2.3 Parking

2.3.1 On-Street Parking

The introduction of the two site access points, including the roundabout 40m west of Scott Street, will result in changes in the availability of on-street parking in surrounding streets. This is illustrated in Figure 4 below. The applicant notes that the loss of 29 on-street parking spaces on Artarmon Road and Richmond Avenue will be off-set by the increase in available parking on the internal road within the site.

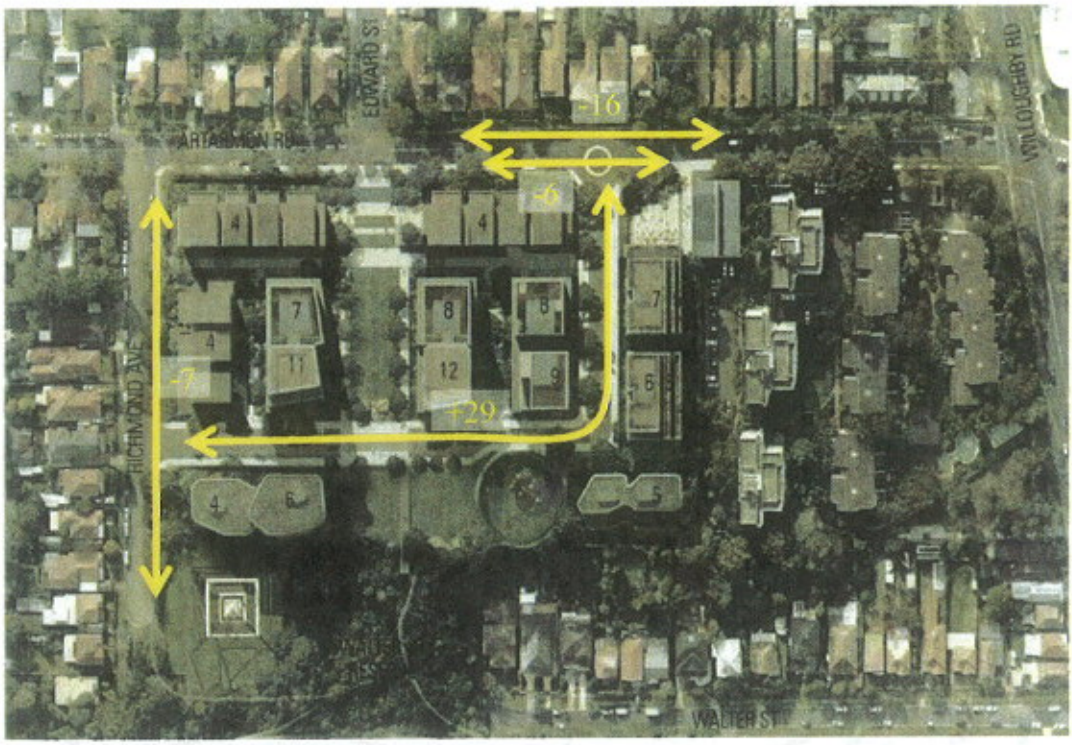

Figure 4 On-street parking changes

Street	Parking loss / gained
Richmond Avenue (east)	-7
Internal road (both sides)	+29
Artarmon Road (south)	-6
Artarmon Road (north)	-16
Total	0

It is important to recognise however that while there will be no net loss of on-street parking in the area, residents of Artarmon Road reliant on parking outside their properties will be impacted by the proposal. Some of these properties contain off-street car parking (accessed off Armstrong Street) however many are reliant on existing parking available on Artarmon Road.

Parking within the internal road should therefore be utilised to compensate for loss of parking on Artarmon Road. Therefore these spaces should be designated as residents parking only, with residents of Artarmon Road (between Edward Street and Willoughby Road) eligible to park in these spaces. This resident parking scheme would be implemented by Council following the occupation of the Channel 9 site.

2.3.2 Off-Street Parking

The rate at which off-street car parking will be provided is consistent with Council DCP rates as well as Condition 29 of the concept plan approval for the site. Visitor parking will be provided at a rate of 1 space per 4 dwellings, which is considered suitable to accommodate visitor demand. Visitors to the site will also be able to park on the internal road within the site, however as previously noted this on-street parking was intended to replace that lost on Artarmon Road and Richmond Avenue and therefore may not be available for visitor use.

2.4 Traffic Modelling Approach

Arup has assessed the impact of the additional number of dwellings on the Channel 9 site on the function of the local road network – specifically the Willoughby Road / Artarmon Road intersection.

2.4.1 Traffic Generation

Traffic generation rates used in this analysis for the Channel 9 site were consistent with the Arup 2013 study as well as the GTA 2016 report supporting the concept plan modification.

The forecast site traffic generation during the AM, PM and Saturday peak hours is summarised in Table 2.

Table 2: Forecast Site Traffic Generation

Peak Hour	Existing Channel 9 Traffic Generation	Forecast Traffic Generation	Difference
Weekday AM (8am – 9am)	198	175	-23
Weekday PM (5pm – 6pm)	176	175	-1
Saturday (11am – 12pm)	24	128	+104

2.4.2 Traffic Distribution

Traffic has been distributed across the road network based on the existing travel patterns of Willoughby residents and workers - shown graphically in Figure 5. The majority of trips will be directed to the Artarmon Road / Willoughby Road intersection, with less than 30% travelling west along Artarmon Road.

Figure 5 Forecast Traffic Distribution

2.4.3 Adjacent Developments

The traffic modelling undertaken for this study has considered the impact of known and potential future developments in the vicinity of the site, based on advice from Willoughby City Council. These are illustrated in Figure 6, and include:

- 5-9 Walter St – Residential flat building – 29 units
- 11-11A and 13 Walter Street – Residential flat building – 24 units
- 1 & 1A Walter Street & 452 & 460 Willoughby Road – 225 place child care centre
- 462 Willoughby Road – Residential flat building – 20 units
- 34-42 Penshurst Street - Residential flat building – 74 units

Additionally, Council advised that the area may have the potential for an additional 350 units, with the areas for this development noted below:

- Mowbray Road, Edward Street , Willoughby Road – 150 units
- Mowbray Road, Small Street , Willoughby Road – 100 units
- Willoughby Road, Walter Street – 100 units

It should be noted that no additional development was considered in the modelling undertaken by GTA consultants to support the concept plan modification.

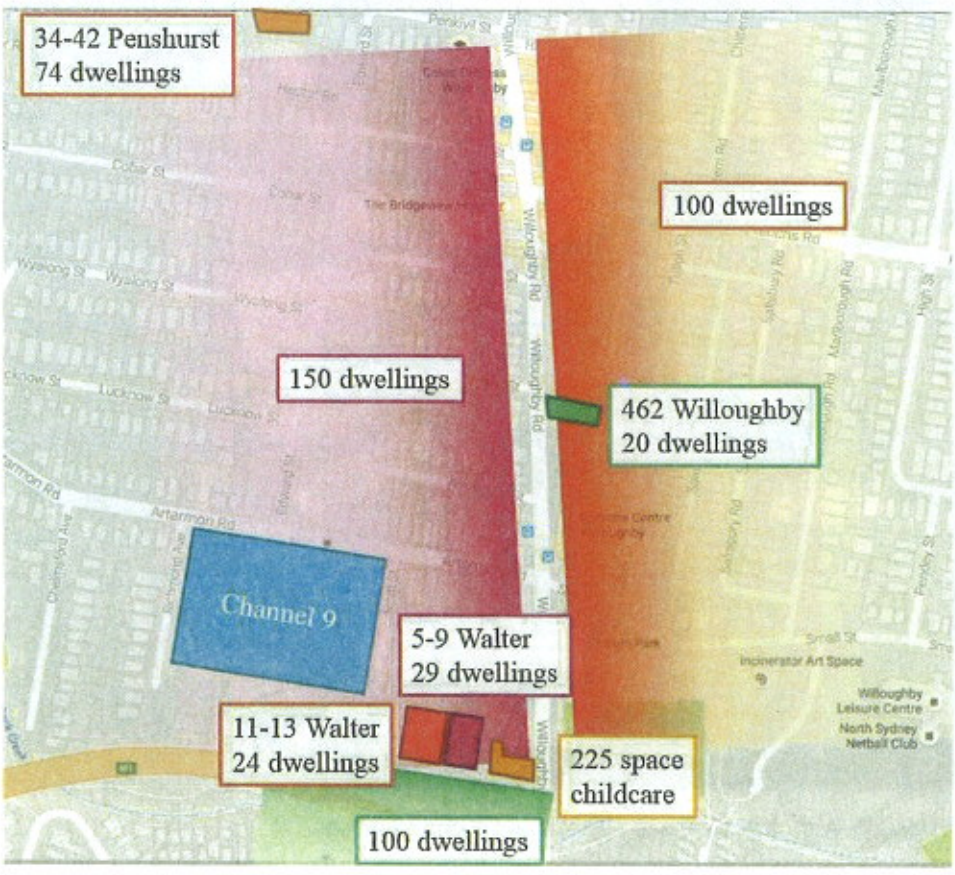

Figure 6 Adjacent developments considered in traffic modelling

2.4.4 Scenarios considered

The traffic modelling has considered the following scenarios:

- Development of Channel 9 site with 400 dwellings
- Development of Channel 9 site with 510 dwellings
- Development of Channel 9 site with 510 dwellings and adjacent development described above

The peak hours considered for this analysis were the PM weekday peak hour and the Saturday peak hour.

2.4.5 Intersection Layout

To improve the operation of the intersection of Willoughby Road/ Artarmon Road/ Small Street, the applicant has proposed to provide a $3 million contribution to the upgrade of the intersection. This proposed upgrade will provide a 100 metre right turn bay for northbound vehicles on Willoughby Road and provide a slip left turn lane out of Small Street into Willoughby Road.

This proposed arrangement is summarised in Figure 7, and has been used as the basis for testing the above mentioned scenarios.

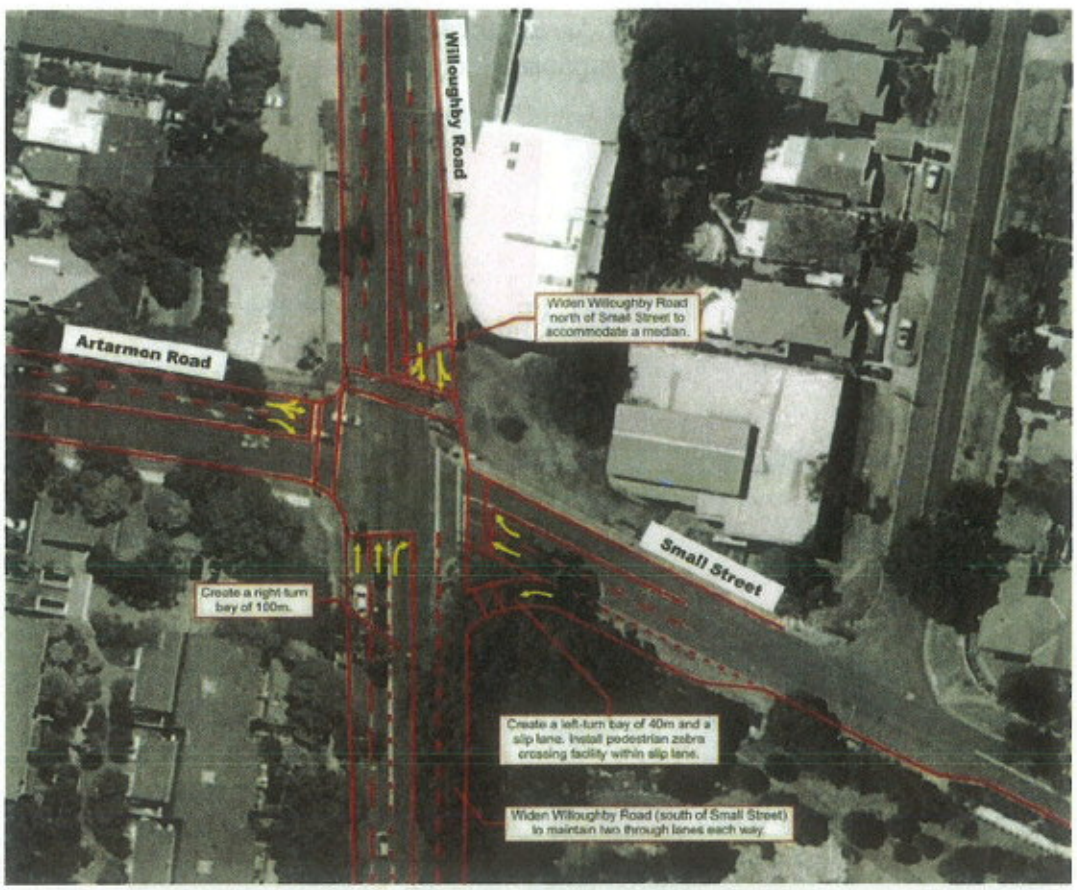

Figure 7 Proposed Willoughby Road / Artarmon Road Upgrade

Source: Willoughby City Council/GTA Consultants, 2012

2.5 Traffic Modelling Outputs

2.5.1 Proposed intersection upgrade without pedestrian crossing

The intersection (under the proposed layout indicated in Figure 7) has been assessed using RMS approved software SIDRA software. In urban areas, the traffic capacity of the major road network is generally a function of the performance of key intersections. This performance is quantified in terms of Level of Service (LOS), is based on the average delay per vehicle. LOS ranges from A = very good to F = unsatisfactory.

The results of the intersection analysis are summarised in Table 3 below.

Table 3: Intersection Analysis - Willoughby Road / Artarmon Road

Peak Hour	Scenario	Intersection Performance				
		LOS	DOS	AVD	Artarmon Road queue length (m)	Small Street vehicle delay (s)
PM (5pm – 6pm)	400 dwellings	B	0.96	23	78	39
	510 dwellings	B	0.96	24	81	48
	510 dwellings + adjacent development	B	0.96	24	82	52
Saturday (11am – 12pm)	400 dwellings	B	0.89	20	105	39
	510 dwellings	C	1.00*	35	112	43
	510 dwellings + adjacent development	C	1.03*	39	113	46

Legend: AVD – Average Vehicle Delay (seconds), LOS – Level of Service, DOS – Degree of Saturation

* The high degree of saturation is related to the right turn movement from Willoughby Road (southbound) into Artarmon Road. The remaining movements operate with spare capacity.

The traffic modelling indicates the increase in dwellings on the Channel 9 site will have a relatively minor impact on the operation of the (upgraded) Willoughby Road / Artarmon Road intersection. The modelling does however indicate the additional number of vehicles turning right from Willoughby Road into Artarmon Road (as a direct result of the development) will result in this movement operate at a degree of saturation above 1.0 – i.e. it is over capacity. This issue is exacerbated on occasions when a southbound travelling bus is stopped on Willoughby Road immediately north of Small Street and a vehicle is waiting to turn right into Artarmon Road. In these situations all southbound (through) traffic on Willoughby Road is blocked – resulting in long vehicle delays and queues.

The lack of a right turn bay into Artarmon Road, or a dedicated traffic signal phase, results in the poor performance of this traffic movement. The provision of a right turn bay (similar to that proposed on the southern approach of Willoughby Road into Small Street) would ameliorate this impact.

2.5.2 Proposed intersection upgrade with pedestrian crossing

It is important to note that the results noted above are based on the proposed intersection upgrade as illustrated in Figure 7 of this report, without the provision of a signalised pedestrian crossing on the southern leg of the intersection. Current RMS policy is that for any new or upgraded signalised intersection, pedestrian crossings must be provided on all approaches unless it can be demonstrated that it is impractical to do so.

The presence of an additional pedestrian crossing on the southern leg of the intersection is preferable given the pedestrian demand generated by the development – particularly between the site and active open space on the eastern side of Willoughby Road. This includes the Willoughby squash centre, Willoughby leisure centre and Bicentennial reserve.

Therefore Arup has undertaken revised modelling to understand the performance of the intersection with the inclusion of a pedestrian crossing on all approaches. The results of the analysis are indicated in Table 4 below.

Table 4: Intersection Analysis - Willoughby Road / Artarmon Road amended layout

Peak Hour	Scenario	Intersection Performance				
		LOS	DOS	AVD	Artarmon Road queue length (m)	Small Street vehicle delay (s)
PM (5pm – 6pm)	400 dwellings	B	0.93	26	106	42
	510 dwellings	C	1.05*	28	108	42
	510 dwellings + adjacent development	D	1.10*	47	108	42
Saturday (11am – 12pm)	400 dwellings	C	0.98	37	149	38
	510 dwellings	D	1.02*	50	167	51
	510 dwellings + adjacent development	D	1.04**	54	167	51

Legend: AVD – Average Vehicle Delay (seconds), LOS – Level of Service, DOS – Degree of Saturation

* The high degree of saturation is related to the right turn movement from Willoughby Road (southbound) into Artarmon Road. The remaining movements operate with spare capacity.

** The high degree of saturation is related to the right turn movement from Willoughby Road (southbound) into Artarmon Road as well as right turn from Artarmon Road (eastbound) into Willoughby Road. The remaining movements operate with spare capacity.

The traffic modelling indicates that when the additional pedestrian crossing is added to the southern approach of the intersection, the intersection operates above it's operating capacity during the Saturday peak hour. Vehicles experience increased delays and queue lengths on Artarmon Road – with queues forecast to extend back nearly 170m.

2.5.3 Queue Lengths – Artarmon Road

The forecast change in forecast queue lengths on Artarmon Road between the scenarios considered are illustrated in Figure 8 below. This illustrates that should the intersection upgrade proceed as per the applicant's proposal, queue lengths on Artarmon Road are expected to extend back to the site access point (roundabout) 40m west of Scott Street. However, should a pedestrian crossing on the southern approach of the intersection be provided (as RMS generally require), queue lengths extend back nearly 170m on Artarmon Road. This queue length has the potential to impact the ingress and egress of vehicles into and out of the site.

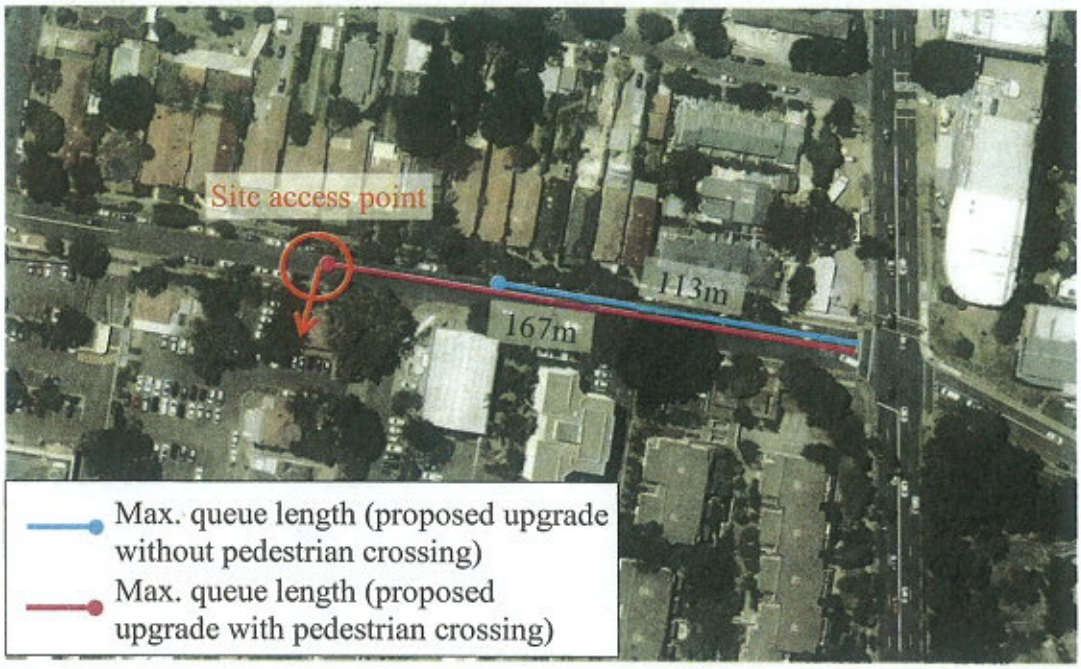

Figure 8 Forecast queue lengths on Artarmon Road

2.6 Intersection Upgrade Costs

Based on experience on similar projects, Arup has prepared indicative cost estimates for the intersection upgrade works. This includes the civil works for upgrading the intersection, as well as costs of land acquisition required. The cost estimate for the works range between $2.5m and $4.5m.

Table 5 Indicative intersection upgrade costs

Works	Unit Rate	Quantum	Indicative Cost
Upgraded intersection including civil works, line marking, traffic control etc.	$1m - $2m	1	$1m-$2m
Land acquisition	$3,000 - $5,000 / m^2	500m^2	$1.5m -$2.5m
Total			**$2.5m - $4.5m**

2.7 Impacts to Local Streets

The development of the site will result in increased traffic flows on some surrounding streets – in particular Edward Street and Richmond Avenue.

The RMS's maximum environmental capacity threshold for a local residential street (as outlined in the *RTA Guide to Traffic Generating Developments*) is 300 vehicles per hour or 3,000 vehicles per day. Currently there are some 50 vehicles per hour on Richmond Avenue and 142 vehicles per hour on Edward Street.

Taking a very conservative approach where all traffic entering/leaving the site uses Richmond Avenue and Edward Street, the number of vehicles travelling on these local streets would still remain below the environmental limits for local streets as prescribed by Roads and Maritime.

3 Summary

Arup was engaged by Willoughby City Council to undertake a review of the traffic assessment supporting the proposed modification to the approved concept plan for the Channel 9 campus at 6-30 Artarmon Road, Willoughby. Key findings arising from the review are as follows:

- The design of the internal street does not allow for a garbage truck to manoeuvre entirely on the correct side of the roadway - creating safety issues. An amended design should be prepared which demonstrates a service vehicle can safely pass an oncoming car.
- The relocation of the Artarmon Road site access point to west of Scott Street achieves the sight distance required for vehicle leaving the site to safely view oncoming traffic.
- Given the slope of Artarmon Road (approximately 10% gradient) the provision of a roundabout to provide controlled entry and exit from the site may not be appropriate. Further investigation regarding the suitability of roundabout control at this location is required, including a concept plan of the proposed layout
- While there will be no net loss of on-street parking in the area as a result of the development, residents of Artarmon Road reliant on parking outside their properties will be impacted by the proposal.
- Parking within the internal road should be utilised to compensate for loss of parking on Artarmon Road with these spaces to be designated as residents parking only.
- The rate at which off-street car parking will be provided is consistent with Council DCP rates as well as Condition 29 of the concept plan approval for the site.
- Visitor parking will be restricted to the building basements as the on-street parking to be provided on the internal road is intended to replace that lost on Artarmon Road and Richmond Avenue
- Traffic modelling indicates the increase in dwellings on the Channel 9 site will have a relatively minor impact on the operation of the Willoughby Road /Artarmon Road intersection during peak periods should the intersection be upgraded as per the applicant's proposal. The exception to this is the right turn movement from Willoughby Road into Artarmon Road, which is forecast to operate above capacity due to the increase in dwellings on the site.
- The intersection upgrade proposed by the applicant does not include the provision of a signalised pedestrian crossing on the southern leg of the intersection. Current RMS policy is that for any new or upgraded signalised intersection, pedestrian crossings must be provided on all approaches unless it can be demonstrated that it is impractical.
- Traffic modelling indicates that when the additional pedestrian crossing is added to the southern approach of the intersection, the intersection operates above it's operating capacity during the Saturday peak hour. Queue lengths on

Artarmon Road are forecast to extend back nearly 170m - impacting the ingress/egress of vehicles into and out of the site.

- The intersection upgrade does significantly improve vehicle travel times and reduce delays for vehicles on Small Street – more than halving delays compared to the current situation
- Should the Willoughby Road / Artarmon Road intersection upgrade not proceed in any form, the intersection will not operate at satisfactory levels and the additional development of the site would not be appropriate.