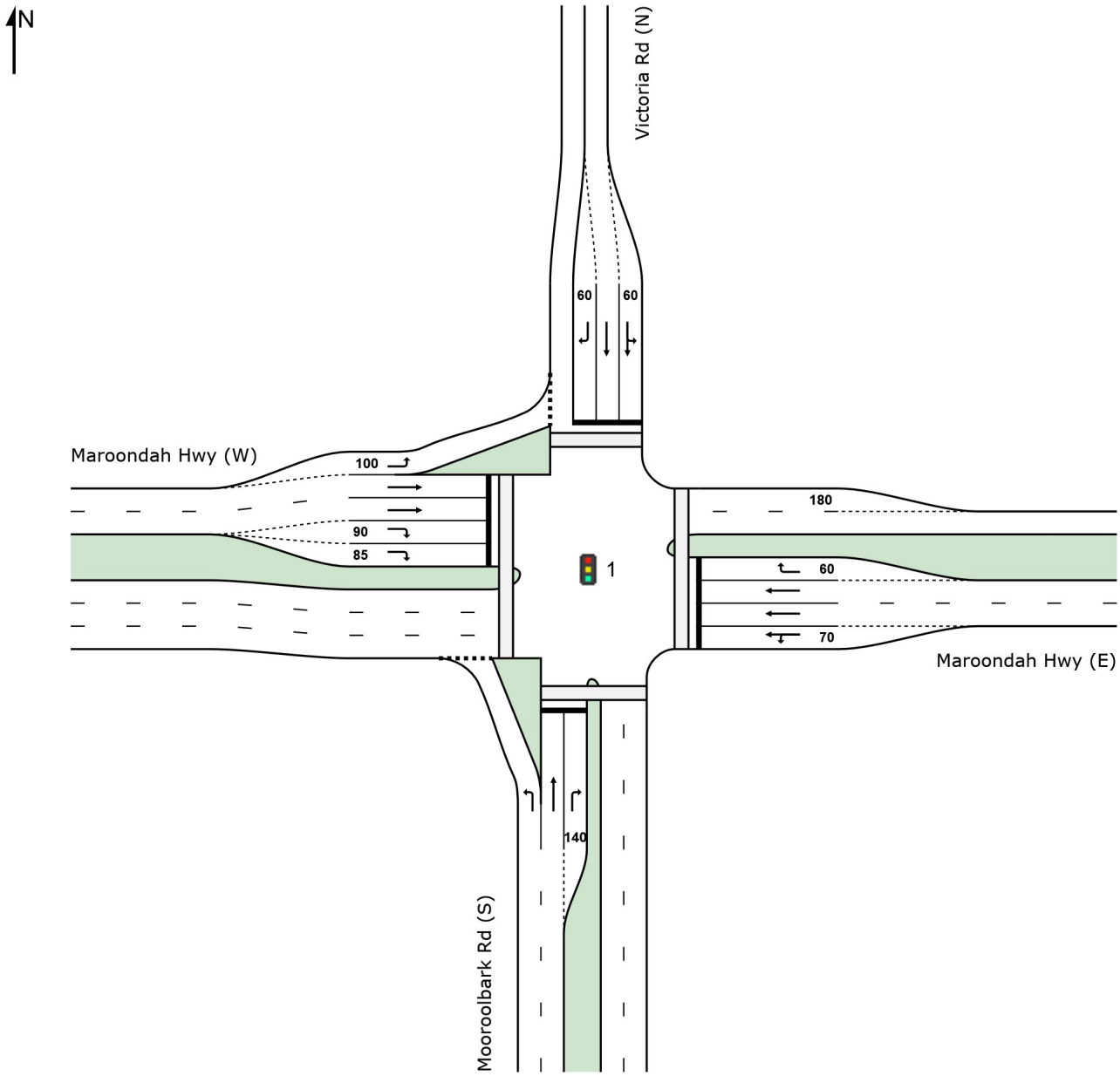
REF: Reference Phase
VAR: Variable Phase



SITE LAYOUT

Site: 1 [MaMoViAM - Proposed- 2020Vol+DEV]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated



LANE SUMMARY

Site: 1 [MaMoViAM - Proposed- 2020Vol+DEV]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Phase Times)

Lane Use and Performance

	Demand 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 %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mooroolbark Rd (S)													
Lane 1	371	5.0	641	0.578	100	38.2	LOS D	17.7	129.5	Full	210	0.0	0.0
Lane 2	217	5.0	262	0.829	100	65.6	LOS E	14.6	106.7	Full	210	0.0	0.0
Lane 3	278	5.0	441	0.630	100	53.9	LOS D	15.8	115.5	Short	140	0.0	NA
Approach	865	5.0		0.829		50.1	LOS D	17.7	129.5				
East: Maroondah Hwy (E)													
Lane 1	482	5.0	500[1]	0.963	100	78.1	LOS E	37.1	270.8	Short	70	0.0	NA
Lane 2	480	5.0	498[1]	0.963	100	74.8	LOS E	36.7	267.9	Full	500	0.0	0.0
Lane 3	636	5.0	661[1]	0.963	100	73.3	LOS E	50.9	371.7	Full	500	0.0	0.0
Lane 4	92	5.0	110	0.830	100	80.9	LOS F	6.4	46.8	Short	60	0.0	NA
Approach	1689	5.0		0.963		75.5	LOS E	50.9	371.7				
North: Victoria Rd (N)													
Lane 1	205	5.0	254	0.808	100	66.3	LOS E	13.7	100.0	Short	60	0.0	NA
Lane 2	211	5.0	262	0.808	100	64.2	LOS E	14.0	102.5	Full	500	0.0	0.0
Lane 3	358	5.0	365[1]	0.982	100	99.6	LOS F	30.4	221.9	Short	60	0.0	NA
Approach	775	5.0		0.982		81.1	LOS F	30.4	221.9				
West: Maroondah Hwy (W)													
Lane 1	303	5.0	1355	0.224	100	11.3	LOS B	5.0	36.5	Short	100	0.0	NA
Lane 2	580	5.0	603[1]	0.962	100[6]	73.2	LOS E	45.5	331.9	Full	510	0.0	0.0
Lane 3	653	5.0	678[1]	0.963	100	73.4	LOS E	52.7	384.5	Full	510	0.0	0.0
Lane 4	88	5.0	110	0.801	100	79.8	LOS E	6.1	44.6	Short	90	0.0	NA
Lane 5	88	5.0	110	0.801	100	79.8	LOS E	6.1	44.6	Short	85	0.0	NA
Approach	1714	5.0		0.963		63.0	LOS E	52.7	384.5				
Intersection	5043	5.0		0.982		67.8	LOS E	52.7	384.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

PHASING SUMMARY

Site: 1 [MaMoViAM - Proposed- 2020Vol+DEV]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Opsheets - Copy (2)
Reference Phase: Phase A
Input Phase Sequence: A, B2, C, D2
Output Phase Sequence: A, B2, C, D2

Phase Timing Summary

Phase	A	B2	C	D2
Phase Change Time (sec)	0	56	94	118
Green Time (sec)	50	32	18	8
Phase Time (sec)	56	38	22	14
Phase Split	43%	29%	17%	11%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence

REF: Reference Phase
VAR: Variable Phase

LANE SUMMARY

Site: 1 [MaMoViPM - Proposed- 2020Vol+DEV]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Phase Times)

Lane Use and Performance

	Demand 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 %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Mooroolbark Rd (S)													
Lane 1	231	5.0	785	0.294	100	23.5	LOS C	8.1	59.2	Full	210	0.0	0.0
Lane 2	199	5.0	218	0.913	100	76.9	LOS E	14.7	107.0	Full	210	0.0	0.0
Lane 3	226	5.0	372	0.608	100	57.4	LOS E	13.2	96.1	Short	140	0.0	NA
Approach	656	5.0		0.913		51.4	LOS D	14.7	107.0				
East: Maroondah Hwy (E)													
Lane 1	447	5.0	557[1]	0.803	100	40.5	LOS D	23.8	173.7	Short	70	0.0	NA
Lane 2	441	5.0	549[1]	0.803	100	37.4	LOS D	23.5	171.7	Full	500	0.0	0.0
Lane 3	539	5.0	671[1]	0.803	100	38.2	LOS D	30.0	218.8	Full	500	0.0	0.0
Lane 4	81	5.0	110	0.734	100	77.7	LOS E	5.5	40.1	Short	60	0.0	NA
Approach	1507	5.0		0.803		40.8	LOS D	30.0	218.8				
North: Victoria Rd (N)													
Lane 1	196	5.0	212	0.924	100	72.9	LOS E	13.7	99.8	Short	60	0.0	NA
Lane 2	201	5.0	218	0.924	100	79.0	LOS E	15.1	110.0	Full	500	0.0	0.0
Lane 3	314	5.0	318[1]	0.988	100	104.5	LOS F	27.1	197.9	Short	60	0.0	NA
Approach	711	5.0		0.988		88.6	LOS F	27.1	197.9				
West: Maroondah Hwy (W)													
Lane 1	413	5.0	1421	0.290	100	10.8	LOS B	6.6	48.5	Short	100	0.0	NA
Lane 2	772	5.0	857	0.901	100[6]	46.3	LOS D	44.8	327.3	Full	510	0.0	0.0
Lane 3	773	5.0	857	0.902	100	46.5	LOS D	45.0	328.8	Full	510	0.0	0.0
Lane 4	188	5.0	262	0.719	100	67.1	LOS E	11.9	87.1	Short	90	0.0	NA
Lane 5	188	5.0	262	0.719	100	67.1	LOS E	11.9	87.1	Short	85	0.0	NA
Approach	2335	5.0		0.902		43.5	LOS D	45.0	328.8				
Intersection	5208	5.0		0.988		49.8	LOS D	45.0	328.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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.

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6 Lane under-utilisation due to downstream effects

PHASING SUMMARY

Site: 1 [MaMoViPM - Proposed- 2020Vol+DEV]

Victoria Road / Maroondah Highway / Mooroolbark Road
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Opsheets - Copy (2)
Reference Phase: Phase A
Input Phase Sequence: A, B2, C, D1, D2
Output Phase Sequence: A, B2, C, D1, D2

Phase Timing Summary

Phase	A	B2	C	D1	D2
Phase Change Time (sec)	0	54	87	108	119
Green Time (sec)	51	27	15	8	8
Phase Time (sec)	57	33	18	11	11
Phase Split	44%	25%	14%	8%	8%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

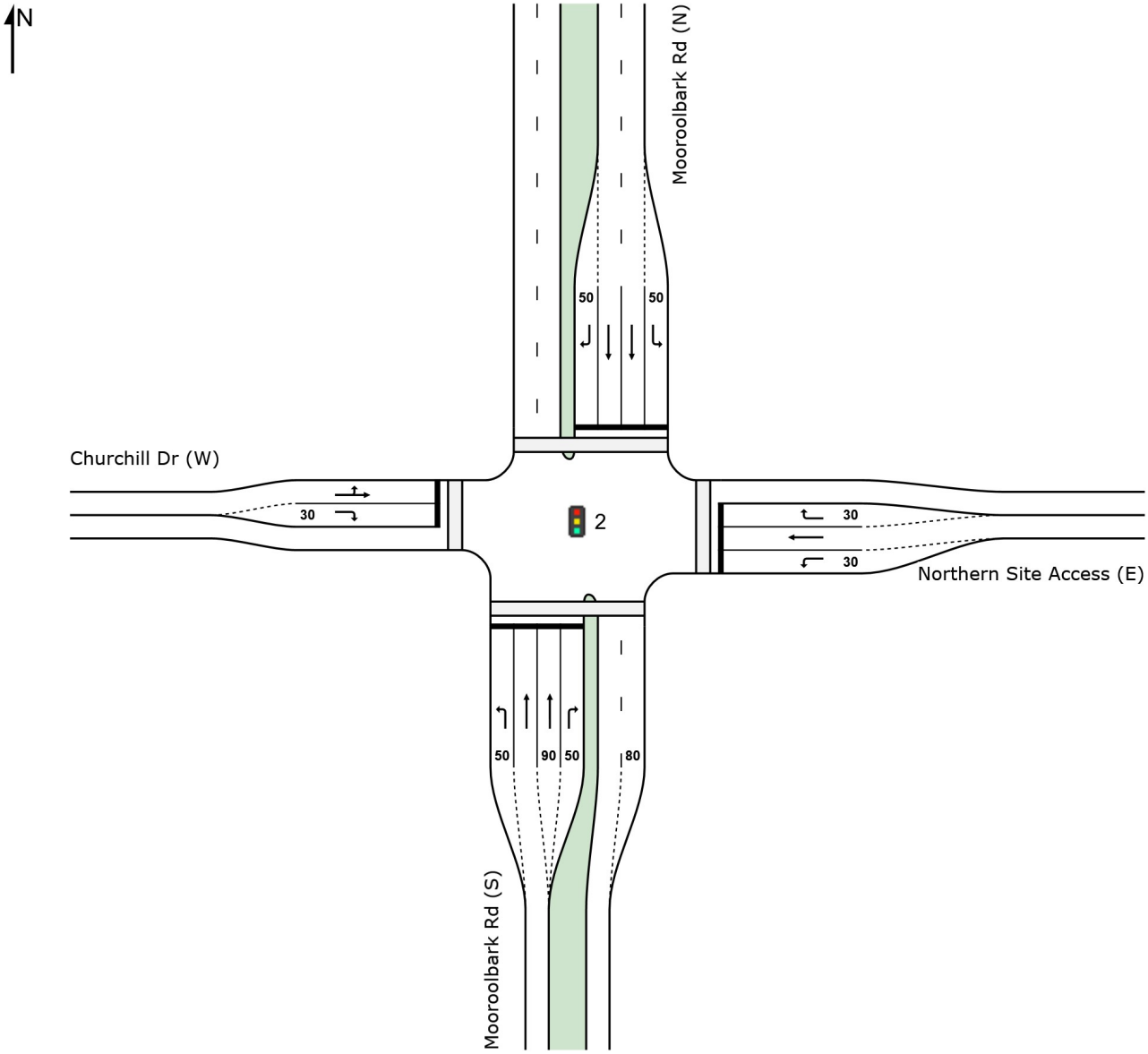
Output Phase Sequence

REF: Reference Phase
VAR: Variable Phase

SITE LAYOUT

Site: 2 [MoChAM - Proposed - 2030Vol+DEV]

Mooroolbark Road / Northern Site Access / Churchill Drive
Site Category: (None)
Signals - Fixed Time Isolated



LANE SUMMARY

Site: 2 [MoChAM - Proposed - 2030Vol+DEV]

Mooroolbark Road / Northern Site Access / Churchill Drive
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 85 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV						Veh	Dist				
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Mooroolbark Rd (S)													
Lane 1	5	2.0	969	0.005	100	16.3	LOS B	0.1	0.7	Short	50	0.0	NA
Lane 2	485	5.0	709[1]	0.684	100	24.1	LOS C	17.0	124.1	Full	500	0.0	0.0
Lane 3	467	5.0	683[1]	0.684	100	23.8	LOS C	16.2	118.0	Short	90	0.0	NA
Lane 4	33	2.0	129	0.252	100	49.6	LOS D	1.4	9.8	Short	50	0.0	NA
Approach	989	4.9		0.684		24.8	LOS C	17.0	124.1				
East: Northern Site Access (E)													
Lane 1	58	2.0	517	0.112	100	29.0	LOS C	1.8	12.7	Short	30	0.0	NA
Lane 2	11	2.0	317	0.033	100	32.4	LOS C	0.4	2.6	Full	500	0.0	0.0
Lane 3	120	2.0	194	0.619	100	46.5	LOS D	5.1	36.3	Short	30	0.0	NA
Approach	188	2.0		0.619		40.3	LOS D	5.1	36.3				
North: Mooroolbark Rd (N)													
Lane 1	65	2.0	969	0.067	100	16.7	LOS B	1.3	9.3	Short	50	0.0	NA
Lane 2	219	5.0	711	0.307	46[6]	20.2	LOS C	6.4	46.7	Full	210	0.0	0.0
Lane 3	432	5.0	646[1]	0.669	100	23.2	LOS C	14.6	106.5	Full	210	0.0	0.0
Lane 4	77	2.0	129	0.595	100	51.4	LOS D	3.4	24.0	Short	50	0.0	NA
Approach	793	4.5		0.669		24.6	LOS C	14.6	106.5				
West: Churchill Dr (W)													
Lane 1	119	2.0	452	0.263	100	31.6	LOS C	4.0	28.4	Full	500	0.0	0.0
Lane 2	17	2.0	194	0.087	100	42.9	LOS D	0.7	4.7	Short	30	0.0	NA
Approach	136	2.0		0.263		33.0	LOS C	4.0	28.4				
Intersection	2106	4.3		0.684		26.6	LOS C	17.0	124.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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.

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PHASING SUMMARY

Site: 2 [MoChAM - Proposed - 2030Vol+DEV]

Mooroolbark Road / Northern Site Access / Churchill Drive
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 85 seconds (Site Optimum Cycle Time - Minimum Delay)

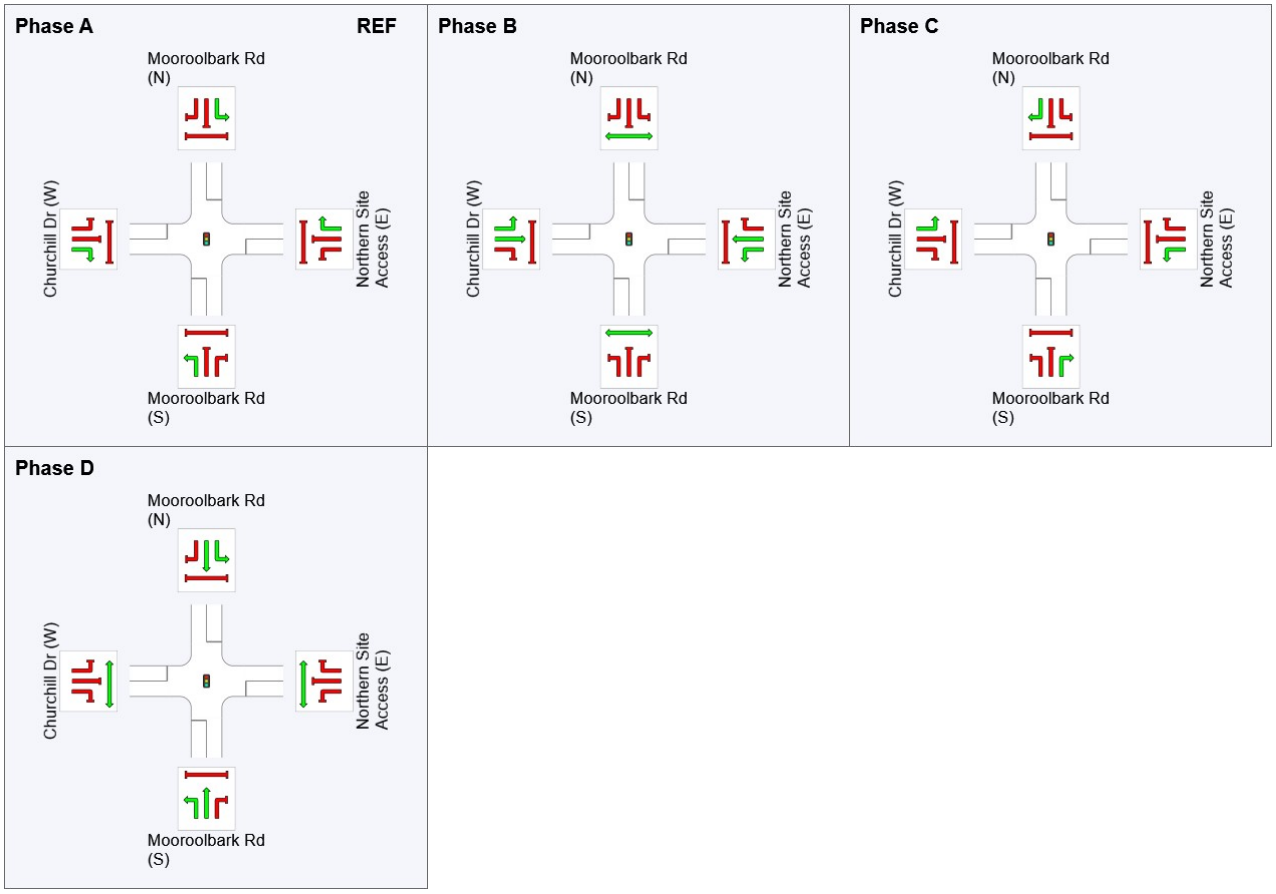
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: DDO - User-Given - Copy
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	0	15	35	47
Green Time (sec)	9	14	6	32
Phase Time (sec)	15	20	12	38
Phase Split	18%	24%	14%	45%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Normal Movement
Permitted/Opposed
Slip/Bypass-Lane Movement
Opposed Slip/Bypass-Lane

LANE SUMMARY

Site: 2 [MoChPM - Proposed - 2030Vol+DEV]

Mooroolbark Road / Northern Site Access / Churchill Drive
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 85 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Mooroolbark Rd (S)													
Lane 1	26	2.0	969	0.027	100	16.5	LOS B	0.5	3.6	Short	50	0.0	NA
Lane 2	356	5.0	778	0.458	100	19.6	LOS B	10.7	78.4	Full	500	0.0	0.0
Lane 3	356	5.0	778	0.458	100	19.6	LOS B	10.7	78.4	Short	90	0.0	NA
Lane 4	40	2.0	129	0.309	100	49.9	LOS D	1.7	12.1	Short	50	0.0	NA
Approach	779	4.7		0.458		21.0	LOS C	10.7	78.4				
East: Northern Site Access (E)													
Lane 1	40	2.0	517	0.077	100	28.7	LOS C	1.2	8.7	Short	30	0.0	NA
Lane 2	11	2.0	317	0.033	100	32.4	LOS C	0.4	2.6	Full	500	0.0	0.0
Lane 3	99	2.0	129	0.766	100	52.1	LOS D	4.5	32.3	Short	30	0.0	NA
Approach	149	2.0		0.766		44.5	LOS D	4.5	32.3				
North: Mooroolbark Rd (N)													
Lane 1	101	2.0	969	0.104	100	17.0	LOS B	2.1	14.7	Short	50	0.0	NA
Lane 2	279	5.0	778	0.359	46[6]	18.6	LOS B	8.0	58.3	Full	210	0.0	0.0
Lane 3	559	5.0	716[1]	0.780	100	25.2	LOS C	20.7	151.4	Full	210	0.0	0.0
Lane 4	78	2.0	129	0.603	100	51.5	LOS D	3.4	24.4	Short	50	0.0	NA
Approach	1017	4.5		0.780		24.6	LOS C	20.7	151.4				
West: Churchill Dr (W)													
Lane 1	55	2.0	399	0.137	100	31.8	LOS C	1.8	13.0	Full	500	0.0	0.0
Lane 2	17	2.0	129	0.130	100	46.9	LOS D	0.7	5.0	Short	30	0.0	NA
Approach	72	2.0		0.137		35.3	LOS D	1.8	13.0				
Intersection	2017	4.3		0.780		25.0	LOS C	20.7	151.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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PHASING SUMMARY

Site: 2 [MoChPM - Proposed - 2030Vol+DEV]

Mooroolbark Road / Northern Site Access / Churchill Drive
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 85 seconds (Site Optimum Cycle Time - Minimum Delay)

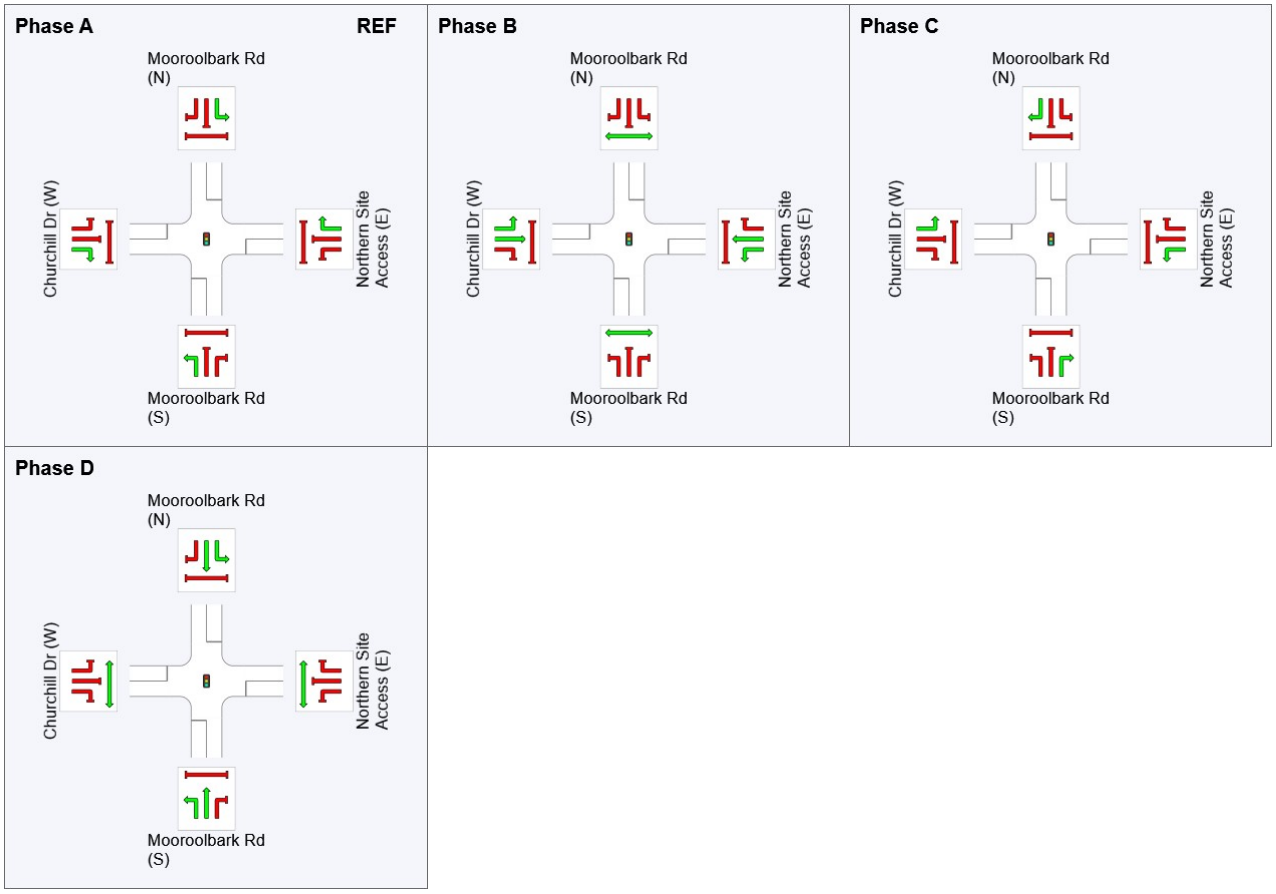
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: DDO - User-Given - Copy
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	0	12	32	44
Green Time (sec)	6	14	6	35
Phase Time (sec)	12	20	12	41
Phase Split	14%	24%	14%	48%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Normal Movement
Permitted/Opposed
Slip/Bypass-Lane Movement
Opposed Slip/Bypass-Lane