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Proposed Tourist Park
Kirkwood Road, Tweed Heads South

TRANSPORT IMPACT ASSESSMENT

Prepared For

Proportional Property Investments

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1 INTRODUCTION

CRG Traffic Pty Ltd has been engaged by Proportional Property Investments to prepare a Transport Impact Assessment for a proposal to develop a Tourist Park, located on Kirkwood Road, in Tweed Heads South.

The proposed development will comprise of 355 cabins / units, situated on an area of land located to the west of the Pacific Highway. This land is located in a developing area, and is also in very close proximity to planned road upgrades as part of the Lower Tweed and Pacific Highway Road Network Master Plan, and in particular, the Kirkwood Road Project.

A review of the proposed development plans in the context of the Tweed Road Contribution Plan (TRCP) has therefore been undertaken as part of this assessment.

This is a revised issue of the report in response to the issues raised by Council in its Request for Further Information dated 23 March 2013 and documented in the JRPP report. The relevant traffic / transport related items and a brief response are provided below.

JRPP report:

Clause 38 – Future Road Corridors

The objective of this clause is to cater for the alignment of and development in proximity to, future roads. Consideration must be given to the effect of development on the future alignment of the road corridor.

Whilst the proposed development does not appear to directly impact upon Kirkwood Road extension itself, several issues are raised in terms of landforming, as discussed in detail later in this report. Direct access off the Kirkwood Road extension is proposed. However, final access design needs to be reviewed in light of the location of cultural heritage artefacts on the boundary of the subject site and the Kirkwood Road extension.

Response:

The proposed plan of development does not impact upon any future road in the area. The site access design considers the future layout of the Kirkwood Road extension and this is document in the report.

104 Traffic-generating development

(1) This clause applies to development specified in Column 1 of the Table to Schedule 3 that involves:

(a) new premises of the relevant size or capacity, or

(b) an enlargement or extension of existing premises, being an alteration or addition of the relevant size or capacity.

As the proposed development incorporates more than 200 car spaces, Clause 104 applies to the proposed development.

(2) In this clause, relevant size or capacity means:

(a) in relation to development on a site that has direct vehicular or pedestrian access to any road—the size or capacity specified opposite that development in Column 2 of the Table to Schedule 3, or

(b) in relation to development on a site that has direct vehicular or pedestrian access to a classified road or to a road that connects to a classified road where the access (measured along the alignment of the connecting road) is within 90m of the connection—the size or capacity specified opposite that development in Column 3 of the Table to Schedule 3.

The proposed development is considered to be a traffic generating development. As such, referral to the Roads and Traffic Authority (now known as Roads and Maritime Services (RMS)) is triggered, in accordance with Column 2 of Schedule 3 of the SEPP.

(3) Before determining a development application for development to which this clause applies, the consent authority must:

(a) give written notice of the application to the RTA within 7 days after the application is made, and

The proposed development was referred to the RTA (now RMS) to determine whether the proposal was Integrated given its future access to the Motorway. The RMS response is detailed later in this report.

(b) take into consideration:

(i) any submission that the RTA provides in response to that notice within 21 days after the notice was given (unless, before the 21 days have passed, the RTA advises that it will not be making a submission), and

The issues raised by RMS have been taken into consideration during the assessment of this application.

(ii) *the accessibility of the site concerned, including:*

(A) *the efficiency of movement of people and freight to and from the site and the extent of multi-purpose trips, and*

(B) *the potential to minimise the need for travel by car and to maximise movement of freight in containers or bulk freight by rail, and*

The abovementioned accessibility issues are not considered to be applicable to the proposed development and have not been raised as an issue by the RMS.

(iii) *any potential traffic safety, road congestion or parking implications of the development.*

The RMS and Council officers have undertaken an assessment of the proposed development in terms of traffic issues. The RMS have concerns with the impact upon local roads. Council considers that a more detailed traffic assessment is required with regard to site access.

(4) *The consent authority must give the RTA a copy of the determination of the application within 7 days after the determination is made.*

A copy of the determination of this application will be provided to the RMS.

Overall, it is not considered that the provisions of Clause 104 have been met, given the issues raised with regard to potential traffic safety and road congestion.

Response:

The RMS has misunderstood the proposed use of Harrier Street for site access as Harrier Street is only proposed to be used for emergency (occasional) access purposes.

Consequently, there is no need to carry out an assessment of impacts upon Harrier Street and its intersection with Fraser Drive. The Traffic Impact Assessment provided an analysis of impacts upon the local road network that would be impacted upon by the proposed development.

Council has advised that a more detailed traffic assessment is required with regard to site access. CRG has previously provided a detailed response to issues raised by Council regarding the proposed site access. Please refer to Section 5 of CRG Traffic Impact Assessment report dated 23 July 2012 and repeated in Section of this report.

A2-Site Access and Parking Code

For Tourist Accommodation, DCP A2 requires one space per unit and one space per staff. With 355 units being proposed and a maximum of 20 staff, the proposed development generates a requirement of 375 car spaces. One additional HRV space is also required for service deliveries.

The proposed development incorporates 375 car spaces, which complies with the provisions of DCP A2. The application has not addressed the issue of service vehicle /delivery space required for the communal facilities associated with the development. As such, the proposed development does not fully comply with the provisions of DCP A2.

Response:

The proposed layout will allow Heavy Rigid Vehicle to circulate throughout the proposed internal road network. Please refer to Section 6 of the CRG Traffic Impact Assessment report dated 23 July 2012 and this report.

It is considered that ample provision has been made for delivery vehicles to access the communal facilities. Service vehicle access to this facility will be minimal and generally 'out of hours', and accordingly it is considered that such does not warrant the provision of a dedicated loading bay. It is noted however that such vehicles could access the building via the proposed maintenance driveway.

Access, Transport and Traffic

Council's Planning and Infrastructure Engineer has provided the following comment with regard to traffic issues:

> *"The site is adjacent to the Kirkwood Road corridor, and site levels have been designed to be consistent with the future construction of this road and highway interchange. The plans also demonstrate that a future connection to Enterprise Avenue (as per TRCP works program) is possible with the site design. However as discussed above, the landforming required is extensive and raises various concerns for Council.*
>
> *The applicant proposes to construct part of the Kirkwood Road West formation, to the minimum width required to service the development (7.5m carriageway), with the intent that the road can be upgraded in the future by Council, and that the works undertaken are creditable against TRCP contributions.*
>
> *The road access issues are linked strongly with the proposed landforming, and as such, until such time as the landforming design can be validated, there is insufficient information to confirm that site access is satisfactory. A more detailed traffic assessment can be undertaken should the landforming issues be resolved."*

As noted within the cultural heritage assessment, stone axes have been found during the construction of the Kirkwood Road extension works. These artefacts are located in proximity to a Tuckeroo Tree situated along the boundary of the subject site. The AAC requires the area around the Tuckeroo Tree to be retained / preserved, with the area not to be developed at all.

This creates a major issue with the access into the subject site. The Tuckeroo Tree is located directly in line with the proposed access road from Kirkwood Road. Given the importance of the artefacts in proximity to the Tuckeroo Tree, access to the site will need to be revised which is likely to impact upon the proposed landforming of the site.

Response:

We understand that the tuckeroo tree in question was recently destroyed in high winds. Notwithstanding this, we understand that a detailed heritage investigation has been carried out. The findings of this study support the proposed access location.

Roads and Maritime

Services

Given that the proposed development is considered to be a traffic generating development and will have immediate access to the Motorway when the Kirkwood Road extension eventually links to the classified road, the proposal was referred to the RMS to determine whether the application was Integrated development.

Initial comment from RMS is noted below:

> *"The roundabout on the western side of the highway as part of the Kirkwood Road extension, will in all probability be a local road, not part of the freeway. Consequently, the proposed 351 lot connection to the…extension will not require RMS approval under 138 of the Roads Act, the proposal is not integrated development.*
>
> *Given the scale it will still require referral to RMS for advice as required by ISEPP."*

Following a detailed assessment of the proposed development, RMS provided the following comments:

> *"RMS has no objection to the long term access arrangements proposed for the tourist facility, however, the proposed access in the short term relies on road connections that are not currently funded or programmed. Occupation and operation of the tourist facility in the short term will require construction of connections to Fraser Drive along the proposed Kirkwood Road west extension. It is noted the Kirkwood Road intersection at Fraser Drive is dependent on roundabout control to adequately provide for development traffic. These works will need to be in place prior to operation of the tourist facility and would be the responsibility of the proponent.*
>
> *The architectural design drawings show a road connection from the tourist facility to Harrier Street. The impact of the additional traffic on the existing residential area in Harrier Street has not been explored by the Transport Impact Assessment (TIA) supporting the proposal. The TIA is also silent about the impact of traffic generated by the proposal on the intersection of Harrier Street and Fraser Drive. The traffic impacts on Harrier Street and its intersection with Fraser Drive should be quantified,*
>
> *and any remedial works necessary to limit any adverse impacts identified and implemented prior to connecting the proposal to Harrier Street.*
>
> *The layout for the proposed internal roads has been designed to accommodate a passenger car and caravan combination. Service vehicle pick up and delivery for the facility is not specified in the TIA. To ensure site servicing activities such as on site garbage collection and deliveries are adequately catered for, Council should satisfy itself that adequate onsite servicing areas have been provided and are free of pedestrian conflict. Service vehicles should enter in a forward direction.*
>
> *The development proposal is adjacent to the Pacific Highway. Council is reminded of its obligations under Clause 101 and 102 of SEPP (Infrastructure) to ensure that appropriate measures will be undertaken in the construction of the dwelling to reduce road traffic noise. These measures are the responsibility of the applicant and are to be at no cost to RMS."*

Response:

The RMS has advised that it has no objection to the long term access arrangements. However, it has mistakenly interpreted the Harrier Street access as being for general traffic. This access is proposed to be used occasionally for emergency vehicle use. As such a road network assessment is not warranted.

Council issues raised in its letter dated 13 March 2013:

6. Engineering

i. The applicant is required to provide additional information to justify the requested variation to landforming controls in DCP-A1. Amended plans shall be provided to optimise the landforming design in order to:

- Preserve the existing landform to the maximum extent possible;
- Minimise batter heights at site boundaries and other interfaces, and provide typical section details at these locations;
- Ensure stormwater treatment and detention areas are feasible and permanently accessible for construction and maintenance;
- Maintain adequate internal and external road access, including for service and emergency vehicles;
- Consider road and/or pedestrian connectivity to the adjoining residential streets to the west (Wren Court, Firetail Street and Harrier Street);
- Address all constraints imposed by cultural heritage assessments and approvals;
- Address all constraints imposed by ecological assessments;
- Address any impacts of the proposed development on noise exposure to adjoining residential properties (i.e. from the Pacific Highway);

Response:

Service vehicle provisions have been addressed and vehicle swept paths analysed for both Medium Rigid Vehicle (MRV) and Heavy Rigid Vehicle (HRV) access. Service vehicle provisions are further discussed in Section 6.5.

Pedestrian and cyclist connectivity is discussed in Section 3.7 and is determined adequate for the scale and type of the development proposed.

8. Roads and Maritime Services

i. Service vehicle pickup and delivery for the facility is not specified in the Transport Impact Assessment. Please demonstrate that site servicing activities such as on site garbage collection and deliveries are adequately catered for and are free of pedestrian conflict, noting that service vehicles should enter in a forward direction.

Response:

Section 2A of the Tweed Shire Development Control Plan specifies that provisions should be made to allow a Heavy Rigid Vehicle (HRV) to enter an exit the site in a forward gear while maintaining adequate clearance at all times. As discussed in Section 6.5, HRV access and servicing provisions have been made and swept path analysis conducted to determine the ability for such a vehicle to manoeuvre throughout the development.

2 SUBJECT SITE & PROPOSED DEVELOPMENT

2.1 Subject Site

The subject site is located on Kirkwood Road in Tweed Heads South, as shown in Figure 2.1. The site is described as Lot 33 on DP1073293.

Figure 2.1 – Location of Subject Sit

2.2 Proposed Development

The proposal consists of the development of a Tourist Park, comprising of cabins and units for temporary accommodation. The cabins will be constructed off-site and transported to the development site. The following yield is proposed:

DEVELOPMENT DATA

LOT Type	LOT no.s	Dwellings Per Lot	Total
Type A	71	2	142
Type B	32	2	64
Type C	16	2	32
Type D	5	1	5
Type RV-A	22	2	44
Type RV-B	7	2	14
Type E	9	6	54
		TOTAL	355

Access to the subject site is initially proposed via a partial construction of Kirkwood Road between the subject site and Fraser Drive. Ultimately, the development will be serviced by the future extension of Kirkwood Road between Minjungbal Drive and Fraser Drive and a new interchange with the Pacific Highway, as well as the proposed extension of Enterprise Avenue (also known as Venture Close) to the south-east of the site.

Proposed site layout plans have been prepared by Knobel Consulting Pty Ltd and are provided in Figure 2.2 and Figure 2.3.

Figure 2.2 – Proposed Site Layout Plan

3 EXISTING TRANSPORT SYSTEM & PROPOSED ROAD UPGRADES

3.1 Road Network Planning

Tweed Shire Council and the NSW Roads and Maritime Services have assessed the future road network requirements for the Tweed Heads South region in preparing the Lower Tweed and Pacific Highway Road Network Master Plan. This plan has identified a number of key road network upgrades to improve existing infrastructure and support population growth within the region into the future. The Kirkwood Road Project is one of the major projects identified as part of this Master Plan. Further discussion regarding the Kirkwood Road Project is provided in Section 3.4, given its proximity to the development site and proposed future access to the site from Kirkwood Road.

3.2 Existing Road Network

Kirkwood Road functions as a local collector road, with a two-way, two-lane pavement. The roadway has an average pavement width of 10 m. Kirkwood Road currently extends from Davey Street in the east, across Minjungbal Drive, terminating at Falcon Way in the west. The road reserve continues west along the future alignment towards Fraser Drive, west of the Pacific Highway. This future extension will run along the northern boundary of the subject development site.

Fraser Drive functions as a distributor road, connecting Terranora Road in the south to Dry Dock Road in the north, and providing access to the western parts of Tweed Heads South. Fraser Drive has a two-lane, two-way pavement with an average width of 10 m. The proposed extension of Kirkwood Road will intersect with Fraser Road at the existing Acacia Street intersection.

Venture Close is the extension of Enterprise Avenue north of Traders Way and function as an industrial access street. Venture Close terminates in a cul-de-sac to the south-east of the development site. The extension of Venture Close to the south (Enterprise Avenue) connects to Greenway Drive, within the industrial precinct of Tweed Heads. Venture Close currently has a single, unmarked pavement, with a typical width of 11 m. An extension of Enterprise Avenue (Venture Close) is proposed as part of the Kirkwood Road Project, with a future connection to Kirkwood Road. Access to the development site will be gained via the extension of Venture Close, prior to the ultimate extension of Kirkwood Road to Fraser Drive.

Images of the relevant roads are presented in Figure 3.1.

Kirkwood Road (existing)
at Falcon Way
(looking west)

Existing Enterprise Avenue
(Venture Close) termination
(looking north-west)

Fraser Drive (existing)
at Kirkwood Road
(looking north)

Figure 3.1 – Existing Roadway Environment

3.3 Existing Traffic Volumes

Existing traffic volumes have been sourced from Tweed Shire Council and the NSW RMS. Traffic volumes for 2012 have been estimated based on the most recent count data available and application of an annual compounding growth rate of 3% (2% for the Pacific Highway). Estimated current traffic volumes are presented in Figure 3.2 on this basis.

It is noted that existing traffic volumes and distributions are likely to change significantly as a result of the significant changes proposed to the traffic network surrounding the site. Forecast traffic volumes are presented in Section 3.5, and have been based on modelling carried out by Veitch Lister as part of the Kirkwood Road Project.

Figure 3.2 – Existing Traffic Volumes - AADT (2012)
(Source: Tweed Shire Council)

3.4 Future Road Network - Kirkwood Road Project

The Kirkwood Road Project involves the extension of Kirkwood Road to ultimately provide an east-west connection between Minjungbal Drive and Fraser Drive. As part of these works, an additional point of access to the Pacific Highway will be provided, via the proposed Kirkwood Road interchange. Enterprise Avenue will also be extended to Kirkwood Road as part of this project.

The Kirkwood Road Project has been identified as part of future critical infrastructure for the Tweed Heads South region. The project is being jointly undertaken by Tweed Shire Council and the NSW Roads and Maritime Services, and is primarily designed to:

- Provide an additional point of access between the Pacific Highway and the Tweed Heads South region.
- Alleviate demand and congestion on Minjungbal Drive.
- Support future growth of the Tweed Heads South region by providing improved access.

The Kirkwood Road interchange will incorporate southbound on- and off-ramps and a northbound off-ramp, with an overpass also to be constructed as part of these works. The ramps will link into roundabouts located to the east and west of the Pacific Highway. Construction plans for the proposed Kirkwood Road Project are illustrated in Figure 3.3.

An existing road reserve runs between the current termination of Kirkwood Road at Falcon Way, and Fraser Drive, to the west. It is proposed that Kirkwood Road will be extended through this alignment, connecting to the western areas of Tweed Heads South.

The proposed upgrade will be constructed over two stages. The first stage, Stage 1A - Kirkwood Road East, involves the extension of Kirkwood Road from Falcon Way in the east to the new Pacific Highway interchange. This will also include the construction of the temporary southbound on- and off-ramps. Construction of Stage 1A is currently underway, with completion expected by mid-2012.

Stage 1B – Kirkwood Road West involves the ultimate extension of Kirkwood Road to Fraser Drive, west of the Pacific Highway. A northbound off-ramp and Pacific Highway overpass will also be constructed as part of this stage. Construction of Stage 1B will be triggered by future growth and development within the Tweed Heads South area, and dependent also on funding. It is expected that construction of Stage 1B will take place between 2015 - 2020.

Figure 3.3 – Kirkwood Road Project (Source: Tweed Shire Council)

3.5 Future Traffic Volumes

Information regarding forecast traffic volumes has been sourced from the Tweed Shire Council, as provided by Veitch Lister Consulting Pty Ltd. Traffic forecasts are based on the ultimate upgrade of Kirkwood Road (Stages 1A and 1B complete) and the associated extension of Venture Close.

Forecast traffic volumes for 2015 and 2025 are presented in Figure 3.4. This is based on the completion of the Kirkwood Road Project in 2015, with a 10-year post-project forecast to 2025.

Figure 3.4 – Forecast Traffic Volumes - AADT (2015/2025)
(Source: Tweed Shire Council)

3.6 Public Transport

Surfside Buslines operates public bus services within the locality of the proposed development site. Bus services most easily accessible to the development are located on Fraser Drive, Greenway Drive and Dry Dock Road. These services include:

Route 604 **Tweed Heads – Vintage Lakes/Hillcrest – Tweed Heads**
Route 607 **Tweed Heads – Flame Tree Park – Tweed Heads**

These services typically run every hour Monday to Friday (during working hours), and 1-2 hourly on weekends. The relevant bus routes are illustrated in Figure 3.4 and Figure 3.5.

It is also noted that additional high frequency bus services are available at the Tweed City Shopping Centre, which is located a walking distance of approximately 1.6 km from the proposed development site.

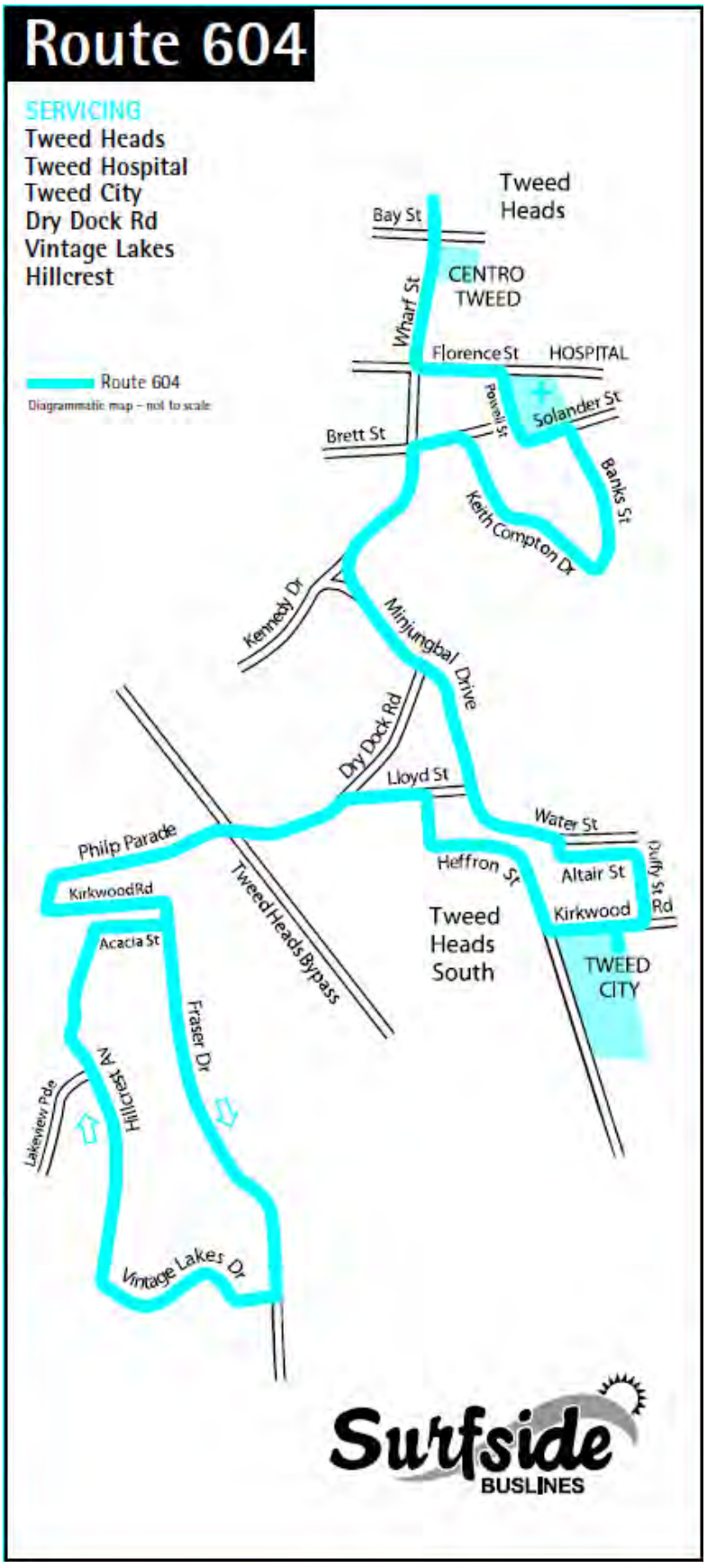


Figure 3.4 – Surfside Bus Route 604

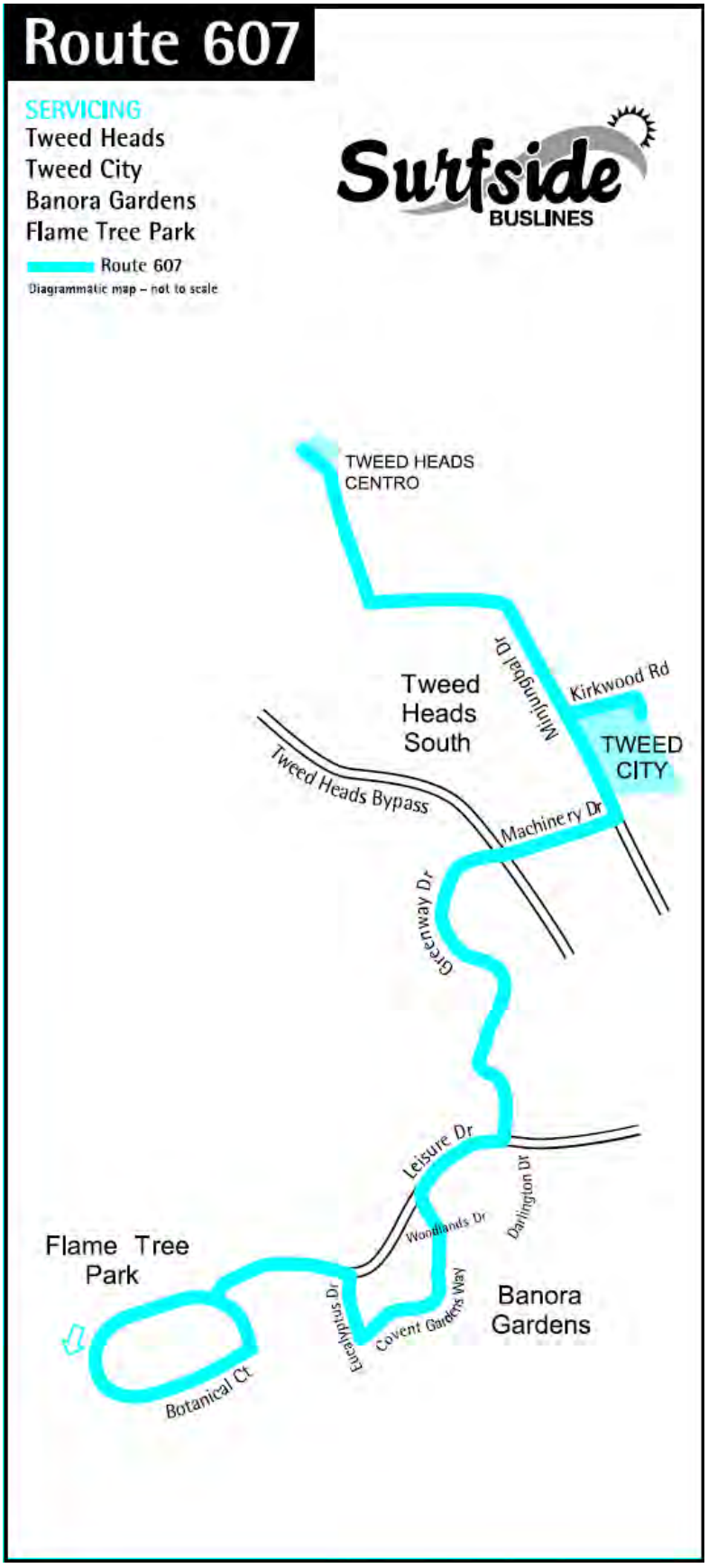


Figure 3.5 – Surfside Bus Route 607

3.7 Pedestrian & Cyclist Facilities

Pedestrian connection from the development to surrounding areas in the interim (i.e. before the Kirkwood Road extension) will primarily be via Venture Close and Greenway Drive. The main pedestrian desire line is expected to be from the site to the Tweed City Shopping Centre, which is located a walking distance of approximately 1.6 km from the site. The future Kirkwood Road extension will provide patrons of the proposed development further opportunity to access the Shopping Centre.

Pedestrian and cyclist facilities consist primarily of footpaths along the surrounding roads. Council has noted that on-road cycle lanes are not proposed as part of the Kirkwood Road upgrade.

It is not anticipated, however, that there will be a strong demand generated for pedestrian activity in association with the proposed development. It is more likely that patrons will primarily use private vehicle transit for travel.

The development itself will provide for pedestrians and cyclists internally with footpaths on-site linking all cabins with the common facilities and administration areas.

Existing and proposed pedestrian and cyclist facilities are considered sufficient based on the nature and scale of development proposed.

4 PROPOSED DEVELOPMENT TRAFFIC

4.1 Trip Generation Rates

An estimation of the trip generating potential of the proposed development has been derived by application of the relevant trip generation rates prescribed within the Queensland Department of Transport and Main Roads' *Road Planning and Design Manual*. In this regard, the rate for a Caravan Park (Urban) has been applied, as follows:

- **Daily:** 4 trips per occupied site per day
- **Peak:** 0.4 trips per occupied site per hour

Assuming a 100% occupancy rate (conservative assessment), the predicted daily and peak development trip volumes, based on a total site yield of 355 cabins / units, are:

- **Daily:** 1,420 vehicle trips per day (vpd)
- **Peak:** 142 vehicle trips per hour (vph)

4.2 Trip Distributions

Development trip distributions have been primarily based on the existing and future road network configurations, with respect to site access.

At project opening, all access to and from the site will be via a partial construction of Kirkwood Road between the subject site and Fraser Drive.

Ultimately, the development will be serviced by the future extension of Kirkwood Road between Minjungbal Drive and Fraser Drive and a new interchange with the Pacific Highway, as well as the proposed extension of Enterprise Avenue (also known as Venture Close) to the south-east of the site. The 10-year forecast therefore includes a redistribution of development trips based on site access via both Kirkwood Road and Venture Close.

The development trip distributions adopted at project opening and beyond are illustrated in Figure 4.1 and Figure 4.2.

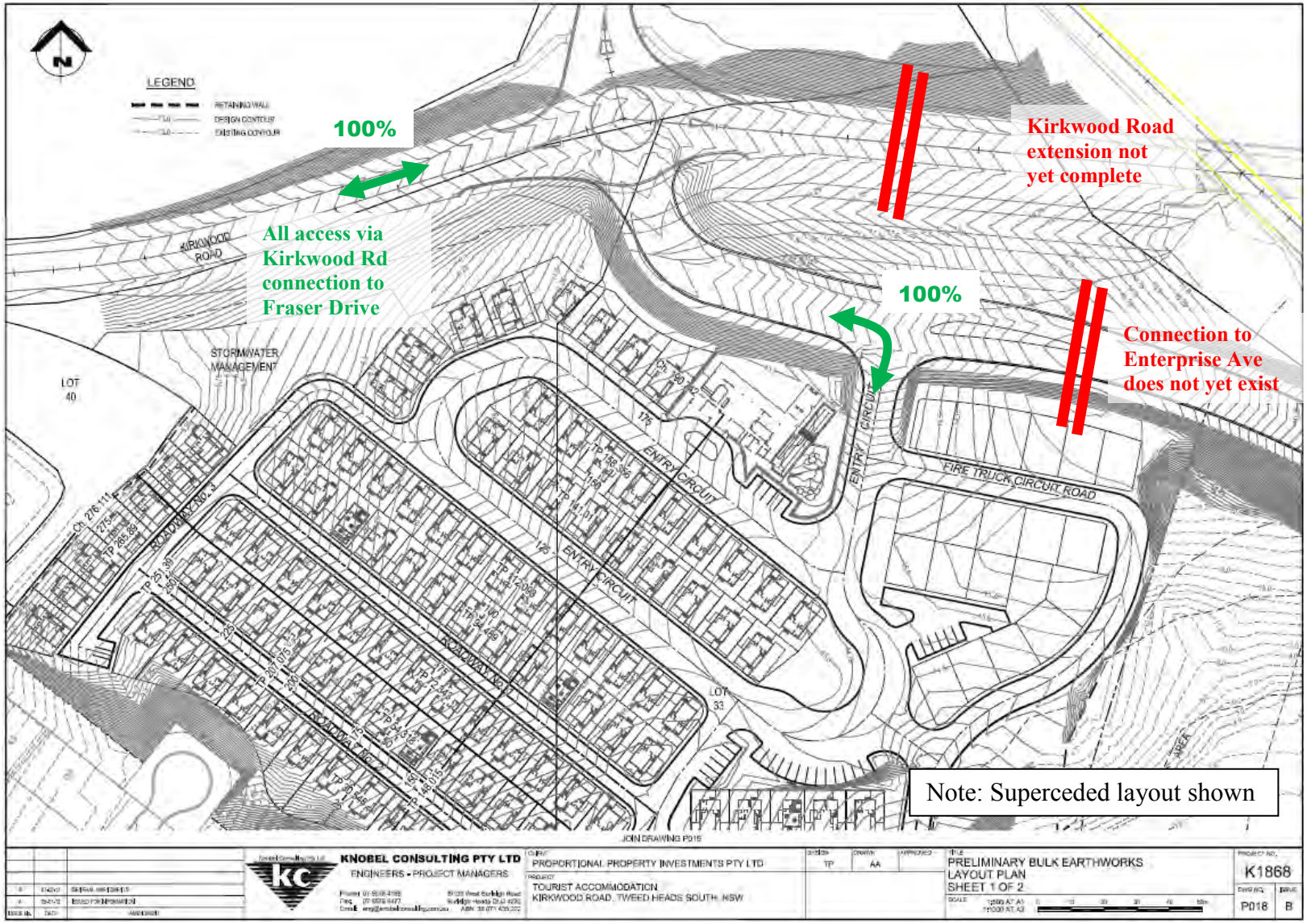


Figure 4.1 – Development Traffic Distribution – Project Opening to 2015

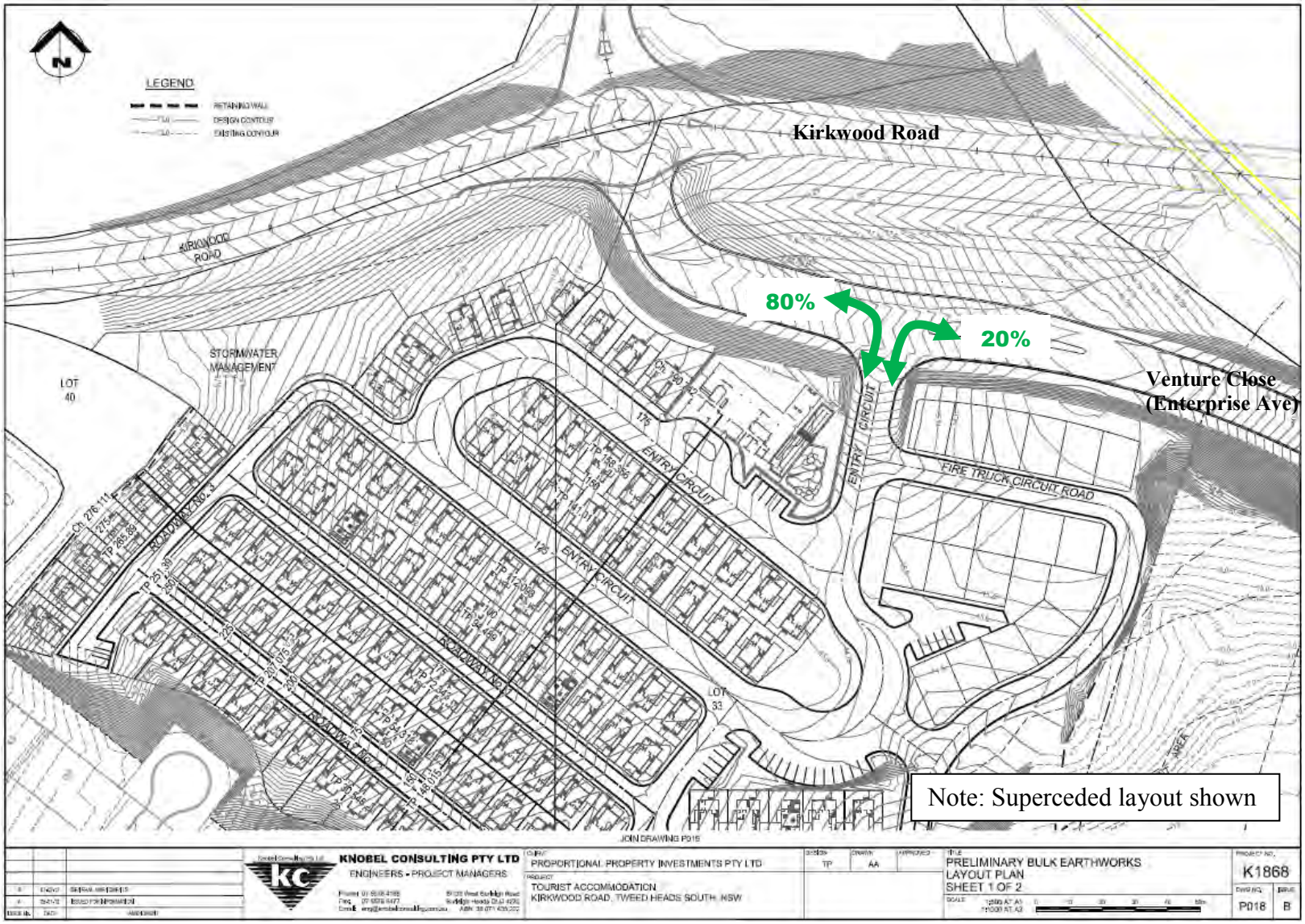


Figure 4.2 – Development Traffic Distribution – Post-2015

4.3 Network Assignment

Typical peak hourly splits for developments of this nature are:

- **AM Peak:** 60% OUT / 40% IN
- **PM Peak:** 40% OUT / 60% IN

Application of the above splits and distributions result in development turning movement volumes as indicated in Figure 4.3 and Figure 4.4.

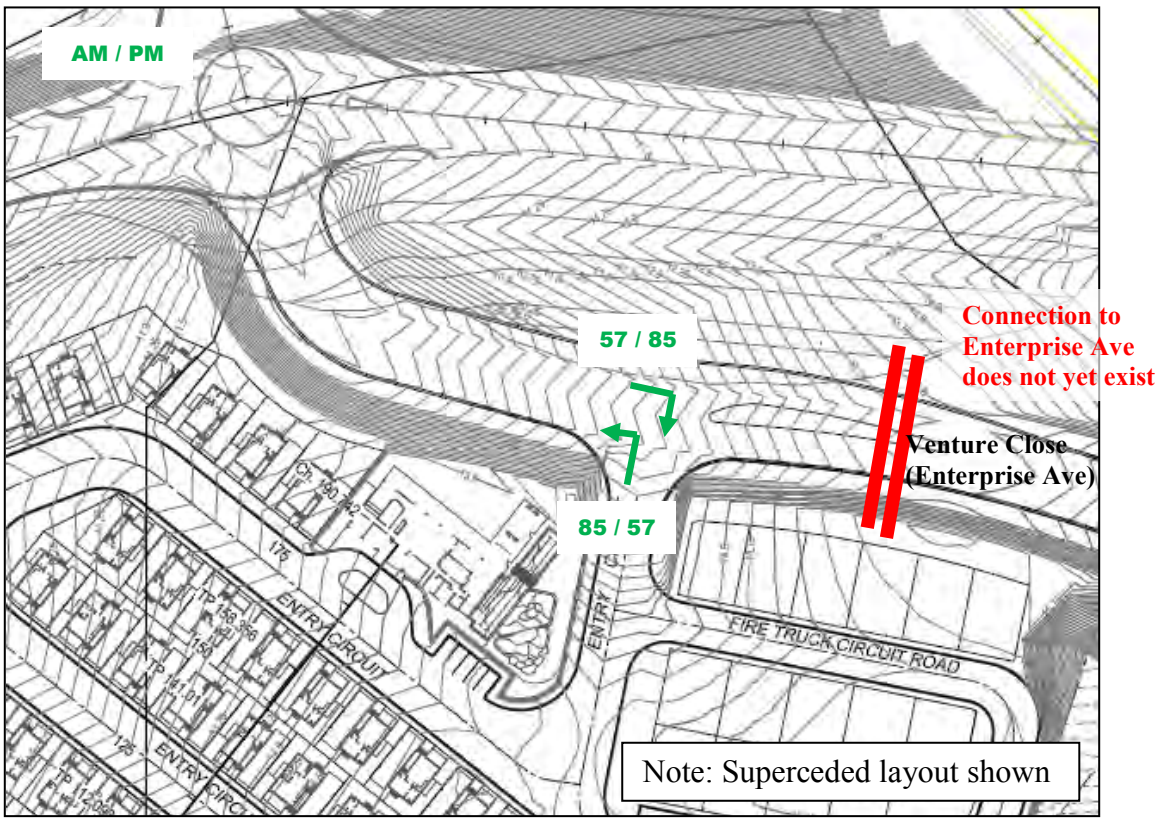


Figure 4.3 – Estimated Development Turning Movement Volumes - Project Opening to 2015

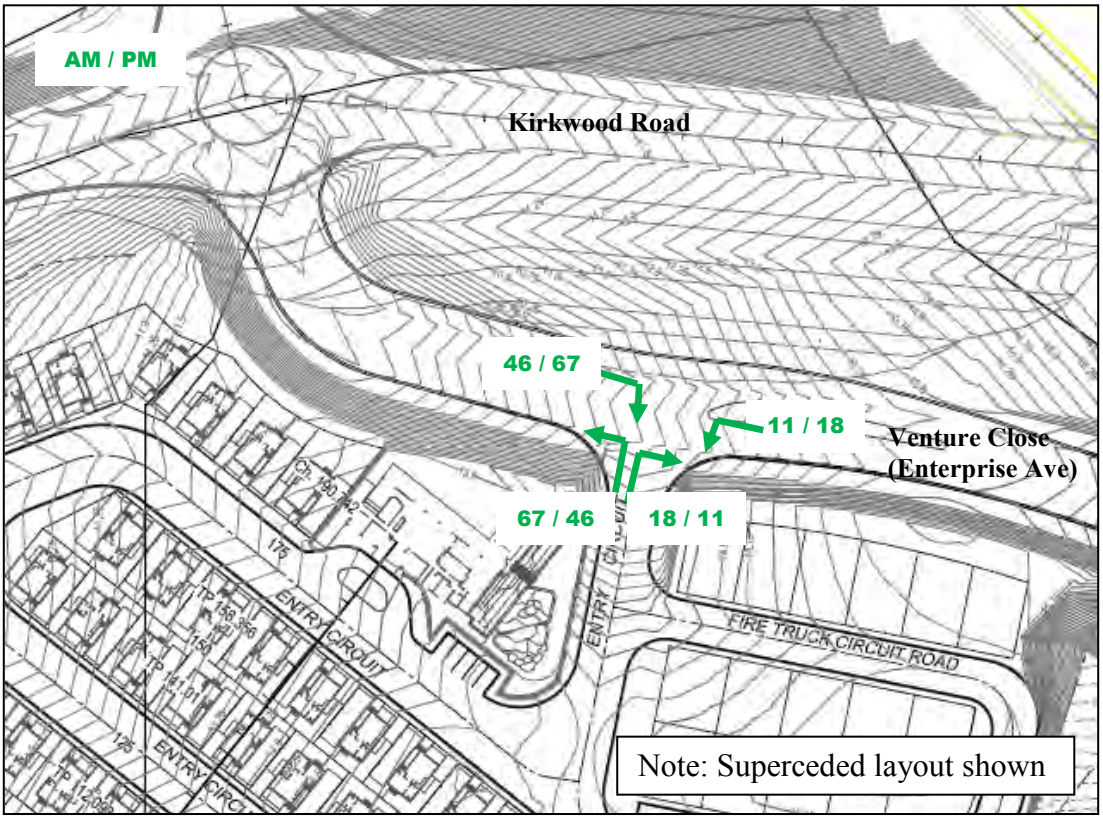


Figure 4.4 – Estimated Development Turning Movement Volumes - Post-2015

5 TRAFFIC IMPACT ASSESSMENT

5.1 Scope of Assessment

Turning warrants analysis and intersection capacity analysis have been undertaken with respect to the potential road impacts of the proposed development. Results are discussed in the following sections.

5.2 Site Access – Turning Warrants

Turning warrants from Austroads Guide to Traffic Engineering Practice Part 4A – *Unsignalised and Signalised Intersections* have been applied in determining the turning treatments required at the site access. This analysis is based on the ultimate configuration of the surrounding road network, with the extensions of Kirkwood Road and Venture Close complete. Development and background traffic volumes are therefore based on 2025 forecast values.

In this regard, a short auxiliary left and channelised right turning lane (Types AUL(S) and CHR) have been recommended, as demonstrated in Figure 5.1.

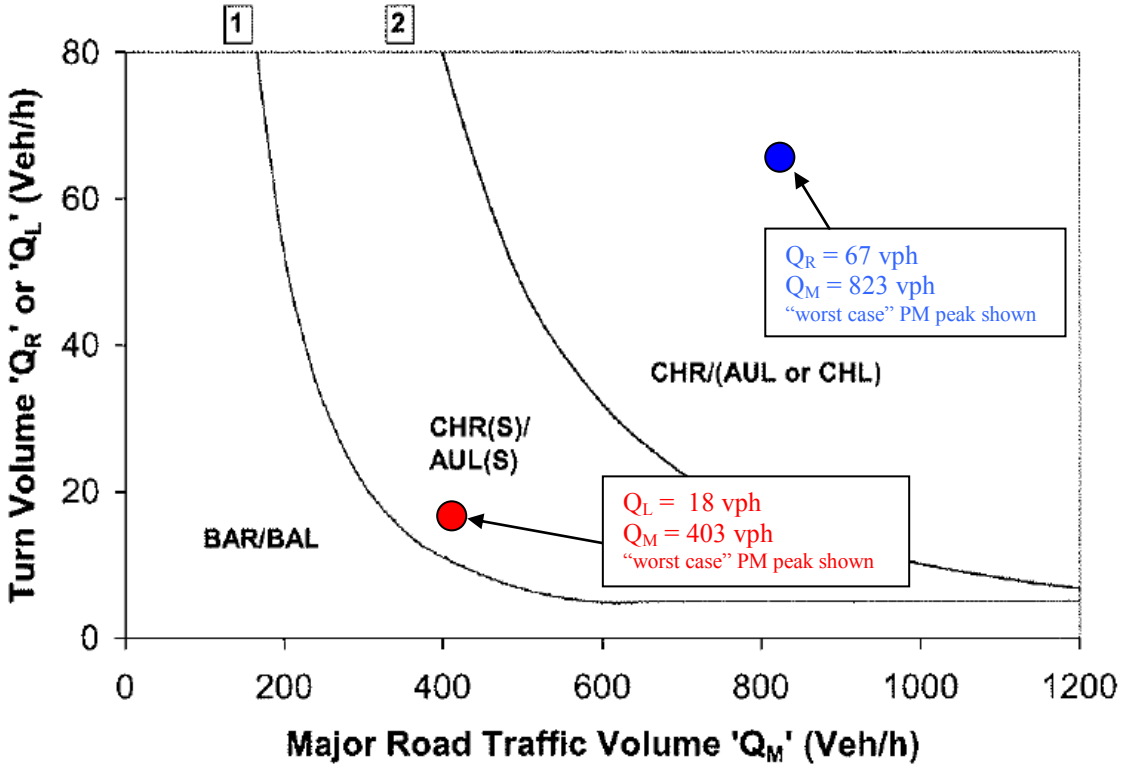
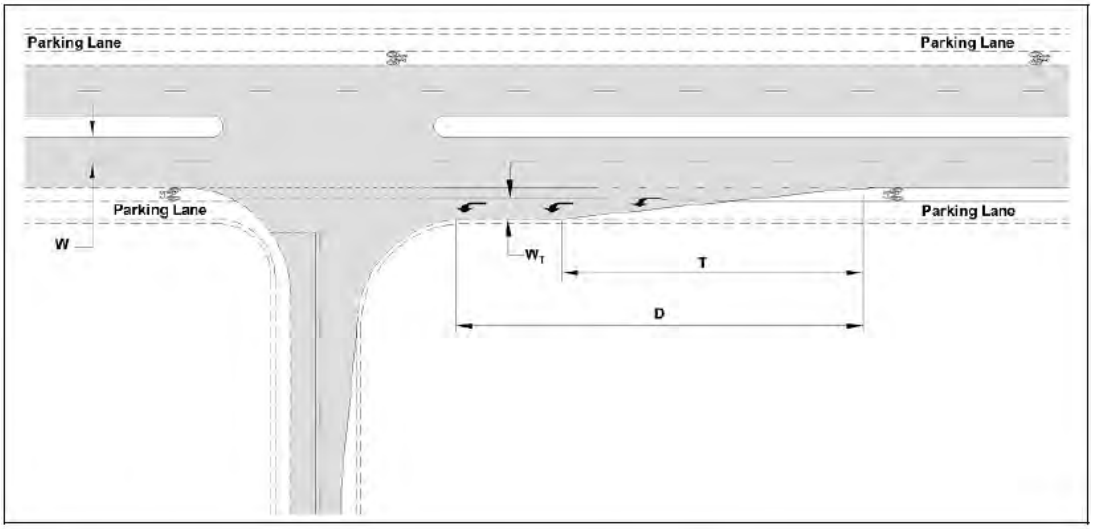


Figure 5.1 – Turning Warrants - Left Turns Into Site (Ultimate Configuration, 2025)

Type AUL(S) and CHR treatments should be installed in accordance with Austroads Part 4A Figures 7.7 and 8.10, as reproduced in Figure 5.2 and Figure 5.3 below.



Notes:

1. For setting out details of the left-turn geometry, use vehicle turning path templates and/or the details in Table 8.4.
2. Approaches to left-turn lanes can create hazardous situations between cyclists and left-turning motor vehicles. Treatments to reduce the number of potential conflicts at left-turn slip lanes are given in this guide.
3. The dimensions of the treatment are defined as follows. Values of D and T are provided in Table 8.4.

W = Nominal through lane width (m) (incl. widening for curves). For a new intersection on an existing road, the width is to be in accordance with the current link strategy.

W_T = Nominal width of turn lane (m) (incl. widening for curves based on the design turning vehicle) = 3.0 m minimum.

T = Physical taper length (m) given by:

$$T = \frac{0.33VW_T}{3.6}$$

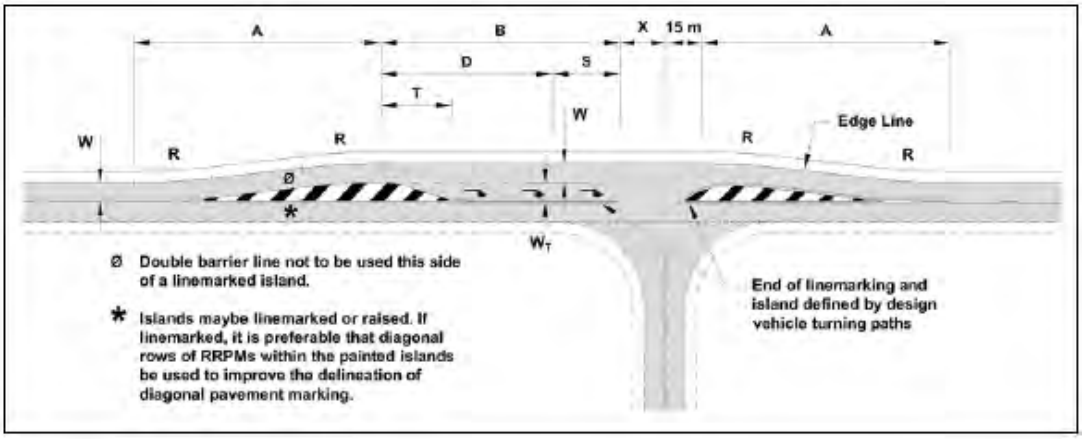
V = Design speed of major road approach (km/h).

Source: Queensland Department of Main Roads.

Design speed of major road approach (km/h)	Diverge/deceleration length D (m)1	Taper length T (m)2
50	20	20
60	25	20
70	35	30
80	45	30
90	55	40

1. Based on a 20% reduction in through road speed at the start of the taper and a value of deceleration of 3.5 m/s² (Table 5.2). Adjust for grade using the 'correction to grade' factor in Table 5.3.
2. Based on a turn lane width of 3.0 m and a bicycle lane width of 1.5 m.

Figure 5.2 – Auxiliary Left Turn Treatment [Type AUL(S)]



Notes:

1. An alternative to the double white line on the offside edge of the right-turn slot is a 1.0 m painted median. The 1.0 m median is particularly useful when the major road is on a tight horizontal curve and oncoming vehicles track across the centreline. Provision of this median will require the dimension 'A' to be increased.
2. A raised concrete median on the minor road may be used with this treatment to minimise 'corner cutting', particularly for higher turning volumes.
3. The dimensions of the treatment are defined below and values of A, D, R and T are shown in Table 7.2:

W = Nominal through lane width (m) (including widening for curves). For a new intersection on an existing road, the width is to be in accordance with the current link strategy.

W_T = Nominal width of turn lane (m), including widening for curves based on the design turning vehicle. Desirable minimum = W, absolute minimum = 3.0 m.

B = Total length of auxiliary lane including taper, diverge/deceleration and storage (m).

D = Diverge/deceleration length including taper. Adjust for grade using the 'correction to grade' factor (Section 5)

T = Physical taper length (m) and is given by:

$$T = \frac{0.33VW_T}{3.6}$$

S = Storage length (m) should be the greater of:

1. the length of one design turning vehicle or
2. (calculated car spaces –1) x 8 m (*Guide to Traffic Management – Part 3: Traffic Studies and Analysis* (Austroads 2009h), or use computer program e.g. aaSIDRA).

V = Design speed of major road approach (km/h)

X = Distance based on design vehicle turning path, typically 10–15 m

Design speed of approach	Length of deceleration D – including diverge taper T										Diverge length Ld3 for lane widths	
	Stop condition1		Design speed of exit curve (km/h)2									
Road (km/h)	0	0	20	30	40	50	60	70	80	90	3.5 m[4]	3.0 m[4]
	Comf. 2.5 m/s²	Max. 3.5 m/s²	Comfortable average rate of deceleration 2.5m/s²									
50	40	30	30	25	15						33	27
60	55	40	50	40	30	15					40	33
70	75	55	70	60	50	40	20				47	40
80	100	70	95	85	75	60	45	25			54	44
90	125	90	120	110	100	85	70	50	25		60	50
100	155	110	150	140	130	115	100	80	55	30	67	57
110	185	135	180	175	160	150	130	110	90	60	74	62

1. Rates of deceleration are: 2.5 m/s² for comfortable deceleration; 3.5 m/s² is the maximum for design purposes.
2. Speed of exit curve depends on radius and crossfall (Figure 5.2).
3. Distance L_d assumes a lateral rate of movement of 1.5 m/s.
4. Example lane widths – use actual lateral shift distance of vehicle.

Notes:

The pink shading indicates that the deceleration lengths given are greater than the diverge length. The length of the deceleration lane should be based on these values.

The grey shading indicates that the diverge length is greater than the deceleration length. In these cases, the length of the deceleration lane should be based on the diverge length (the values shown in yellow shading).

Adjust for grade using Table 5.3.

All lengths are in metres.

Source: Based on Austroads (2005).

Figure 5.3 – Channelised Right Turn Treatment (Type CHR)

Austroads recommends a 25 metre deceleration length (taper + storage) for the left turn lane, and a 55 metre deceleration length for the right turn lane. The Site Access intersection has been modelled in SIDRA to confirm adequate storage capacities and acceptable intersection operation.

Results of SIDRA analysis are summarised in Table 5.1. Full SIDRA results are provided in Appendix A.

Table 5.1 – Summary of SIDRA Results – Site Access Intersection (2025)

With Development (2025)		Key Indicators			
		Average Vehicle Delay (seconds)		95th %ile Queue Length (metres)	
		AM	PM	AM	PM
Site Access	L	9.5	9.5	2.2	1.5
	R	13.0	13.2	0.9	0.6
Venture Close (east)	L	7.4	7.4	0	0
	T	0	0	0	0
Venture Close (west)	T	0	0	0	0
	R	8.6	8.6	1.1	1.6

Results of intersection analysis demonstrate that the proposed turning treatments will be more than sufficient to accommodate development trips and background traffic growth over a 10-year forecast.

5.3 Intersection Capacity Analysis – Kirkwood Road & Fraser Drive

Intersection capacity analysis has been focussed on the potential impacts of development traffic on Fraser Drive and also the configuration of the site access intersection. Given the scale of current road upgrades being undertaken as part of the Lower Tweed Traffic Master Plan, it is anticipated that there will be sufficient capacity within the surrounding road network to accommodate development traffic associated with the site. Road upgrades have been based on modelling assumptions which accommodate future growth within the area, including trips generated by developments such as that proposed. It is therefore anticipated that intersections surrounding the subject development in connection with the new alignment of Kirkwood Road will have sufficient capacity to accommodate development-related traffic, including the future (roundabout) intersection of Kirkwood Road and Venture Close.

Prior to the completion of the Kirkwood Road Project, all access to and from the site will be via a partial construction of Kirkwood Road from the subject site to Fraser Drive. This will remain the case until the anticipated completion of the Kirkwood Road Project. The potential impact of development traffic upon Fraser Drive has therefore been assessed, with intersection capacity analysis undertaken at the intersection of Fraser Drive and Kirkwood Road.

The analysis has been undertaken for 2012 and future 2025 traffic conditions on Fraser Drive, assuming that the Kirkwood Road extension is not complete. The intersection has been modelled as a single lane roundabout as shown in Figure 7.2.

Results of SIDRA analysis are summarised in Tables 5.2. Full SIDRA results are provided in Appendix A.

Table 5.2 – Summary of SIDRA Results – Fraser Drive / Kirkwood Road Intersection

Scenario	Level Of Service	Degree Of Saturation	Average Delay (sec)	95th Percentile Queue (vehicles)
AM 2012 with development	A	0.429	8.7	3.2
PM 2012 with development	A	0.448	8.7	3.4
AM 2025 with development	A	0.579	8.8	5.4
PM 2025 with development	A	0.605	8.9	5.8

As shown in Table 5.2, the proposed interim roundabout on Fraser Drive will operate satisfactorily over the next 10 years even if the Kirkwood Road extension to Minjungbal Drive is not constructed during that time. The intersection will operate with minimal delays and vehicle queuing on all approaches.

6 CAR PARKING, ACCESS AND SERVICING

6.1 Development Control Plan Car Parking Requirements

The development proposal is subject to the Tweed Shire Development Control Plan (DCP). Schedule A2 – *Site Access and Parking Code* states that car parking for the development is to be provided in accordance with the relevant rate, as follows:

- **Tourist Accommodation:** 1 space per unit plus 1 space per staff member

Application of Council's rates to the proposed development results in a requirement for 347 parking spaces for guests (based on development yield), plus a further supply of parking to facilitate staff parking at peak operation.

6.2 Proposed Car Parking Provision

Car parking for guests is provided within each cabin site, and therefore achieves compliance with Council's minimum provision requirements. Additionally, a further 5 parking spaces are provided for staff/visitors, including two parking spaces for people with disabilities. The proposed staff/visitor parking provision is considered sufficient with respect to the expected demand.

It is further noted that a porte cochere arrangement is provided on entrance to the park's reception, with a lay-by bay available for parking. This are will be used by guests on arrival at the park.

The proposed car parking provision is considered adequate and compliant with respect to Council's minimum car parking requirements.

6.3 Layout and Design

The proposed car parking areas have been designed in accordance with the relevant User Class requirements as outlined in Australian Standards AS2890.1: 2004. Car parking areas have generally been designed with the following minimum dimensions:

Staff/Visitor parking bays -	2.6 metres wide x 5.4 metres long
Aisle -	6.2 metres

Guest parking is provided alongside each cabin, for convenient access. Staff/visitor parking is located in close proximity to the administration/reception building.

6.4 Vehicle Queuing

Queuing provision has been made on-site for vehicles entering and exiting the development. A queuing distance of 24 metres (4 car lengths) has been provided to the first conflict point. This distance is sufficient to accommodate the expected volume of development traffic.

6.5 Service Vehicle Requirements

As per the Tweed Shire Development Control Plan, Section 2A – Site Access and Parking Code the design service vehicle for the proposed development is a Heavy Rigid Vehicle (HRV). As shown in Figure 6.1 an HRV can satisfactorily manoeuvre the entry circuit road and stand adjacent to the communal facilities while servicing the site without impacting surrounding vehicle manoeuvring.

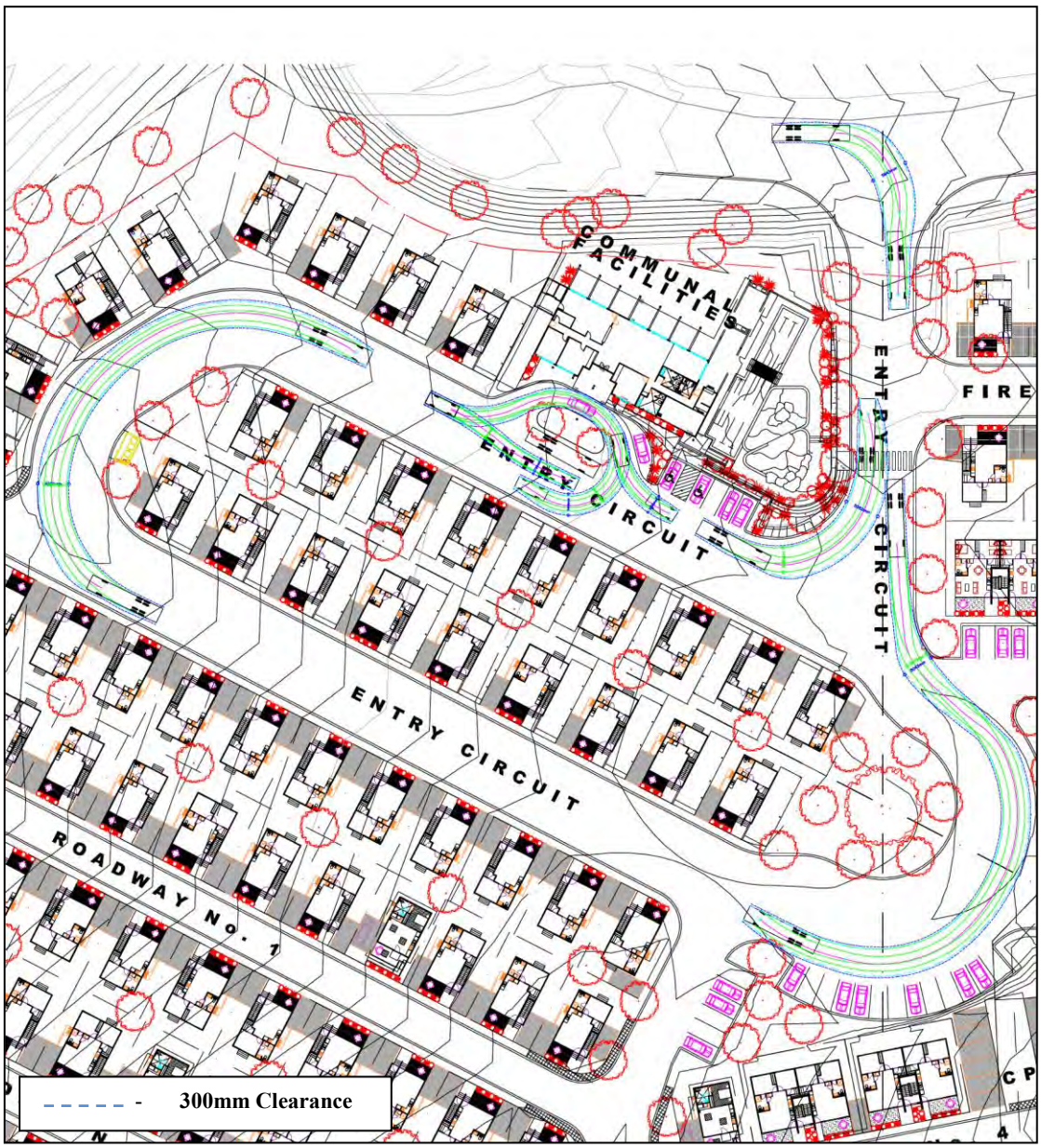


Figure 6.1 – 12.5m HRV Manoeuvring

Provisions have also been made to allow occasional access for a Medium Rigid Vehicle (MRV). Swept path analysis has been undertaken to demonstrate the ability for such a vehicle to manoeuvre throughout the development. Results of swept path analysis are illustrated in Figure 6.2 - 6.4 and demonstrate compliant manoeuvring is achieved in all areas. The internal roadways have been designed to accommodate the swept path of such a vehicle, with provision for passing of two vehicles also catered for. In compliance with Australian Standards AS2890.2, the nominated service vehicle required for the proposed development is able to achieve entry and exit in a forward gear.

Figure 6.2 – 8.8m MRV Manoeuvring (Overall Site)

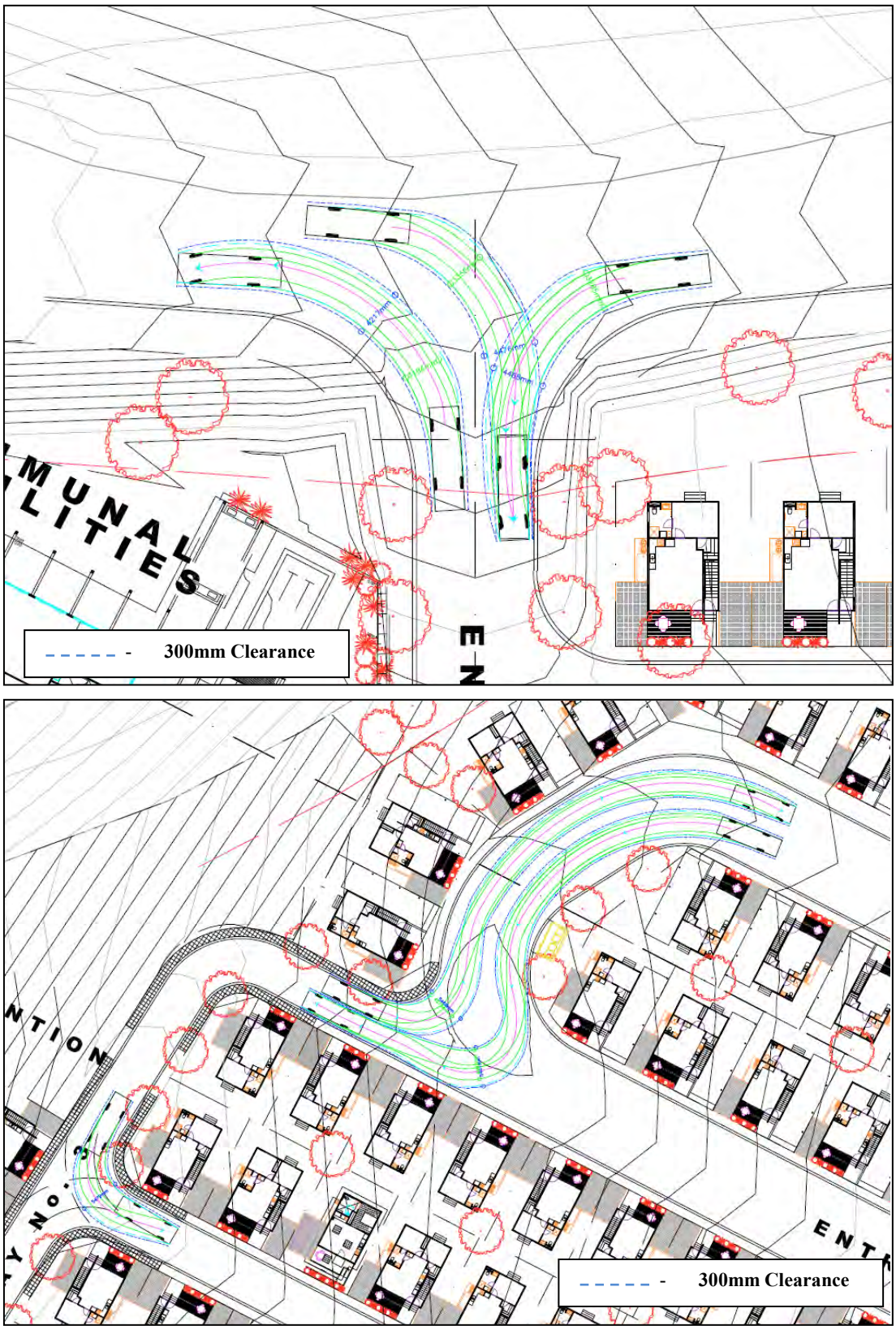


Figure 6.3 – MRV Manoeuvring
At Entrance and Western End of Site

Figure 6.4 – MRV Manoeuvring
At Eastern and Southern Ends of Site

7 SITE ACCESS AND EXTERNAL ROAD NETWORK CONSIDERATIONS

7.1 Site Access

Prior to the completion of Stage 1B (Kirkwood Road west) of the Kirkwood Road Plan, access to the site will be provided via a partial construction of Kirkwood Road between the subject site and Fraser Drive. Ultimately, the development will be serviced by the future extension of Kirkwood Road between Minjungbal Drive and Fraser Drive and a new interchange with the Pacific Highway, as well as the proposed extension of Enterprise Avenue (also known as Venture Close) to the south-east of the site.

Access to the site has therefore been considered with respect to planned future road upgrades. As established in Section 5, it is recommended that the development provides auxiliary left and channelised right turning treatments at the site access. This configuration is expected to be suitable across all forecast scenarios, through to 2025.

A concept layout of the proposed intersection configuration is illustrated in Figure 7.1.

7.2 External Road Network

Prior to the completion of the Kirkwood Road Project, all access to/from the site will be via a partial construction of Kirkwood Road between the subject site and Fraser Drive. The road will be constructed in accordance with Council's design, however it is proposed to construct only half the ultimate width of Kirkwood Road. This will adequately cater for the proposed development traffic demands until such time as Council completes the Kirkwood Road construction works.

Drawings of the temporary Kirkwood Road access, including the proposed interim roundabout on Fraser Drive have been prepared by Knobel Consulting and are shown in Figures 7.2 and 7.3 on the following pages.

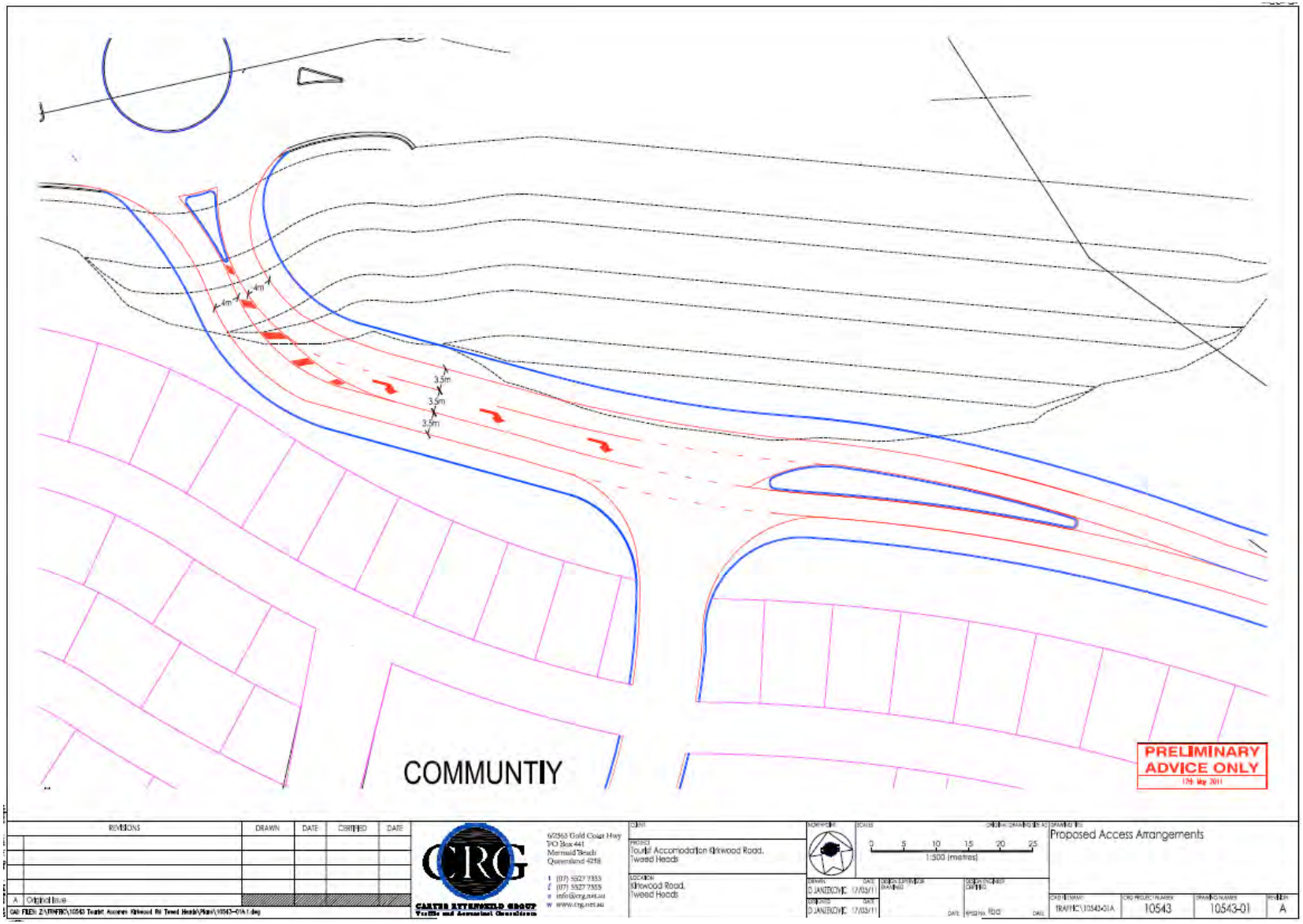


Figure 7.1 – Proposed Site Access Intersection

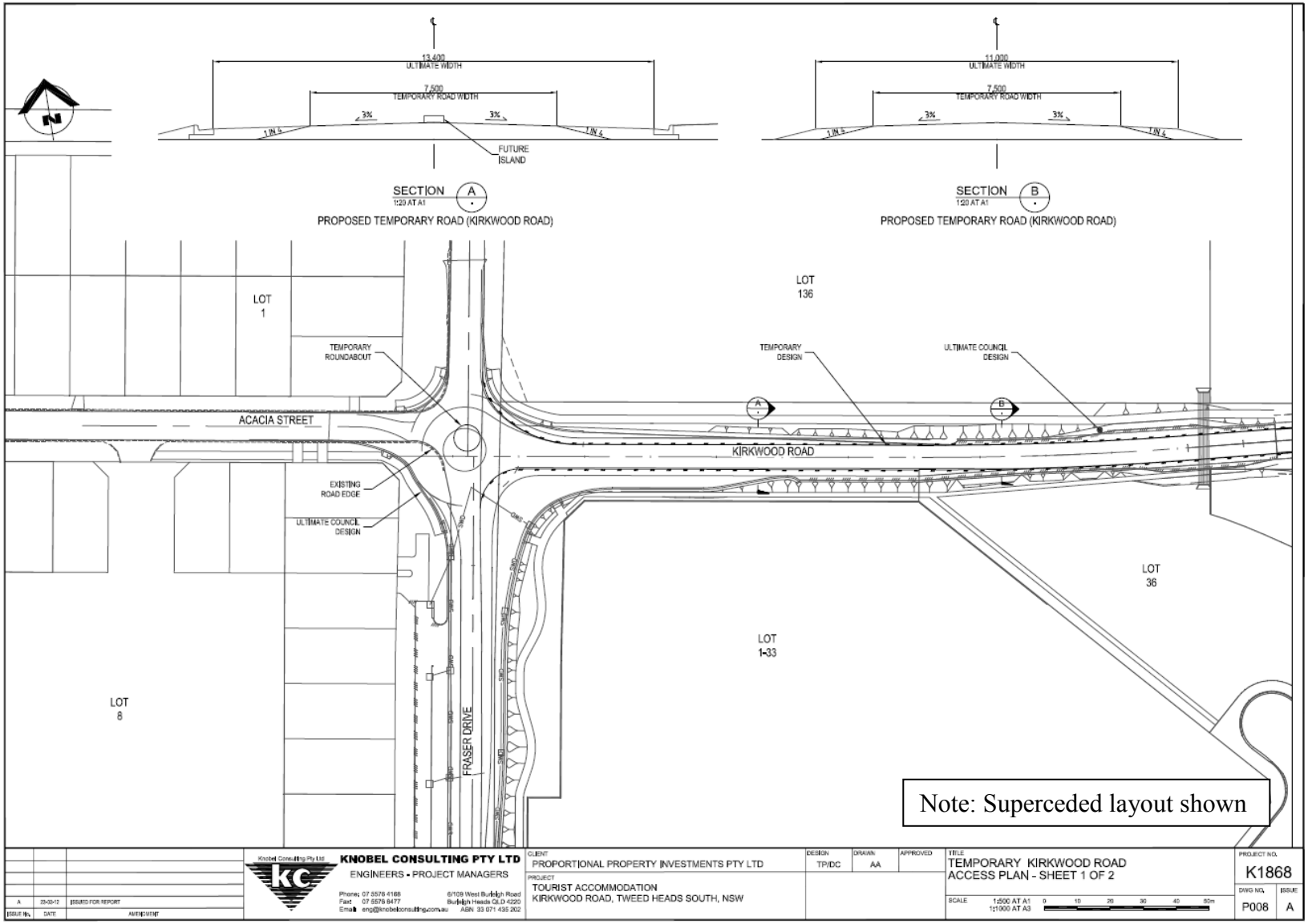


Figure 7.2 – Temporary Kirkwood Road Access Plan

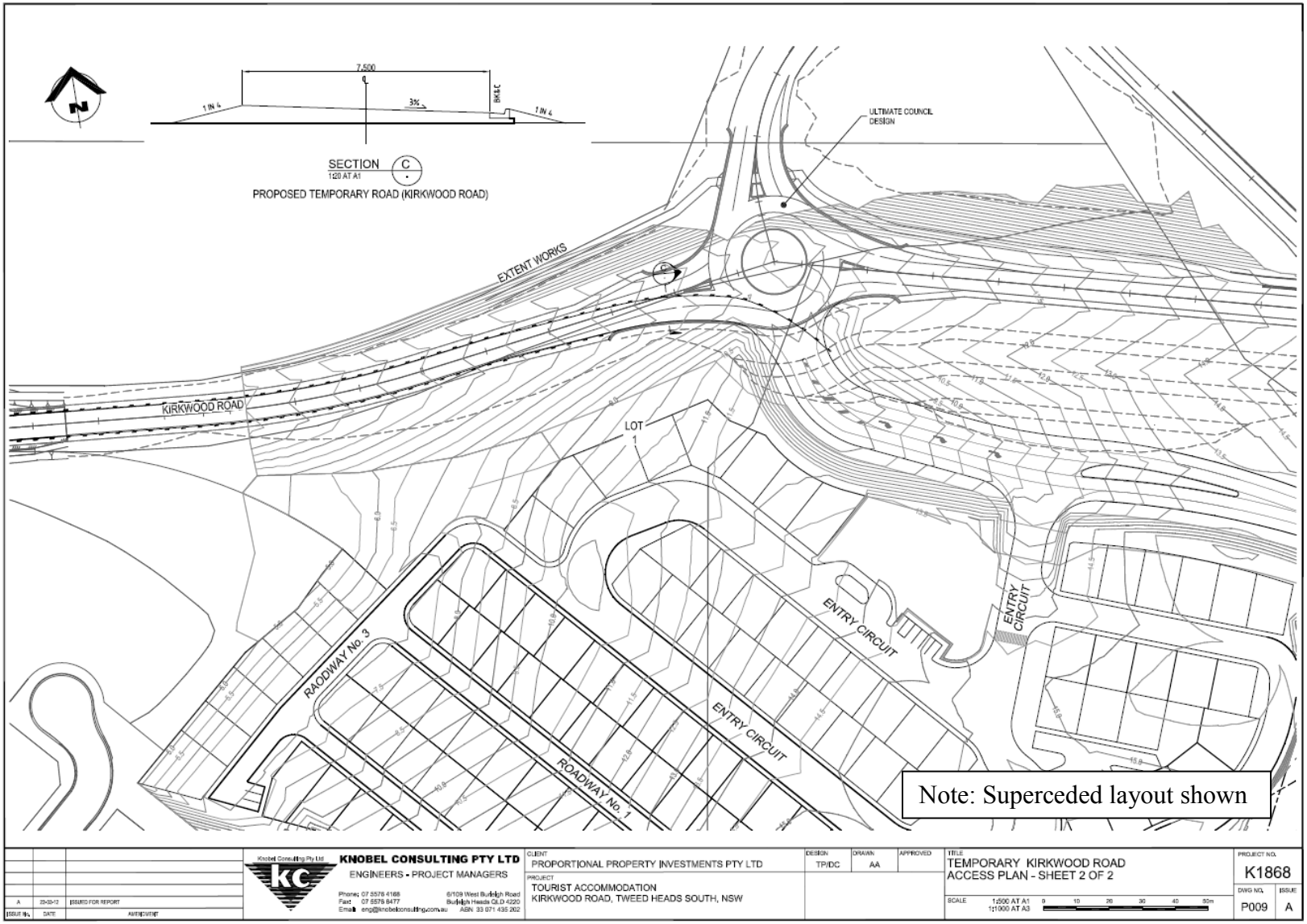


Figure 7.3 – Temporary Kirkwood Road Access Plan

8 PROVISION FOR PEDESTRIANS & CYCLISTS

Based on the nature of the site and its location within the surrounding area, it is expected that there will be little demand for pedestrian/cyclist activity to/from the site. Internally, provision is made for pedestrians and cyclists within the internal roadway. The internal roads provide connection between the administration building / common facilities and cabins.

9 SUMMARY OF CONCLUSIONS & RECOMMENDATIONS

- The subject site is located in Tweed Heads South, to the west of the Pacific Highway. The site is currently undeveloped land and is located in a developing area, surrounded generally by residential dwellings. The Tweed City Shopping Centre is located to the site's east.

- The proposed development consists of a Tourist Park, with a total of 355 cabins / units for temporary accommodation.

- Access to the subject site is initially proposed via a partial construction of Kirkwood Road between the subject site and Fraser Drive. Ultimately, the development will be serviced by the future extension of Kirkwood Road between Minjungbal Drive and Fraser Drive and a new interchange with the Pacific Highway, as well as the proposed extension of Enterprise Avenue (also known as Venture Close) to the south-east of the site.

- The Kirkwood Road Project is being undertaken jointly by Tweed Shire Council and the Department of Transport and Main Roads. The project will provide an extension of Kirkwood Road to facilitate connection between Minjungbal Drive in the east and Fraser Drive to the west. AS part of the upgrade, the Kirkwood Road interchange will be constructed to provide an additional access point to/from the Pacific Highway for areas located in South Tweed Heads. An extension of Enterprise Avenue is also planned as part of the project, to provide a future connection to Kirkwood Road. Planning estimates that Stage 1A of the project (Kirkwood Road East) will be complete by late 2012, with Stage 1B (Kirkwood Road West) to be complete by 2015.

- A roundabout is proposed just north of the site access as part of the Kirkwood Road interchange, and will facilitate connection between Kirkwood Road and Enterprise Avenue. The Site Access road will extend from the Enterprise Avenue connection, and a concept intersection layout has been prepared by CRG and is included in this report.

- The proposed development is expected to generate up to 1,420 vehicle trips per day, with approximately 142 of these occurring in the peak hours.

- Turning warrants analysis indicates that auxiliary left and channelised right turn treatments are required at the Site Access, and intersection capacity analysis demonstrates that the proposed treatments will be sufficient across the 10-year forecast to 2025.

- Intersection capacity analysis has been undertaken for the proposed Fraser Drive and Kirkwood Road roundabout. The analysis has revealed that the proposed interim roundabout on Fraser Drive will operate satisfactorily over the next 10 years even if the Kirkwood Road extension to Minjungbal Drive is not constructed during that time. The intersection will operate with minimal delays and vehicle queuing on all approaches.

- Car parking for guests, staff and visitors is proposed on-site in compliance with Council's minimum requirements.

- Internal roadways within the development have been designed to accommodate the design service vehicle (HRV). Swept path analysis demonstrates that internal roadways are sufficient to accommodate manoeuvring by the design service vehicle.

- It is expected that the development will generate low demand for pedestrian/cyclist activities external to the site, based on the location and nature of the proposed development. Existing pedestrian and cyclist facilities are therefore considered adequate and appropriate based on the nature of the proposed development. Internally, the site caters for pedestrians and cyclists with internal connection between the cabins and common facilities/administration building.

- Public transport services (public bus routes) currently service the area and are readily accessible to the proposed development. Existing bus services are considered adequate and appropriate in the context of the nature, scale and location of the proposed development.

REFERENCES

Austroads Guide to Traffic Engineering Part 4A
AS2890.1: 2004 Off-Street Car Parking Facilities
AS2890.2: 2002 Commercial Vehicle Facilities
Tweed Shire Council Development Control Plan

APPENDIX A

Criteria for Interpreting Results of SIDRA Analysis

1. Level of Service (LOS)

LOS	Traffic Signals and Roundabouts	Give Way and Stop Signs
'A'		Good operation.
'B'	Good operation. Good with acceptable delays and spare capacity.	Acceptable delays and spare capacity.
'C'	Satisfactory.	Satisfactory but accident study required.
'D'	Operating near capacity.	Near capacity and accident study required.
'E'	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode.	At capacity and requires other control mode.
'F'	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode.

2. Average Vehicle Delay (AVD)

The AVD provides a measure of the operational performance of an intersection as indicated on the table below which relates AVD to LOS. The AVD's listed in the table should be taken as a guide only as longer delays could be tolerated in some locations (i.e. inner city conditions) and on some roads (ie minor side street intersecting with a major arterial route).

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

3. Degree of Saturation (DS)

The DS is another measure of the operational performance of individual intersections.

For intersections controlled by **traffic signals**[1] both queue length and delay increase rapidly as DS approaches 1, and it is usual to attempt to keep DS to less than 0.9. Values of DS in the order of 0.7 generally represent satisfactory intersection operation. When DS exceeds 0.9 queues can be anticipated.

For intersections controlled by a **roundabout or GIVE WAY or STOP signs**, satisfactory intersection operation is indicated by a DS of 0.8 or less.

1 *The values of DS for intersections under traffic signal control are only valid for cycle length of 120 secs.*

APPENDIX B

SIDRA Results

MOVEMENT SUMMARY

Site: With Dev (2025) AM

Site Access / Venture Close Intersection
With Development - Forecast (2015)
AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Site Access											
1	L	66	0.0	0.086	9.5	LOS A	0.3	2.2	0.45	0.72	41.8
3	R	17	0.0	0.038	13.0	LOS B	0.1	0.9	0.63	0.82	39.3
Approach		83	0.0	0.086	10.2	LOS B	0.3	2.2	0.49	0.74	41.3
East: Venture Close (east)											
4	L	11	0.0	0.006	7.4	LOS A	0.0	0.0	0.00	0.65	48.6
5	T	403	0.0	0.207	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		414	0.0	0.207	0.2	NA	0.0	0.0	0.00	0.02	59.6
West: Venture Close (west)											
11	T	403	0.0	0.207	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	45	0.0	0.037	8.6	LOS A	0.2	1.1	0.44	0.63	46.8
Approach		448	0.0	0.207	0.9	NA	0.2	1.1	0.04	0.06	58.4
All Vehicles		945	0.0	0.207	1.4	NA	0.3	2.2	0.06	0.10	56.9

MOVEMENT SUMMARY

Site: With Dev (2025) PM

Site Access / Venture Close Intersection
With Development - Forecast (2015)
PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Site Access											
1	L	50	0.0	0.065	9.5	LOS A	0.2	1.6	0.45	0.71	41.9
3	R	12	0.0	0.028	13.3	LOS B	0.1	0.6	0.65	0.82	39.1
Approach		62	0.0	0.065	10.2	LOS B	0.2	1.6	0.49	0.73	41.3
East: Venture Close (east)											
4	L	19	0.0	0.010	7.4	LOS A	0.0	0.0	0.00	0.65	48.6
5	T	403	0.0	0.207	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		422	0.0	0.207	0.3	NA	0.0	0.0	0.00	0.03	59.4
West: Venture Close (west)											
11	T	403	0.0	0.207	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	74	0.0	0.061	8.6	LOS A	0.3	1.9	0.45	0.65	46.7
Approach		477	0.0	0.207	1.3	NA	0.3	1.9	0.07	0.10	57.6
All Vehicles		961	0.0	0.207	1.5	NA	0.3	1.9	0.07	0.11	56.9

MOVEMENT SUMMARY

Site: AM 2012 with development

Fraser Drive & Kirkwood Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Fraser Drive											
1	L	75	0.0	0.429	8.1	LOS A	3.1	22.1	0.37	0.61	48.3
2	T	450	3.0	0.429	7.4	LOS A	3.1	22.1	0.37	0.55	48.6
3	R	34	0.0	0.429	11.6	LOS B	3.1	22.1	0.37	0.76	46.0
Approach		559	2.4	0.429	7.8	LOS A	3.1	22.1	0.37	0.57	48.4
East: Kirkwood Road											
4	L	50	0.0	0.108	10.9	LOS B	0.6	4.2	0.65	0.73	46.0
5	T	1	0.0	0.108	10.1	LOS B	0.6	4.2	0.65	0.70	46.3
6	R	33	0.0	0.108	14.4	LOS B	0.6	4.2	0.65	0.80	43.5
Approach		84	0.0	0.108	12.2	LOS B	0.6	4.2	0.65	0.76	44.9
North: Fraser Drive											
7	L	22	0.0	0.425	8.1	LOS A	3.2	22.6	0.39	0.61	48.2
8	T	450	3.0	0.425	7.5	LOS A	3.2	22.6	0.39	0.55	48.4
9	R	75	0.0	0.425	11.7	LOS B	3.2	22.6	0.39	0.75	45.9
Approach		547	2.5	0.425	8.1	LOS A	3.2	22.6	0.39	0.58	48.1
West: Acacia Street											
10	L	75	0.0	0.185	10.5	LOS B	1.1	7.4	0.63	0.74	46.4
11	T	5	0.0	0.185	9.7	LOS A	1.1	7.4	0.63	0.70	46.5
12	R	75	0.0	0.185	14.0	LOS B	1.1	7.4	0.63	0.80	43.8
Approach		155	0.0	0.185	12.1	LOS B	1.1	7.4	0.63	0.77	45.1
All Vehicles		1345	2.0	0.429	8.7	LOS A	3.2	22.6	0.42	0.61	47.6

MOVEMENT SUMMARY

Site: PM 2012 with development

Fraser Drive & Kirkwood Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Fraser Drive											
1	L	79	0.0	0.439	8.0	LOS A	3.3	23.4	0.37	0.61	48.3
2	T	450	3.0	0.439	7.4	LOS A	3.3	23.4	0.37	0.54	48.6
3	R	50	0.0	0.439	11.6	LOS B	3.3	23.4	0.37	0.75	45.9
Approach		579	2.3	0.439	7.8	LOS A	3.3	23.4	0.37	0.57	48.3
East: Kirkwood Road											
4	L	34	0.0	0.074	10.8	LOS B	0.4	2.9	0.65	0.72	46.0
5	T	1	0.0	0.074	10.1	LOS B	0.4	2.9	0.65	0.68	46.3
6	R	22	0.0	0.074	14.4	LOS B	0.4	2.9	0.65	0.78	43.5
Approach		57	0.0	0.074	12.2	LOS B	0.4	2.9	0.65	0.74	45.0
North: Fraser Drive											
7	L	33	0.0	0.448	8.3	LOS A	3.4	24.0	0.43	0.62	48.0
8	T	450	3.0	0.448	7.6	LOS A	3.4	24.0	0.43	0.56	48.2
9	R	79	0.0	0.448	11.8	LOS B	3.4	24.0	0.43	0.75	45.8
Approach		562	2.4	0.448	8.3	LOS A	3.4	24.0	0.43	0.59	47.8
West: RoadName											
10	L	79	0.0	0.195	10.5	LOS B	1.1	7.9	0.64	0.75	46.3
11	T	5	0.0	0.195	9.8	LOS A	1.1	7.9	0.64	0.71	46.5
12	R	79	0.0	0.195	14.1	LOS B	1.1	7.9	0.64	0.81	43.8
Approach		163	0.0	0.195	12.2	LOS B	1.1	7.9	0.64	0.77	45.0
All Vehicles		1361	2.0	0.448	8.7	LOS A	3.4	24.0	0.44	0.61	47.5

MOVEMENT SUMMARY

Site: AM 2025 with development

Fraser Drive & Kirkwood Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Fraser Drive											
1	L	75	0.0	0.579	8.3	LOS A	5.3	37.6	0.45	0.61	48.0
2	T	660	3.0	0.579	7.6	LOS A	5.3	37.6	0.45	0.55	48.1
3	R	34	0.0	0.579	11.8	LOS B	5.3	37.6	0.45	0.74	45.9
Approach		769	2.6	0.579	7.9	LOS A	5.3	37.6	0.45	0.57	48.0
East: Kirkwood Road											
4	L	50	0.0	0.136	12.9	LOS B	0.8	5.8	0.78	0.81	44.0
5	T	1	0.0	0.136	12.2	LOS B	0.8	5.8	0.78	0.79	44.2
6	R	33	0.0	0.136	16.5	LOS B	0.8	5.8	0.78	0.85	41.9
Approach		84	0.0	0.136	14.3	LOS B	0.8	5.8	0.78	0.83	43.1
North: Fraser Drive											
7	L	22	0.0	0.578	8.3	LOS A	5.4	38.9	0.48	0.61	47.8
8	T	660	3.0	0.578	7.6	LOS A	5.4	38.9	0.48	0.56	47.9
9	R	75	0.0	0.578	11.8	LOS B	5.4	38.9	0.48	0.73	45.8
Approach		757	2.6	0.578	8.1	LOS A	5.4	38.9	0.48	0.57	47.7
West: Acacia Street											
10	L	75	0.0	0.229	12.4	LOS B	1.4	10.0	0.77	0.83	44.5
11	T	5	0.0	0.229	11.6	LOS B	1.4	10.0	0.77	0.81	44.7
12	R	75	0.0	0.229	15.9	LOS B	1.4	10.0	0.77	0.87	42.3
Approach		155	0.0	0.229	14.0	LOS B	1.4	10.0	0.77	0.85	43.4
All Vehicles		1765	2.2	0.579	8.8	LOS A	5.4	38.9	0.51	0.61	47.2

MOVEMENT SUMMARY

Site: PM 2025 with development

Fraser Drive & Kirkwood Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Fraser Drive											
1	L	79	0.0	0.588	8.2	LOS A	5.6	39.7	0.45	0.60	47.9
2	T	660	3.0	0.588	7.6	LOS A	5.6	39.7	0.45	0.54	48.1
3	R	50	0.0	0.588	11.8	LOS B	5.6	39.7	0.45	0.73	45.9
Approach		789	2.5	0.588	7.9	LOS A	5.6	39.7	0.45	0.56	47.9
East: Kirkwood Road											
4	L	34	0.0	0.095	12.9	LOS B	0.6	4.0	0.78	0.79	44.1
5	T	1	0.0	0.095	12.1	LOS B	0.6	4.0	0.78	0.77	44.3
6	R	22	0.0	0.095	16.4	LOS B	0.6	4.0	0.78	0.83	41.9
Approach		57	0.0	0.095	14.2	LOS B	0.6	4.0	0.78	0.80	43.2
North: Fraser Drive											
7	L	33	0.0	0.605	8.5	LOS A	5.8	41.3	0.54	0.62	47.6
8	T	660	3.0	0.605	7.9	LOS A	5.8	41.3	0.54	0.58	47.6
9	R	79	0.0	0.605	12.1	LOS B	5.8	41.3	0.54	0.73	45.8
Approach		772	2.6	0.605	8.3	LOS A	5.8	41.3	0.54	0.59	47.4
West: RoadName											
10	L	79	0.0	0.243	12.5	LOS B	1.5	10.7	0.77	0.84	44.4
11	T	5	0.0	0.243	11.7	LOS B	1.5	10.7	0.77	0.82	44.6
12	R	79	0.0	0.243	16.0	LOS B	1.5	10.7	0.77	0.88	42.2
Approach		163	0.0	0.243	14.1	LOS B	1.5	10.7	0.77	0.86	43.3
All Vehicles		1781	2.2	0.605	8.9	LOS A	5.8	41.3	0.53	0.61	47.1