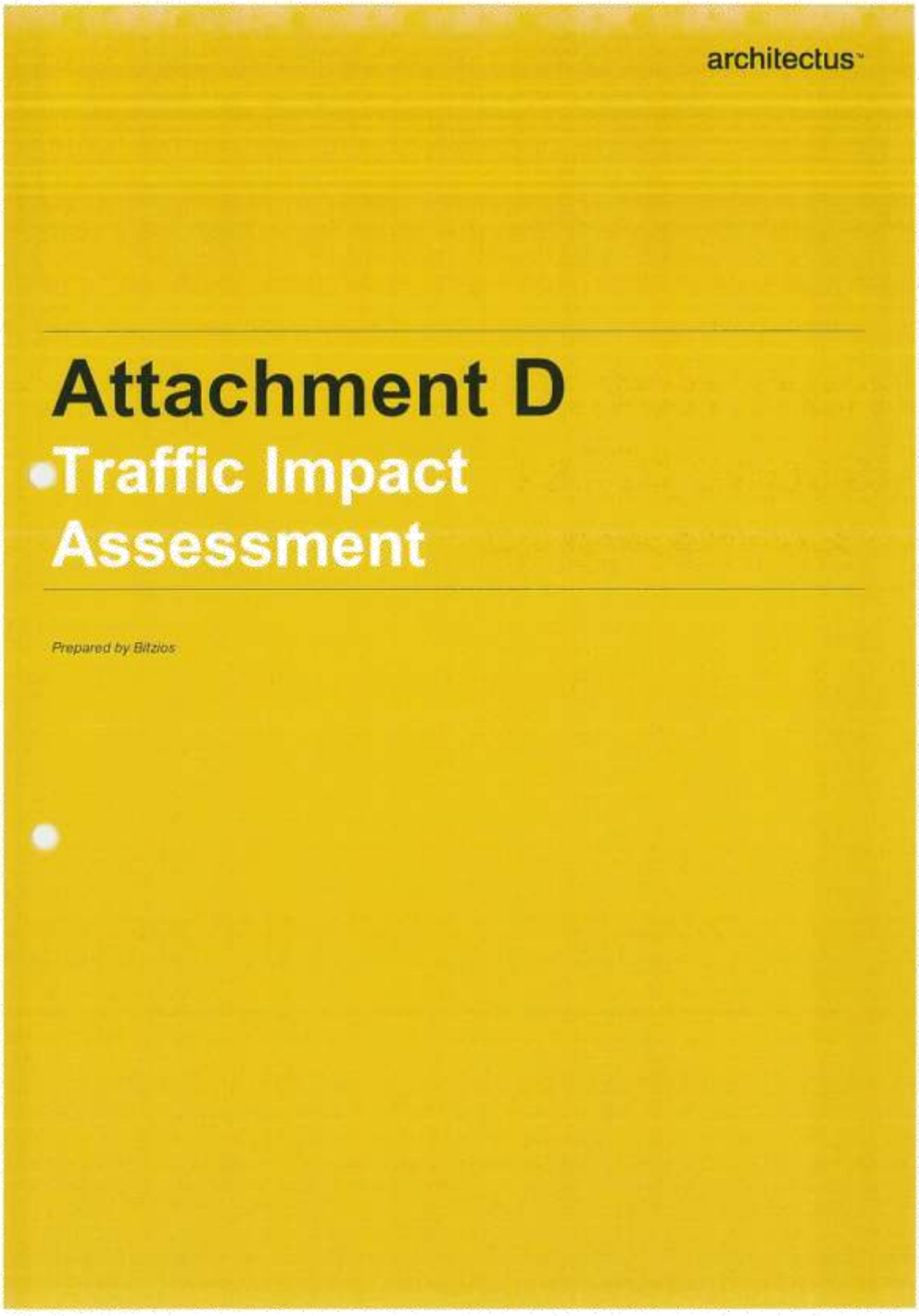
ITEM 5 (continued) **ATTACHMENT 5**



ITEM 5 (continued) **ATTACHMENT 5**

66-82 TALAVERA ROAD, MACQUARIE PARK
TRAFFIC IMPACT ASSESSMENT

FOR

HOLDMARK

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Project No P2235 Version No 004 Issue date 02 October 2015

ITEM 5 (continued) **ATTACHMENT 5**

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P2235 003R 66-82 Talavera Road TIA.doc	F. Lau	D. Bitzios	F. Lau	21/09/2015	Adrian Melo (Architectus) Adrian.Melo@architectus.com.au
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1. INTRODUCTION

1.1 BACKGROUND

Bitzios Consulting has been commissioned by Holdmark to prepare a Traffic Impact Assessment (TIA) to support a planning proposal. The planning proposal involves change to the permissible use at 66–82 Talavera Road, Macquarie Park from B7 (Business Park) to B4 (Mixed Use); increasing the floor-space-ratio from 1:1 to 3.5:1 and increasing the height limit from 30m to 120m.

The site is on the south-east corner of Alma Road and Talavera Road (see Figure 1.1), and borders the south-east corner of the Herring Road (Epping and Macquarie Park Urban Renewal Area). It is also located across the road from the Macquarie Shopping Centre with bus station located at the shopping centre on Herring Street and 500m walking distance to the Macquarie University Rail Station.

Figure 1.1: Locality Map

There are currently several buildings occupying the site, including the existing Astra Zeneca office premises on Alma Road which the existing employees will be relocated to a Council approved proposed new six (6) storey office/ commercial development eastern corner of the study area.

1.2 SCOPE

The purpose of this report is to assess the traffic and transport impacts of the planning proposal on the operation of the road and transport network. Specifically, this report includes:

- Identification of potential impacts on the road network;
- Proposed access points and arrangements; and
- Parking provisions.

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2. EXISTING CONDITION

2.1 ROAD NETWORK

The site (66-82 Talavera Road, Macquarie Park) is accessed via Talavera Road with an access also off Alma Road. The nearest RMS-controlled roads (arterial roads) are accessed via the Herring Road/ Talavera Road signalised intersection and Lane Cove Road/ Talavera Road signalised intersection. An alternative access point to Lane Cove Road is at Fontenoy Road (accessed via Khartoum Road), north of the Lane Cove Road/ M2 Motorway intersection.

M2 entry and exit ramps are located at Herring Road and Christie Road, allowing direct access to the site from the M2 via the western leg of Talavera Road. Figure 2.1 shows existing major roads and key trip generating areas near the site.

Source: NSW Globe (google earth)

Figure 2.1: Existing Major Roads and Trip Generators

The existing premises within the site access via a driveway on Alma Road as well as a direct access onto Talavera Road in the east. The Alma Road intersection with Talavera Road is left-in/ left-out priority intersection, a median strip is located on Talavera Road at Alma Road that restrict right turn movement in and out of Alma Road. The existing access arrangements are shown in Figure 2.2.

Source: NSW Globe (google earth)

Figure 2.2: Existing Access Arrangements

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Talavera Road is a two-way sub-arterial road with a posted speed limit of 50km/h. Restricted "6P Ticket" parking is allowed on both sides of the road outside of AM and PM peak periods, as sign-posted. Alma Road bordering the site is essentially a local access road with a 50kph speed limit and on street parking.

2.2 EXISTING TRAFFIC VOLUMES

The intersection counts for Talavera Road/Lane Cove Road signalised intersection and Talavera Road/ Khartoum Road signalised intersection were extracted from the previous report titled "*Astra Zeneca Office, Macquarie Park Traffic Impact Assessment*" dated 25 June 2015 (Bitzios Consulting).

Surveys for the other nearby intersections were undertaken on 3 September 2015 and the AM and PM peak periods counted were:

- AM Peak – 7:15-9:15am; and
- PM Peak – 4:15-6:15pm.

From the traffic survey data it was determined that the AM and PM peak hours for the study area are:

- AM Peak – 8:15-9:15am; and
- PM Peak – 4:45-5:45pm.

Figure 2.3 presents the existing traffic volumes for these peak hours.

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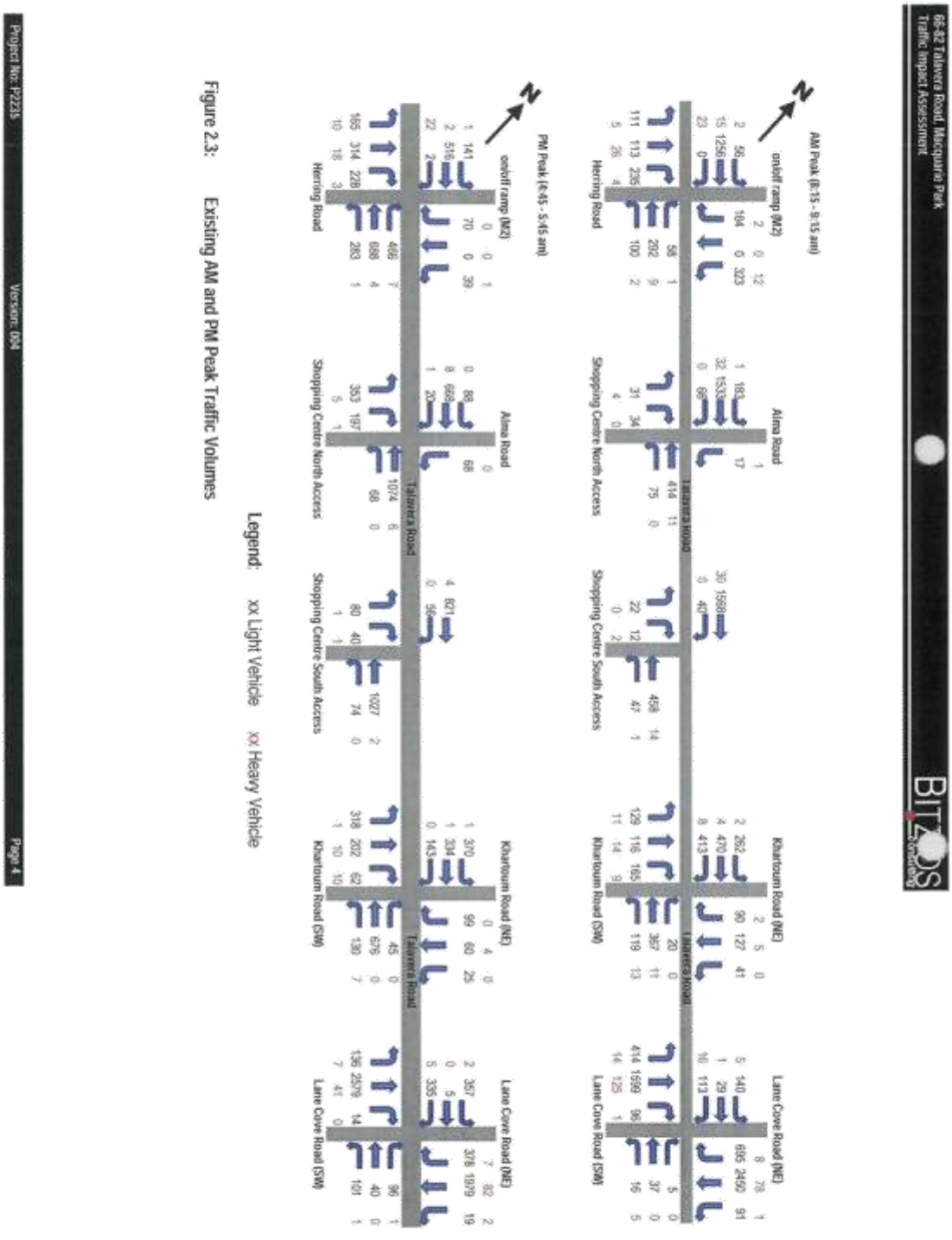

Figure 2.3: Existing AM and PM Peak Traffic Volumes

ITEM 5 (continued) **ATTACHMENT 5**

3. PLANNING PROPOSAL

3.1 PROPOSAL DETAILS

Macquarie Park, now one of the premier business centres of "Global Sydney", is facing a severe deficiency in accessible open space as it continues to grow. The planning proposal seeks to provide one hectare of public open space on the site, with the remainder of the site to include a mixed use development including an option for key worker housing. Based on this proposal, there is a need to apply for a rezoning from B7 (business park) to B4 (mixed use).

The concept Master Plan allows for:

- Minimum 1 hectare public open space;
- Minimum 20,000 m² of non-residential floorspace, with the combination of:
  - A childcare facilities suitable for 60 children (approximate gross floor area (GFA) of 800m²);
  - Council approved Astra Zeneca building (9,000m²);
  - Retail/ restaurant approximately 4,000m²; and
  - 6,200m² of commercial/ office.
- Approximately 40 Key worker dwellings (around 3% of the total dwellings provided, up to 15% of the open space (1,500 m²); and
- 1,125 apartments.

A traffic impact assessment was recently undertaken for the Astra Zeneca building within the study area. This proposal has been approved by Council and is currently under construction. The relevant data from the traffic assessment for that development was extracted and used in this assessment.

The study area is proposed to be accessed via three (3) accesses as shown in Figure 3.1:

- Alma Road (currently a left-in/left-out arrangement);
- Western Access (proposed left-in/left-out arrangement); and
- Eastern Access (currently a left-in/left-out arrangement, proposed to re-align with shopping centre access to form a four-leg signalised intersection).

Figure 3.1: Proposed Development Layout and Access locations

These access would replace the single access off Alma Road and the two access off Talavera Road that currently exist.

ITEM 5 (continued) **ATTACHMENT 5**

3.2 PARKING PROVISION

The existing land use type in accordance with the Ryde Local Environmental Plan (LEP) 2014 stipulates that the off street parking rate for the Macquarie Park Corridor is 1 space per 46m² gross floor area. With the full potential of the site being development under the B7 provision, a maximum of 870 parking spaces are permissible.

The State Environmental Planning Policy No.65 (SEPP65) – Design Quality of Residential Apartment Development recommends the minimum amount of car parking for a residential apartment should be in accordance with the *Apartment Design Guide* parking provision which refers to the *Roads and Maritime Services (RMS) Guide to Traffic Generating Development*. The minimum parking provision rates are as follows:

- 0.6 space per 1 bedroom unit;
- 0.9 space per 2 bedroom unit;
- 1.4 space per 3 bedroom unit; and
- 1 visitor space per 5 units.

The initial draft Master Plan proposes around 1600 off street car parking spaces provided over several levels of basement parking in conjunction with the changed of land use type. Access to the basement car parking is provided from Alma Road and via the internal circulation road. A small amount of convenient parking is also provided at ground level along the internal circulation road.

With the proposed change of land use to the study area, the residential parking requirement would be different to the existing and in accordance with Macquarie Park Corridor Development Control Plan (DCP) 2014, the maximum parking rates for residential development are as follows:

- 0.6 space per 1 bedroom;
- 0.9 space per 2 bedroom;
- 1.4 space per 3 bedroom;
- 1 visitor space per 10 dwellings; and
- 1 car share space per 50 proposed parking spaces.

These parking provision rates are similar to the RMS rates with the exception that lesser visitor parking spaces are permissible and the provision for car share spaces. Therefore it is recommended that the parking provision be in accordance with the DCP parking rates.

An assumed residential mix for the master plan are as follows:

- 20% one bedroom;
- 70% two bedroom; and
- 10% three bedroom.

On this basis, a maximum permissible parking spaces for the proposed residential development under the master plan are:

- 1,173 residential parking spaces; and
- 132 visitor parking spaces.

The remaining non-residential development is to be in accordance with the parking restriction stipulated in the LEP that totals to a maximum of 221 parking spaces excluding the Council approved Astra Zeneca parking provision.

Thus, a maximum of parking provision permissible for the proposed development are 1,526 spaces (excluding car share spaces and service vehicle spaces). Under the Macquarie Park DCP, a Framework Travel Plan would be required for any future development which exceeds 10,000m².

ITEM 5 (continued) **ATTACHMENT 5**

3.3 DEVELOPMENT TRAFFIC GENERATION AND DISTRIBUTION

3.3.1 Traffic Generation Rates

Traffic volumes were generated in accordance with the RTA *Guide to Traffic Generating Developments* and the *RMS Technical Direction with Updated Traffic Surveys*. These rates are as follows:

- High density residential;
  - AM Peak: 0.19 trips per unit; and
  - PM Peak: 0.15 trips per unit.
- Office block;
  - AM Peak: 1.6 trips per 100m² GFA; and
  - PM Peak: 1.2 trips per 100m² GFA.
- Childcare (long day care):
  - AM Peak: 0.8 trips per child; and
  - PM Peak: 0.3 trips per child.

The residential development is within walking distance to major shopping, education, recreational opportunities and mass public transport and hence using the high density rate is entirely appropriate in this location. This rate was checked against a first principles assessment considering access to other uses and public transport and correlated very well with the surveyed RMS rates.

3.3.2 Generated Traffic by Development Component

The proposed changes to the land use type on site are to generate traffic volumes in the peak hours as outlined in Table 3.1.

The retail/ restaurant type uses (approximately 4,000m²) are expected to provide services for the residential development in the area primarily and restaurant-generated traffic is outside of the commuter peak hours in any event. The retail/restaurant traffic generation has therefore been excluded.

The childcare centre is expected to provide services primarily to the residential development in the area, and it has been estimated that approximately 20% (12) children attending the childcare centre would travel from outside of the development by car.

Table 3.1: Peak Hour Traffic Generation

Development Type	Size	Trip Generated	
		AM Peak	PM Peak
Apartment	38 (key worker dwellings)	7	6
	1,125	214	169
Childcare	60 Children (12 arriving by car)	10	4
Non-residential	Astra Zeneca*	150	122
	6,200m² commercial/ office space	99	74
	Total Traffic Generated	480	374

*Council approved development adopted from the Astra Zeneca traffic impact assessment report

The site is currently zoned B7 Business Park which would limit its potential redevelopment to office type uses. The current built form controls for the site provide for 2 potential development outcomes on site as a result of the base case and incentivised planning controls. The development potential and resultant traffic generation is detailed in Table 3.2 below.

ITEM 5 (continued) **ATTACHMENT 5**

Table 3.2: Potential Peak Hour Traffic Generation

Development Scenario	Potential Floor Space	Trip Generated	
		AM Peak	PM Peak
FSR of 1.0:1	37,832m²	605	454
FSR of 1.5:1	56,748m²	908	681

The planning proposal would be expected to generate a lesser volume of vehicle trips during the commuter peak period decreasing the site's potential traffic demands in both peak periods. The main reason for this is that the proposal replaces a "business park" development type that is heavily private car dependent with a mixed use development that more heavily relies on local travel, public transport, walking and cycling for its accessibility.

3.3.3 Traffic Distribution Splits

The RTA Guide to Traffic Generating Developments assumes for residential development that 80% of morning peak movements are outbound and 20% inbound. The split is reversed in the evening peak. For commercial development the RTA Guide assumes 80% of employees are inbound and 20% outbound in the morning peak, with the reverse occurring in the afternoon peak. Based on these assumptions the peak hour inbound and outbound development traffic movements are:

- AM Peak
  - Inbound – 272 vehicle trips; and
  - Outbound – 237 vehicle trips.
- PM Peak
  - Inbound –186 vehicle trips; and
  - Outbound – 212 vehicle trips.

The distribution of the development traffic from the proposed has been assumed to match the movement patterns identified in the previous Herring Road Urban Activation Precinct (UAP) Transport Strategy, with:

- 65% of the trips to/from the east;
- 14% of the trips to/from the west;
- 11% of trips to/from the north; and
- 10% of trips to/from the south.

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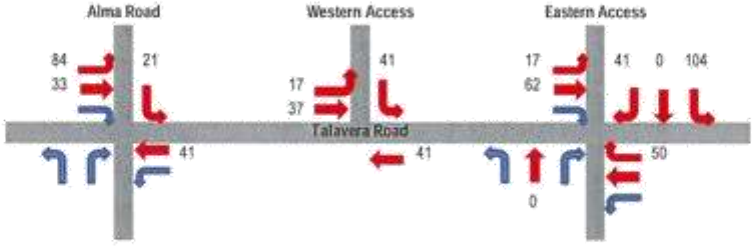
3.4 ACCESS TRAFFIC

The estimated development-generated peak period traffic with the distribution assumptions described above is shown in Figure 3.2.

AM Peak

PM Peak



Legend: Development Generated Traffic

Figure 3.2: Expected Development Generated Traffic Turning Volumes

ITEM 5 (continued) **ATTACHMENT 5**

4. INTERSECTION ANALYSIS

4.1 PERFORMANCE MEASURES

Key intersections near the site were analysed using SIDRA Intersection Analysis Software to assess the predicted traffic conditions as a result of the development. The results of the analysis are reported in terms of Level of Service (LoS) based on the average delay per vehicle, as shown in Table 4.1.

Table 4.1: Level of Service Measurement

Level of Service	Average Delay per Vehicle (sec/veh)	Description
A	< 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity
F	70 and above	Unsatisfactory

Source: RTA Guide to Traffic Generating Developments 2002

For signalised intersections, the LoS is based on the average delay per vehicle for the whole intersection. For priority intersections (Give Way and Stop controlled) the LoS is based on the average delay for the worst movement. Similarly, the LoS for a roundabout is based on the average delay for the worst movement.

The Degree of Saturation (DoS) is the ratio of the actual or modelled traffic volumes compared to the theoretical capacity of the intersection or traffic movement. A DoS of less than 0.5 indicates that the intersection has spare capacity and queues would be expected to be relatively short. A DoS above 0.85 (priority intersection) and 0.9 (signalised intersection) indicates that the intersection may be unstable at times with long queues and delays as the traffic volumes approach practical capacity. Intersections with DoS greater than 1.0 are considered to be over capacity and have a LoS F.

Queue lengths are based on the 95th percentile back of queue, defined as meaning that the queue length is exceeded only 5% of the time. The queue lengths presented in the following sections represent the longest queue on each approach at the intersection.

4.2 EXISTING INTERSECTION PERFORMANCE

Using Council's TIA process for Macquarie Park developments shows identifies the location of the site as 'Location Type 3' and at a traffic generation 'Level 2' (> 50 trips per peak hour). This requires a 'Level 2' assessment, which is a localised assessment of the nearest key intersections within 400m of the site. On this basis there are five (5) relevant intersections and these were assessed using the SIDRA intersection analysis package. The intersections are:

- Talavera Road/ Herring Road/ M2 on/off ramp signalised intersection;
- Talavera Road/ Alma Road/ Shopping Centre West Access signalised intersection;
- Talavera Road/ Shopping Centre East Access signalised intersection;
- Talavera Road/ Khartoum Road signalised intersection; and
- Talavera Road/ Lane Cove Road signalised intersection.

The summary results of the intersection analysis is shown in Table 4.2. Site investigations suggest that most of the intersections assessed along Talavera Road are currently at practical capacity with a degree of saturation above 0.8 and that the Lane Cove Road/ Talavera Road signalised intersection operates with a degree of saturation above 1.0. This implies that the intersection is currently over saturated and delays would increase without any upgrades being implemented.

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Table 4.2: Existing Intersection Performance Summary

Intersection	Degree of Saturation	Average Delay (s)	LOS	95th% Back of Queue (m)
AM Peak				
Talavera Road/ Herring Road/ M2 on/off ramp	0.90	45	LOS D	270
Talavera Road/ Alma Road/ Shopping Centre West Access	0.84	29	LOS C	278
Talavera Road/ Shopping Centre East Access	0.84	22	LOS B	205
Talavera Road/ Khartoum Road	1.00	42	LOS C	148
Talavera Road/ Lane Cove Road	1.00	54	LOS D	558
PM Peak				
Talavera Road/ Herring Road/ M2 on/off ramp	0.77	37	LOS C	104
Talavera Road/ Alma Road/ Shopping Centre West Access	0.88	40	LOS C	190
Talavera Road/ Shopping Centre East Access	0.77	19	LOS B	127
Talavera Road/ Khartoum Road	0.81	36	LOS C	147
Talavera Road/ Lane Cove Road	1.1	114	LOS F	992

Given that the planning proposal will, by being of a transit-orientated mixed use form, reduce the traffic generating potential of the site, it would not worsen that traffic conditions that would have otherwise occurred under the current B7 zoning.

4.3 Proposed Development - Access Intersection Needs Analysis

Three (3) direct accesses to the development were analysed with the proposed development traffic volumes. These intersections are:

- Talavera Road/ Alma Road/ Shopping Centre Western Access (adjacent to the Alma Road/Talavera Road left in/out arrangement);
- A new proposed left-in/ left-out Talavera Road/ Central Access (Figure 4.1); and
- Connection into the Talavera Road/ Macquarie Centre Eastern Access signalised intersection with all movements allowed (Figure 4.2 & 4.3).

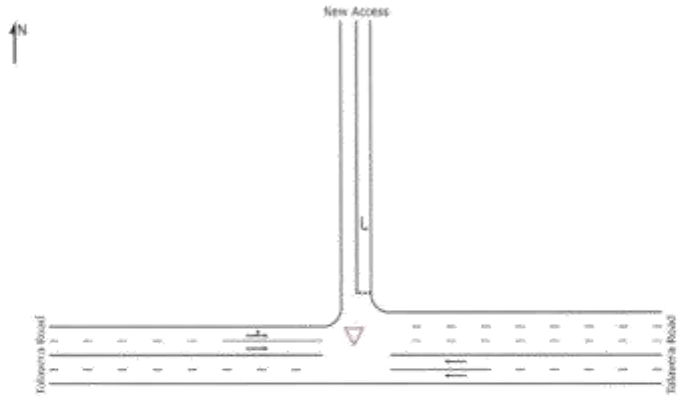

Figure 4.1: Proposed Talavera Road/ Western Access Road Intersection Layout

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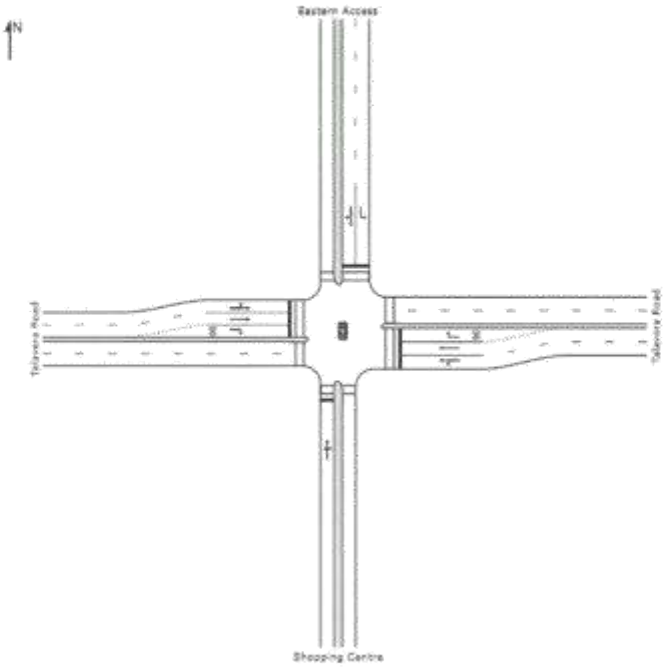

Figure 4.2: Proposed Talavera Road/ Shopping Centre / Eastern Access Intersection Layout

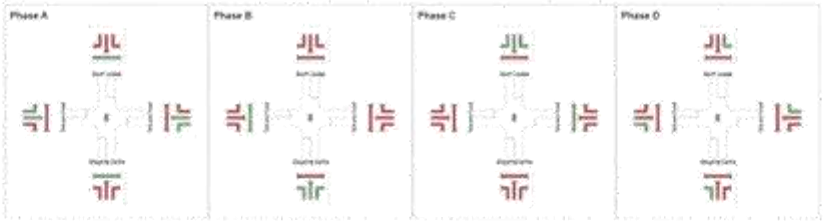

Figure 4.3: Proposed Talavera Road/ Shopping Centre/ Eastern Access Signal Phasing

Table 4.3 presents the analysis summary. The results show that all three intersections would operate at an acceptable level of peak hour performance. Furthermore, the proposed re-alignment of the eastern access to align with the recently constructed traffic signals would be expected to benefit the network by providing alternate routes for site traffic rather than the more circuitous routes that exist due to the absence of right turn in opportunities.

ITEM 5 (continued) **ATTACHMENT 5**

Table 4.3: Proposed Access - Intersection Performance Summary (with development)

Intersection	Degree of Saturation	Average Delay (s)	LOS	95th% Back of Queue (m)
AM Peak				
Talavera Road/ Alma Road/ Shopping Centre West Access	0.87	31	LOS C	311
Talavera Road/ New Access	0.44	12	LOS A	2
Talavera Road/ Shopping Centre East Access	0.90	23	LOS B	292
PM Peak				
Talavera Road/ Alma Road/ Shopping Centre West Access	0.85	39	LOS C	200
Talavera Road/ New Access	0.30	8	LOS A	1
Talavera Road/ Shopping Centre East Access	0.77	29	LOS C	186

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5. CONCLUSION

The key findings from the traffic impact assessment for the proposed development are:

- A maximum of 1,526 parking spaces is permissible in accordance with the relevant LEP and DCP for the development types proposed, although there may be opportunities to reduce this requirement considering shared usage and high levels of alternative mode usage;
- There are some traffic accessibility advantages of allowing unrestricted access between the three proposed accesses (i.e. underground) to assist with the potential for shared parking and reducing the length of travel of the external road system;
- The development is estimated to generate 480 vehicle trips and 374 vehicle trips in the AM and PM peak respectively;
- The full potential of the existing B7 zoning would be expected to generate much higher traffic volumes during the peak hours compared to the planning proposal. The planning proposal would reduce the traffic generating potential of the site in both peak period, primarily due the transit-orientated, mixed use nature of the proposal;
- The proposed three (3) accesses to the development were assessed and were shown to operate within acceptable RMS guidelines for intersection performance;
- The existing major intersections east of the study area such as Talavera Road/ Khartoum Road and Lane Cove Road/ Talavera Road intersection were found to be at capacity in peak periods already and would require future upgrades in any event, should the intention be that these intersection operate under capacity. This finding is independent of the planning proposal's impacts particularly considering that it reduces site-generated traffic compared to its potential under its current zoning.

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BITZIOS consulting

APPENDIX A

SIDRA SUMMARY SHEETS

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Herring Road AM

Talavera Road / Herring Road AM
Signals - Fixed Time Cycle Time = 100 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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: Herring Road											
1	L2	116	4.3	0.322	43.1	LOS D	4.9	35.8	0.90	0.78	34.5
2	T1	139	18.7	0.490	38.3	LOS C	6.0	49.0	0.92	0.74	29.7
3	R2	239	1.7	0.685	48.0	LOS D	11.3	80.3	0.99	0.85	33.4
Approach		494	7.1	0.685	44.1	LOS D	11.3	80.3	0.95	0.80	32.9
East: Talavera Road											
4	L2	102	2.0	0.151	28.1	LOS B	3.3	23.5	0.70	0.73	40.7
5	T1	301	3.0	0.202	21.6	LOS B	4.8	34.6	0.70	0.57	44.4
6	R2	59	1.7	0.268	57.3	LOS E	1.5	10.4	0.99	0.72	17.5
Approach		462	2.6	0.268	27.6	LOS B	4.8	34.6	0.74	0.63	38.7
North: On/Off Ramp											
7	L2	335	3.6	0.771	56.5	LOS D	8.7	62.5	1.00	0.89	23.3
9	R2	166	1.2	0.820	59.4	LOS E	8.9	62.7	1.00	0.93	22.7
Approach		501	2.8	0.820	57.4	LOS E	8.9	62.7	1.00	0.90	23.1
West: Talavera Road											
10	L2	58	3.4	0.899	50.1	LOS D	38.1	269.5	1.00	1.08	19.4
11	T1	1271	1.2	0.899	44.5	LOS D	38.1	269.5	1.00	1.08	34.7
12	R2	23	100.0	0.354	60.3	LOS E	1.2	15.7	0.99	0.72	29.8
Approach		1352	3.0	0.899	45.0	LOS D	38.1	269.5	1.00	1.07	33.9
All Vehicles		2809	3.6	0.899	44.2	LOS D	38.1	269.5	0.95	0.92	32.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	35.4	LOS D	0.1	0.1	0.84	0.84
P2S	East Slip/Bypass Lane Crossing	50	13.0	LOS B	0.1	0.1	0.51	0.51
P3	North Full Crossing	50	28.2	LOS C	0.1	0.1	0.75	0.75
P4	West Full Crossing	50	44.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		200	30.2	LOS D			0.76	0.76

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Herring Road PM

Talavera Road / Herring Road PM
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road											
1	L2	175	5.7	0.487	34.0	LOS C	6.2	45.8	0.85	0.78	37.7
2	T1	332	5.4	0.724	32.9	LOS C	12.4	88.4	0.91	0.82	31.6
3	R2	231	1.3	0.724	43.0	LOS D	12.4	88.4	0.98	0.88	35.4
Approach		738	4.2	0.724	36.3	LOS C	12.4	88.4	0.92	0.83	34.6
East: Talavera Road											
4	L2	284	0.4	0.373	25.4	LOS B	8.7	60.9	0.74	0.77	42.0
5	T1	692	0.6	0.594	27.3	LOS B	13.8	97.2	0.88	0.75	41.5
6	R2	473	1.5	0.772	48.5	LOS D	10.9	76.9	1.00	0.90	18.8
Approach		1449	0.8	0.772	33.9	LOS C	13.8	97.2	0.89	0.81	32.7
North: On/Off Ramp											
7	L2	40	2.5	0.164	51.0	LOS D	0.9	6.3	0.97	0.70	24.7
9	R2	70	0.0	0.565	53.2	LOS D	3.2	22.7	1.00	0.78	24.3
Approach		110	0.9	0.565	52.4	LOS D	3.2	22.7	0.99	0.75	24.4
West: Talavera Road											
10	L2	142	0.7	0.772	44.5	LOS D	14.5	102.1	1.00	0.92	20.0
11	T1	518	0.4	0.772	38.9	LOS C	14.8	104.1	1.00	0.92	36.4
12	R2	22	100.0	0.304	54.1	LOS D	1.0	13.4	0.99	0.72	31.4
Approach		682	3.7	0.772	40.5	LOS C	14.8	104.1	1.00	0.91	32.5
All Vehicles		2979	2.3	0.772	36.7	LOS C	14.8	104.1	0.93	0.83	32.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	39.3	LOS D	0.1	0.1	0.94	0.94
P2S	East Slip/Bypass Lane Crossing	50	14.5	LOS B	0.1	0.1	0.57	0.57
P3	North Full Crossing	50	39.3	LOS D	0.1	0.1	0.94	0.94
P4	West Full Crossing	50	34.7	LOS D	0.1	0.1	0.88	0.88
All Pedestrians		200	31.9	LOS D			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

▽ Site: Talavera Road / Alma Road AM

◊◊ Network: Talavera Road / Alma Road / Shopping Centre AM

Talavera Road / Alma Road AM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Talavera Road													
5	T1	460	3.3	460	3.3	0.120	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		460	3.3	460	3.3	0.120	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: Alma Road													
7	L2	18	5.6	18	5.6	0.022	7.6	LOS A	0.1	0.5	0.43	0.63	28.7
Approach		18	5.6	18	5.6	0.022	7.6	LOS A	0.1	0.5	0.43	0.63	28.7
West: Talavera Road													
10	L2	184	0.5	184	0.5	0.316	5.6	LOS A	0.0	0.0	0.00	0.18	53.2
11	T1	1631	2.0	1631	2.0	0.316	0.0	LOS A	0.0	0.0	0.00	0.05	59.1
Approach		1815	1.8	1815	1.8	0.316	0.6	NA	0.0	0.0	0.00	0.06	58.3
All Vehicles		2293	2.1	2293	2.1	0.316	0.5	NA	0.1	0.5	0.00	0.05	58.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

▽ Site: Talavera Road / Alma Road PM ◇◇ Network: Talavera/Alma PM

Talavera Road / Alma Road PM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Talavera Road													
5	T1	1438	0.8	1438	0.8	0.371	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1438	0.8	1438	0.8	0.371	0.0	NA	0.0	0.0	0.00	0.00	59.9
North: Alma Road													
7	L2	68	0.0	68	0.0	0.060	6.2	LOS A	0.2	1.5	0.27	0.57	30.7
Approach		68	0.0	68	0.0	0.060	6.2	LOS A	0.2	1.5	0.27	0.57	30.7
West: Talavera Road													
10	L2	88	0.0	88	0.0	0.136	5.6	LOS A	0.0	0.0	0.00	0.20	53.0
11	T1	697	1.3	697	1.3	0.136	0.0	LOS A	0.0	0.0	0.00	0.05	59.1
Approach		785	1.1	785	1.1	0.136	0.6	NA	0.0	0.0	0.00	0.07	58.2
All Vehicles		2291	0.9	2291	0.9	0.371	0.4	NA	0.2	1.5	0.01	0.04	58.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Shopping Centre AM

Network: Talavera Road / Alma Road / Shopping Centre AM

Talavera Road / Shopping Centre AM
Signals - Fixed Time Cycle Time = 110 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shopping Centre													
1	L2	35	11.4	35	11.4	0.167	47.1	LOS D	2.4	17.8	0.88	0.74	23.8
3	R2	34	0.0	34	0.0	0.167	54.6	LOS D	2.4	17.8	0.93	0.72	31.2
Approach		69	5.8	69	5.8	0.167	50.8	LOS D	2.4	17.8	0.91	0.73	28.2
East: Talavera Road													
4	L2	75	0.0	75	0.0	0.082	21.2	LOS B	2.1	14.7	0.56	0.70	43.6
5	T1	425	2.6	425	2.6	0.226	17.0	LOS B	6.4	46.0	0.61	0.51	38.7
Approach		500	2.2	500	2.2	0.226	17.6	LOS B	6.4	46.0	0.60	0.54	39.8
West: Talavera Road													
11	T1	1583	2.1	1583	2.1	0.838	29.4	LOS C	39.0	277.7	0.94	0.90	40.4
12	R2	66	0.0	66	0.0	0.652	65.5	LOS E	3.8	26.5	1.00	0.80	28.5
Approach		1649	2.0	1649	2.0	0.838	30.9	LOS C	39.0	277.7	0.94	0.89	39.8
All Vehicles		2218	2.2	2218	2.2	0.838	28.5	LOS C	39.0	277.7	0.86	0.81	39.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	20.4	LOS C	0.1	0.1	0.61	0.61
P4	West Full Crossing	50	49.3	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		100	34.9	LOS D			0.78	0.78

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Shopping Centre PM

Network: Talavera/Alma PM

Talavera Road / Shopping Centre PM
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shopping Centre													
1	L2	358	1.4	358	1.4	0.876	52.9	LOS D	18.2	128.8	1.00	0.99	22.1
3	R2	198	0.5	198	0.5	0.875	57.8	LOS E	10.1	71.0	1.00	1.01	30.4
Approach		556	1.1	556	1.1	0.876	54.7	LOS D	18.2	128.8	1.00	1.00	25.8
East: Talavera Road													
4	L2	68	0.0	68	0.0	0.114	28.6	LOS C	2.1	14.7	0.74	0.73	40.1
5	T1	1080	0.6	1080	0.6	0.874	41.0	LOS C	27.0	190.1	1.00	1.05	25.7
Approach		1148	0.5	1148	0.5	0.874	40.3	LOS C	27.0	190.1	0.98	1.04	26.8
West: Talavera Road													
11	T1	744	1.1	744	1.1	0.596	27.8	LOS B	13.8	97.7	0.89	0.77	41.2
12	R2	21	4.8	21	4.8	0.175	51.1	LOS D	0.9	6.8	0.97	0.70	32.1
Approach		765	1.2	765	1.2	0.596	28.4	LOS B	13.8	97.7	0.90	0.77	40.9
All Vehicles		2469	0.9	2469	0.9	0.876	39.8	LOS C	27.0	190.1	0.96	0.94	31.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	28.9	LOS C	0.1	0.1	0.80	0.80
P4	West Full Crossing	50	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		100	34.1	LOS D			0.87	0.87

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Processed: Monday, 7 September 2015 5:20:10 PM
SIDRA INTERSECTION 6.0.24.4877
Project: P:\P2235 66-82 Talavera Road Mac Park Mixed Use\Technical Work\Models\SIDRA\P2235 SIDRA.sip6
8000283, 6019145, BITZIOS CONSULTING, PLUS / Floating

SIDRA INTERSECTION 6

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Shopping Centre East-AM

Talavera Road / Shopping Centre AM
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shopping Centre											
1	L2	22	0.0	0.064	22.0	LOS B	0.8	6.2	0.71	0.69	38.1
3	R2	14	14.3	0.064	22.1	LOS B	0.8	6.2	0.71	0.69	37.9
Approach		36	5.6	0.064	22.1	LOS B	0.8	6.2	0.71	0.69	38.0
East: Talavera Road											
4	L2	48	2.1	0.692	34.8	LOS C	8.7	62.2	0.98	0.87	34.8
5	T1	472	3.0	0.692	30.2	LOS C	9.0	64.3	0.98	0.87	35.2
Approach		520	2.9	0.692	30.6	LOS C	9.0	64.3	0.98	0.87	35.2
West: Talavera Road											
11	T1	1733	1.7	0.835	19.5	LOS B	28.9	205.1	0.90	0.91	39.4
12	R2	40	0.0	0.084	26.1	LOS B	1.0	7.3	0.79	0.70	36.5
Approach		1773	1.7	0.835	19.7	LOS B	28.9	205.1	0.89	0.90	39.3
All Vehicles		2329	2.0	0.835	22.2	LOS B	28.9	205.1	0.91	0.89	38.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	29.3	LOS C	0.1	0.1	0.92	0.92
P4	West Full Crossing	50	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		100	29.3	LOS C			0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Shopping Centre East-PM

Talavera Road / Shopping Centre PM
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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: Shopping Centre											
1	L2	81	1.2	0.209	23.1	LOS B	3.0	21.6	0.76	0.74	37.7
3	R2	41	2.4	0.209	23.1	LOS B	3.0	21.6	0.76	0.74	37.6
Approach		122	1.6	0.209	23.1	LOS B	3.0	21.6	0.76	0.74	37.7
East: Talavera Road											
4	L2	74	0.0	0.769	28.0	LOS B	17.8	124.8	0.94	0.90	37.3
5	T1	1029	0.2	0.769	23.4	LOS B	18.1	126.6	0.94	0.89	37.7
Approach		1103	0.2	0.769	23.7	LOS B	18.1	126.6	0.94	0.90	37.7
West: Talavera Road											
11	T1	837	0.5	0.397	10.0	LOS A	8.3	58.5	0.62	0.54	43.9
12	R2	56	0.0	0.352	39.6	LOS C	1.9	13.6	0.98	0.74	32.1
Approach		893	0.4	0.397	11.9	LOS A	8.3	58.5	0.65	0.56	42.9
All Vehicles		2118	0.4	0.769	18.7	LOS B	18.1	126.6	0.81	0.74	39.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	19.4	LOS B	0.1	0.1	0.74	0.74
P4	West Full Crossing	50	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		100	24.3	LOS C			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: Talavera_Ex_AM

Talavera Road/Khartoum Road Signalised Intersection

Signals - Fixed Time Cycle Time = 90 seconds (Optimum Cycle Time - Minimum Delay)

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 East: Talavera Road											
4	L	139	9.8	0.839	54.2	LOS D	12.3	91.1	1.00	1.02	22.9
5	T	398	2.9	0.839	46.0	LOS D	13.8	99.0	1.00	1.02	22.7
6	R	21	0.0	0.170	52.6	LOS D	0.9	6.5	0.97	0.70	22.9
Approach		558	4.5	0.839	48.3	LOS D	13.8	99.0	1.00	1.01	22.8
North East: Khartoum Road											
7	L	43	0.0	0.343	40.8	LOS C	3.5	25.1	0.88	0.79	28.1
8	T	139	3.8	0.472	33.9	LOS C	7.3	52.5	0.91	0.73	28.9
9	R	97	2.2	0.472	41.6	LOS C	7.3	52.5	0.92	0.82	27.7
Approach		279	2.6	0.472	37.7	LOS C	7.3	52.5	0.91	0.77	28.4
North West: Talavera Road											
10	L	278	0.8	0.827	41.0	LOS C	17.3	121.8	1.00	1.03	26.4
11	T	616	0.8	0.827	36.9	LOS C	21.0	148.3	1.00	0.99	25.1
12	R	326	1.9	1.000[3]	48.6	LOS D	14.9	105.7	1.00	0.85	23.9
Approach		1220	1.2	1.000	41.0	LOS C	21.0	148.3	1.00	0.96	25.0
South West: Khartoum Road											
1	L	147	7.9	0.318	20.0	LOS B	2.6	19.6	0.77	0.77	37.8
2	T	137	10.8	0.829	42.4	LOS C	15.0	112.1	0.99	0.97	25.7
3	R	183	5.2	0.829	50.8	LOS D	15.0	112.1	1.00	0.98	24.7
Approach		467	7.7	0.829	38.6	LOS C	15.0	112.1	0.93	0.91	28.0
All Vehicles		2524	3.3	1.000	41.8	LOS C	21.0	148.3	0.98	0.94	25.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	Across SE approach	50	39.2	LOS D	0.1	0.1	0.93	0.93
P5	Across NE approach	50	30.4	LOS D	0.1	0.1	0.82	0.82
P7	Across NW approach	50	39.2	LOS D	0.1	0.1	0.93	0.93
P1	Across SW approach	50	39.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		200	37.0	LOS D			0.91	0.91

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera_Ex_PM

Talavera Road/Khartoum Road Signalised Intersection

Signals - Fixed Time Cycle Time = 95 seconds (Optimum Cycle Time - Minimum Delay)

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 East: Talavera Raod											
4	L	144	5.1	0.807	46.2	LOS D	19.3	137.5	0.99	0.96	25.1
5	T	712	0.0	0.807	38.5	LOS C	20.9	146.5	0.99	0.95	24.8
6	R	47	0.0	0.404	56.7	LOS E	2.3	15.9	1.00	0.74	21.9
Approach		903	0.8	0.807	40.7	LOS C	20.9	146.5	0.99	0.94	24.7
North East: Khartoum Road											
7	L	26	0.0	0.258	42.1	LOS C	2.6	18.6	0.87	0.78	27.7
8	T	67	6.3	0.355	35.2	LOS C	5.4	38.1	0.88	0.69	28.4
9	R	104	0.0	0.355	43.2	LOS D	5.4	38.1	0.91	0.79	26.7
Approach		198	2.1	0.355	40.3	LOS C	5.4	38.1	0.89	0.76	27.4
North West: Talavera Road											
10	L	391	0.3	0.521	18.0	LOS B	8.0	55.8	0.77	0.81	36.1
11	T	353	0.3	0.521	27.0	LOS B	12.5	87.9	0.86	0.74	29.1
12	R	151	0.0	0.770	56.8	LOS E	7.5	52.3	1.00	0.90	21.9
Approach		894	0.2	0.770	28.1	LOS B	12.5	87.9	0.85	0.80	30.0
South West: Khartoum Road											
1	L	336	0.3	0.792	30.3	LOS C	9.9	69.3	0.97	0.89	31.6
2	T	223	4.7	0.814	44.9	LOS D	14.7	109.2	1.00	0.96	25.4
3	R	76	13.9	0.814	52.6	LOS D	14.7	109.2	1.00	0.96	24.7
Approach		635	3.5	0.814	38.1	LOS C	14.7	109.2	0.98	0.93	28.2
All Vehicles		2629	1.4	0.814	35.8	LOS C	20.9	146.5	0.93	0.88	27.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	Across SE approach	50	41.7	LOS E	0.1	0.1	0.94	0.94
P5	Across NE approach	50	28.8	LOS C	0.1	0.1	0.78	0.78
P7	Across NW approach	50	41.7	LOS E	0.1	0.1	0.94	0.94
P1	Across SW approach	50	32.0	LOS D	0.1	0.1	0.82	0.82
All Pedestrians		200	36.1	LOS D			0.87	0.87

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: LCR_Ex_AM

Talavera Road/Lane Cove Road Signalised Intersection
Signals - Fixed Time Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Delay)

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 East: Talavera Road											
4	L	22	23.8	0.058	55.3	LOS D	1.2	10.4	0.80	0.72	23.3
5	T	39	0.0	0.137	57.3	LOS E	2.8	19.3	0.89	0.67	20.3
6	R	5	0.0	0.137	64.6	LOS E	2.8	19.3	0.89	0.76	21.6
Approach		66	7.9	0.137	57.2	LOS E	2.8	19.3	0.86	0.69	21.4
North East: Lane Cove Road											
7	L	97	1.1	0.873	18.3	LOS B	30.6	219.6	0.49	1.15	45.3
8	T	2661	3.1	0.873	7.5	LOS A	30.6	219.6	0.45	0.43	54.5
9	R	740	1.1	1.004	146.4	LOS F	42.1	297.5	1.00	1.17	11.8
Approach		3498	2.6	1.004	37.2	LOS C	42.1	297.5	0.57	0.60	31.9
North West: Talavera Road											
10	L	153	3.4	0.332	36.8	LOS C	6.5	47.2	0.86	0.78	28.5
11	T	32	3.3	0.901	91.2	LOS F	7.2	54.0	1.00	1.05	15.0
12	R	136	12.4	0.901	99.3	LOS F	7.2	54.0	1.00	1.05	16.2
Approach		320	7.2	0.901	68.7	LOS E	7.2	54.0	0.93	0.92	20.3
South West: Lane Cove Road											
1	L	451	3.3	0.991	105.4	LOS F	75.9	553.0	1.00	1.15	15.5
2	T	1815	7.3	0.991	70.2	LOS E	75.9	557.6	1.00	1.17	21.5
3	R	102	1.0	0.831	91.8	LOS F	8.1	57.3	1.00	0.90	17.0
Approach		2367	6.2	0.991	77.8	LOS F	75.9	557.6	1.00	1.16	20.0
All Vehicles		6252	4.3	1.004	54.4	LOS D	75.9	557.6	0.75	0.83	25.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	Across SE approach	50	18.3	LOS B	0.1	0.1	0.49	0.49
P7	Across NW approach	50	33.3	LOS D	0.1	0.1	0.67	0.67
P1	Across SW approach	50	69.1	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		150	40.2	LOS E			0.71	0.71

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Processed: Wednesday, 2 April 2014 10:08:09 AM
SIDRA INTERSECTION 5.1.11.2079
Project: P:\P2235 66-82 Talavera Road Mac Park Mixed Use\Technical Wbrk\Models\SIDRA\Khartoum Road (from 1598).sip
8000283, BITZIOS CONSULTING, FLOATING

SIDRA INTERSECTION

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: LCR_Ex_PM

Talavera Road/Lane Cove Road Signalised Intersection
Signals - Fixed Time Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Delay)

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 East: Talavera Road											
4	L	107	1.0	0.273	60.6	LOS E	6.6	46.2	0.88	0.78	22.0
5	T	42	0.0	0.462	61.3	LOS E	9.6	67.7	0.95	0.77	19.3
6	R	102	1.0	0.462	68.6	LOS E	9.6	67.7	0.95	0.80	20.6
Approach		252	0.8	0.462	64.0	LOS E	9.6	67.7	0.92	0.79	21.0
North East: Lane Cove Road											
7	L	22	9.5	0.713	15.6	LOS B	15.3	111.0	0.32	1.27	47.5
8	T	2169	4.0	0.713	6.1	LOS A	15.3	111.0	0.31	0.28	57.2
9	R	405	1.8	1.036	187.9	LOS F	25.5	181.2	1.00	1.27	9.6
Approach		2597	3.7	1.036	34.6	LOS C	25.5	181.2	0.42	0.44	33.4
North West: Talavera Road											
10	L	378	0.6	1.021	133.3	LOS F	36.8	258.9	1.00	1.27	12.9
11	T	5	0.0	1.063	219.7	LOS F	25.7	182.1	1.00	1.54	7.7
12	R	358	1.5	1.063	218.2	LOS F	25.7	182.1	1.00	1.51	8.8
Approach		741	1.0	1.063	174.9	LOS F	36.8	258.9	1.00	1.39	10.5
South West: Lane Cove Road											
1	L	151	4.9	1.072	187.2	LOS F	137.8	981.6	1.00	1.65	9.8
2	T	2758	1.6	1.072	172.3	LOS F	139.8	991.8	1.00	1.68	11.1
3	R	15	0.0	0.198	88.0	LOS F	1.1	7.7	1.00	0.69	17.6
Approach		2923	1.7	1.072	172.7	LOS F	139.8	991.8	1.00	1.68	11.0
All Vehicles		6513	2.4	1.072	113.7	LOS F	139.8	991.8	0.76	1.12	15.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	Across SE approach	50	19.3	LOS B	0.1	0.1	0.51	0.51
P7	Across NW approach	50	28.2	LOS C	0.1	0.1	0.61	0.61
P1	Across SW approach	50	69.1	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		150	38.9	LOS D			0.69	0.69

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

▽ Site: Talavera Road / Alma Road AM - w dev

Network: Talavera/Alma AM W Dev

Talavera Road / Alma Road AM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Talavera Road													
5	T1	507	3.0	507	3.0	0.133	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		507	3.0	507	3.0	0.133	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: Alma Road													
7	L2	24	0.0	24	0.0	0.030	7.8	LOS A	0.1	0.7	0.46	0.66	28.3
Approach		24	0.0	24	0.0	0.030	7.8	LOS A	0.1	0.7	0.46	0.66	28.3
West: Talavera Road													
10	L2	136	0.0	136	0.0	0.316	5.6	LOS A	0.0	0.0	0.00	0.13	53.8
11	T1	1685	1.9	1685	1.9	0.316	0.0	LOS A	0.0	0.0	0.00	0.04	59.2
Approach		1821	1.8	1821	1.8	0.316	0.5	NA	0.0	0.0	0.00	0.04	58.7
All Vehicles		2352	2.0	2352	2.0	0.316	0.4	NA	0.1	0.7	0.00	0.04	58.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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.

Processed: Wednesday, 9 September 2015 4:13:05 PM
SIDRA INTERSECTION 6.0.24.4877
Project: P:\P2235 66-82 Talavera Road Mac Park Mixed Use\Technical Work\Models\SIDRA\P2235 SIDRA.sip6
8000283, 6019145, BITZIOS CONSULTING, PLUS / Floating

SIDRA INTERSECTION 6

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

▽ Site: Talavera Road / Alma Road PM - w dev

◇◇ Network: Talavera/Alma PM w Dev

Talavera Road / Alma Road PM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Talavera Road													
5	T1	1480	0.7	1480	0.7	0.381	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1480	0.7	1480	0.7	0.381	0.0	NA	0.0	0.0	0.00	0.00	59.9
North: Alma Road													
7	L2	21	0.0	21	0.0	0.019	6.2	LOS A	0.1	0.5	0.26	0.56	30.7
Approach		21	0.0	21	0.0	0.019	6.2	LOS A	0.1	0.5	0.26	0.56	30.7
West: Talavera Road													
10	L2	93	0.0	93	0.0	0.143	5.6	LOS A	0.0	0.0	0.00	0.20	53.0
11	T1	734	1.2	734	1.2	0.143	0.0	LOS A	0.0	0.0	0.00	0.05	59.1
Approach		827	1.1	827	1.1	0.143	0.6	NA	0.0	0.0	0.00	0.07	58.2
All Vehicles		2328	0.9	2328	0.9	0.381	0.3	NA	0.1	0.5	0.00	0.03	59.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Shopping Centre AM - w dev

Network: Talavera/Alma AM W Dev

Talavera Road / Shopping Centre AM
Signals - Fixed Time Cycle Time = 110 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shopping Centre													
1	L2	35	11.4	35	11.4	0.167	47.1	LOS D	2.4	17.8	0.88	0.74	23.8
3	R2	34	0.0	34	0.0	0.167	54.6	LOS D	2.4	17.8	0.93	0.72	31.2
Approach		69	5.8	69	5.8	0.167	50.8	LOS D	2.4	17.8	0.91	0.73	28.2
East: Talavera Road													
4	L2	75	0.0	75	0.0	0.082	21.2	LOS B	2.1	14.7	0.56	0.70	43.6
5	T1	472	2.3	472	2.3	0.250	17.2	LOS B	7.2	51.7	0.62	0.52	38.5
Approach		547	2.0	547	2.0	0.250	17.8	LOS B	7.2	51.7	0.61	0.55	39.6
West: Talavera Road													
11	T1	1643	1.9	1643	1.9	0.869	33.6	LOS C	43.8	311.4	0.96	0.95	38.6
12	R2	66	0.0	66	0.0	0.652	65.5	LOS E	3.8	26.5	1.00	0.80	28.5
Approach		1709	1.9	1709	1.9	0.869	34.8	LOS C	43.8	311.4	0.96	0.95	38.1
All Vehicles		2325	2.0	2325	2.0	0.869	31.3	LOS C	43.8	311.4	0.88	0.85	38.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	20.4	LOS C	0.1	0.1	0.61	0.61
P4	West Full Crossing	50	49.3	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		100	34.9	LOS D			0.78	0.78

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Shopping Centre PM - w dev

Network: Talavera/Alma PM w Dev

Talavera Road / Shopping Centre PM
Signals - Fixed Time Cycle Time = 100 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shopping Centre													
1	L2	358	1.4	358	1.4	0.846	53.1	LOS D	19.0	134.5	1.00	0.95	22.1
3	R2	198	0.5	198	0.5	0.823	58.0	LOS E	10.5	74.0	1.00	0.93	30.3
Approach		556	1.1	556	1.1	0.846	54.8	LOS D	19.0	134.5	1.00	0.94	25.7
East: Talavera Road													
4	L2	68	0.0	68	0.0	0.105	29.0	LOS C	2.2	15.5	0.71	0.72	39.9
5	T1	1122	0.5	1122	0.5	0.840	38.0	LOS C	28.5	200.4	0.98	0.97	26.9
Approach		1190	0.5	1190	0.5	0.840	37.5	LOS C	28.5	200.4	0.97	0.96	27.8
West: Talavera Road													
11	T1	734	1.1	734	1.1	0.542	28.1	LOS B	14.4	101.6	0.86	0.74	41.0
12	R2	21	4.8	21	4.8	0.234	58.7	LOS E	1.1	7.7	0.99	0.70	30.1
Approach		755	1.2	755	1.2	0.542	29.0	LOS C	14.4	101.6	0.86	0.74	40.6
All Vehicles		2501	0.8	2501	0.8	0.846	38.8	LOS C	28.5	200.4	0.94	0.89	31.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	28.9	LOS C	0.1	0.1	0.76	0.76
P4	West Full Crossing	50	41.5	LOS E	0.1	0.1	0.91	0.91
All Pedestrians		100	35.2	LOS D			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

▽ Site: Talavera Road / New Access AM - w dev

Talavera Road / Alma Road AM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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
East: Talavera Road											
5	T1	551	2.5	0.144	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		551	2.5	0.144	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: New Access											
7	L2	47	0.0	0.099	11.6	LOS A	0.3	2.3	0.67	0.86	8.8
Approach		47	0.0	0.099	11.6	LOS A	0.3	2.3	0.67	0.86	8.8
West: Talavera Road											
10	L2	27	0.0	0.436	5.6	LOS A	0.0	0.0	0.00	0.02	55.2
11	T1	1650	1.9	0.436	0.1	LOS A	0.0	0.0	0.00	0.01	59.7
Approach		1677	1.9	0.436	0.2	NA	0.0	0.0	0.00	0.01	59.6
All Vehicles		2275	2.0	0.436	0.4	NA	0.3	2.3	0.01	0.02	58.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / New Access PM - w dev

Talavera Road / Alma Road PM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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
East: Talavera Road											
5	T1	1155	0.5	0.297	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1155	0.5	0.297	0.0	NA	0.0	0.0	0.00	0.00	59.9
North: New Access											
7	L2	42	0.0	0.051	7.7	LOS A	0.2	1.2	0.45	0.67	9.6
Approach		42	0.0	0.051	7.7	LOS A	0.2	1.2	0.45	0.67	9.6
West: Talavera Road											
10	L2	19	0.0	0.241	5.6	LOS A	0.0	0.0	0.00	0.02	55.2
11	T1	914	1.0	0.241	0.0	LOS A	0.0	0.0	0.00	0.01	59.7
Approach		933	1.0	0.241	0.1	NA	0.0	0.0	0.00	0.01	59.6
All Vehicles		2130	0.7	0.297	0.2	NA	0.2	1.2	0.01	0.02	58.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Shopping Centre East-AM - w dev

Talavera Road / Shopping Centre AM
Signals - Fixed Time Cycle Time = 140 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shopping Centre											
1	L2	22	0.0	0.156	40.2	LOS C	1.7	12.1	0.91	0.72	32.1
2	T1	1	0.0	0.156	35.7	LOS C	1.7	12.1	0.91	0.72	32.3
3	R2	14	14.3	0.156	40.4	LOS C	1.7	12.1	0.91	0.72	32.0
Approach		37	5.4	0.156	40.2	LOS C	1.7	12.1	0.91	0.72	32.1
East: Talavera Road											
4	L2	48	2.1	0.271	25.9	LOS B	9.9	71.3	0.62	0.57	38.0
5	T1	472	3.0	0.271	21.0	LOS B	10.0	72.1	0.61	0.54	38.7
6	R2	82	0.0	0.883	88.3	LOS F	6.3	44.4	1.00	1.00	22.5
Approach		602	2.5	0.883	30.6	LOS C	10.0	72.1	0.67	0.61	35.2
North: Eastern Access											
7	L2	119	0.0	0.299	54.3	LOS D	6.8	47.8	0.88	0.77	28.5
8	T1	1	0.0	0.181	57.4	LOS E	2.9	20.4	0.92	0.74	27.1
9	R2	47	0.0	0.181	61.9	LOS E	2.9	20.4	0.92	0.74	26.9
Approach		167	0.0	0.299	56.5	LOS D	6.8	47.8	0.89	0.76	28.1
West: Talavera Road											
10	L2	27	0.0	0.897	20.6	LOS B	41.1	291.9	0.70	0.69	40.6
11	T1	1669	1.8	0.897	15.6	LOS B	41.1	291.9	0.67	0.65	41.1
12	R2	40	0.0	0.438	78.5	LOS F	2.8	19.8	1.00	0.73	23.9
Approach		1736	1.7	0.897	17.1	LOS B	41.1	291.9	0.68	0.66	40.5
All Vehicles		2542	1.8	0.897	23.2	LOS B	41.1	291.9	0.69	0.65	37.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	20.1	LOS C	0.1	0.1	0.54	0.54
P2	East Full Crossing	50	64.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	50	21.8	LOS C	0.1	0.1	0.56	0.56
P4	West Full Crossing	50	64.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		200	42.6	LOS E			0.75	0.75

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

ITEM 5 (continued) **ATTACHMENT 5**

MOVEMENT SUMMARY

Site: Talavera Road / Shopping Centre East-PM - w dev

Talavera Road / Shopping Centre PM
Signals - Fixed Time Cycle Time = 110 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shopping Centre											
1	L2	81	1.2	0.393	29.6	LOS C	3.9	27.7	0.93	0.77	35.3
2	T1	1	0.0	0.393	25.0	LOS B	3.9	27.7	0.93	0.77	35.6
3	R2	41	2.4	0.393	29.6	LOS C	3.9	27.7	0.93	0.77	35.4
Approach		123	1.6	0.393	29.6	LOS C	3.9	27.7	0.93	0.77	35.4
East: Talavera Road											
4	L2	74	0.0	0.765	37.2	LOS C	26.5	185.8	0.94	0.85	34.1
5	T1	1029	0.2	0.765	32.4	LOS C	26.5	185.8	0.93	0.84	34.5
6	R2	56	0.0	0.553	63.5	LOS E	3.2	22.2	1.00	0.76	26.6
Approach		1159	0.2	0.765	34.2	LOS C	26.5	185.8	0.93	0.84	34.0
North: Eastern Access											
7	L2	106	0.0	0.216	38.6	LOS C	4.4	31.1	0.82	0.75	32.5
8	T1	1	0.0	0.127	40.9	LOS C	1.9	13.6	0.87	0.72	30.9
9	R2	42	0.0	0.127	45.5	LOS D	1.9	13.6	0.87	0.72	30.7
Approach		149	0.0	0.216	40.6	LOS C	4.4	31.1	0.84	0.74	31.9
West: Talavera Road											
10	L2	19	0.0	0.623	22.5	LOS B	14.8	104.1	0.65	0.58	39.7
11	T1	889	0.4	0.623	17.7	LOS B	14.8	104.1	0.65	0.58	40.2
12	R2	56	0.0	0.562	63.7	LOS E	3.2	22.2	1.00	0.77	26.5
Approach		964	0.4	0.623	20.4	LOS B	14.8	104.1	0.67	0.59	39.0
All Vehicles		2395	0.3	0.765	28.8	LOS C	26.5	185.8	0.82	0.73	35.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	24.9	LOS C	0.1	0.1	0.67	0.67
P2	East Full Crossing	50	49.3	LOS E	0.1	0.1	0.95	0.95
P3	North Full Crossing	50	27.0	LOS C	0.1	0.1	0.70	0.70
P4	West Full Crossing	50	49.3	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		200	37.6	LOS D			0.82	0.82

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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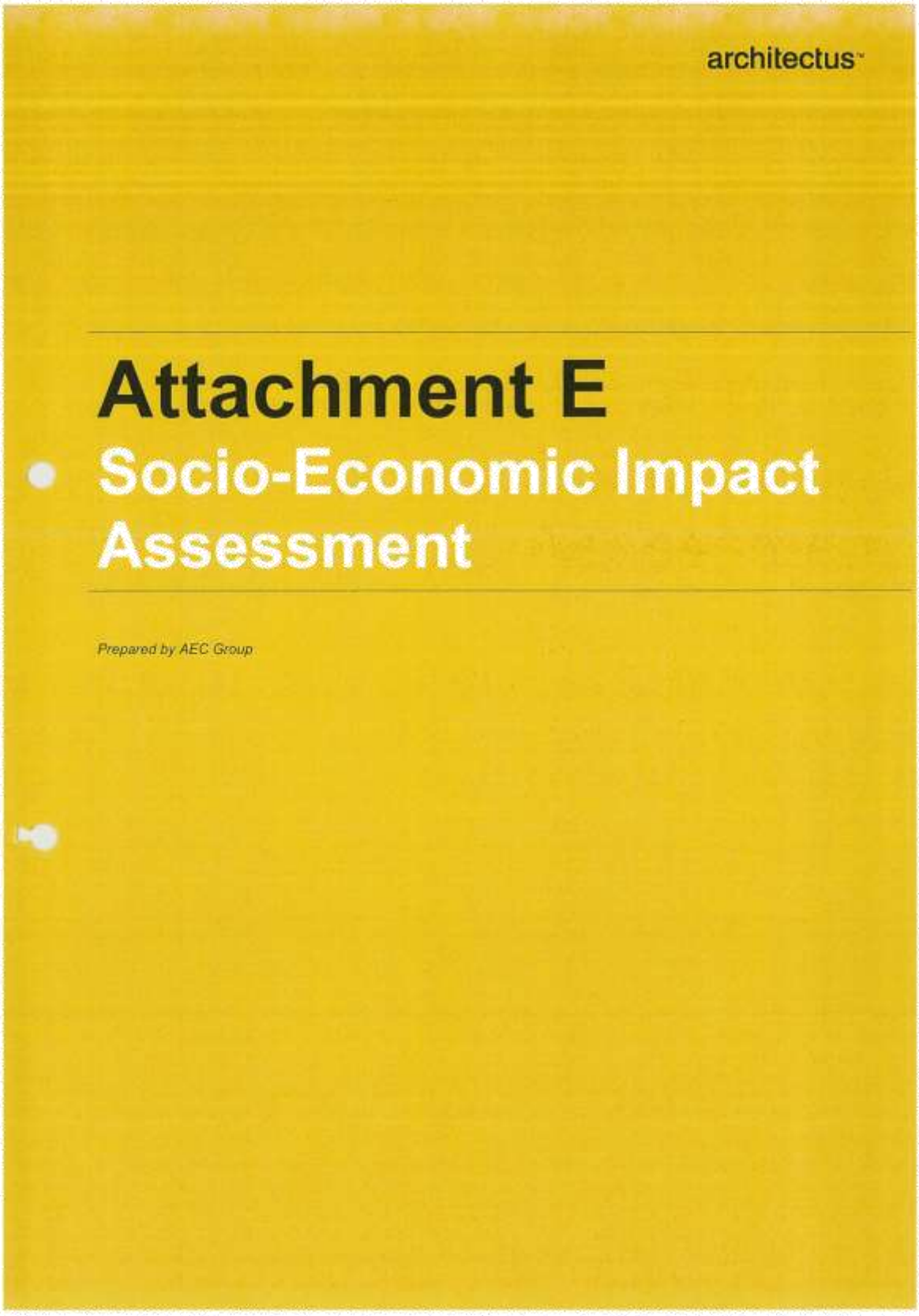

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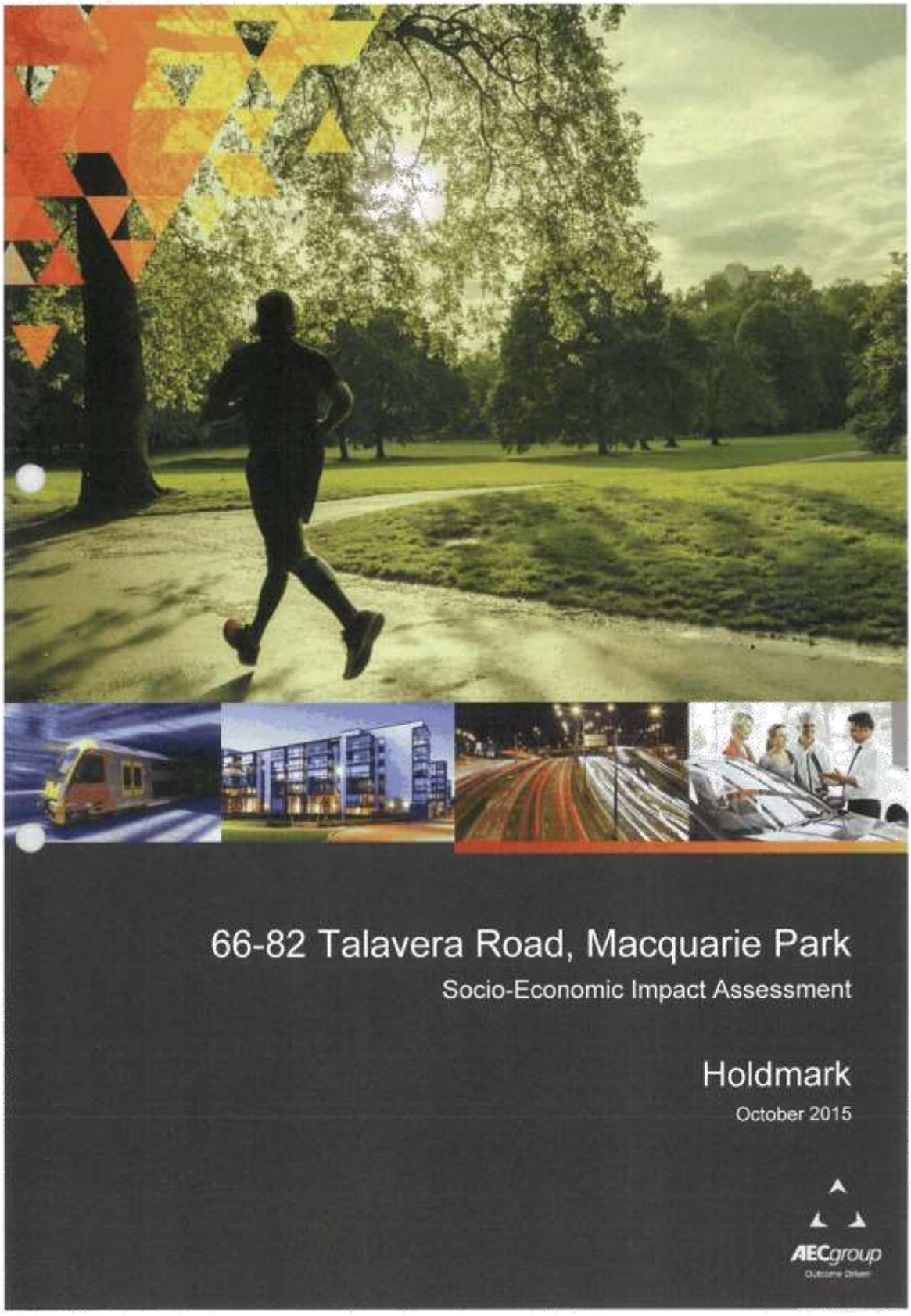

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AECgroup
Outcome Driven

ITEM 5 (continued) **ATTACHMENT 6**

Executive Summary

Introduction and Background

Architectus on behalf of Holdmark are preparing a Planning Proposal to rezone 66-82 Talavera Road, Macquarie Park Corridor ("the Site") from B7 Business Park to B4 Mixed Use and subsequently redevelop the Site and deliver the Concept Master Plan.

AEC Group (AEC) has been engaged by Holdmark to prepare a Socio-economic Impact Assessment (SEIA) to analyse the social and economic impacts likely to result from the proposed rezoning and subsequent delivery of the Concept Master Plan. The economic and social impacts that result from a redevelopment of the Site are analysed in the context of the proposed Concept Master Plan.

The Planning Proposal seeks to:

- Amend the land use controls for the site. Currently the land is zoned B7 Business Park. It is proposed that a B4 Mixed Use Zone be applied to the site, to allow for the site's development for public open space, residential, retail and commercial uses. Through the development process, open space would be dedicated back to Council and rezoned as RE1 Zone at a later stage when the boundaries of the open space are defined if required by Council. It is also intended that a number of key worker affordable housing apartments would also be provided and dedicated to Council;
- Amend the current maximum building height controls from 30m to 120m; and
- Amend the current maximum FSR controls from 1.0:1 to 3.5:1.

The Planning Proposal seeks to enable the delivery of the Concept Master Plan, which will accommodate approximately 1,125 apartments, 40 key worker housing apartments, 16,000sqm GFA commercial floorspace and 4,000sqm GFA of retail floorspace, 1 childcare centre for 60 children and 1ha public open space.

Need for the Proposal

The Macquarie Park Corridor is positioned on a new growth trajectory, with significant growth in residents and employment expected to further strengthen its importance and significance as one of Sydney's economic engine rooms and Sydney's second largest commercial office precinct after the Sydney CBD.

The NSW Bureau of Transport Statistics forecasts that the population in Macquarie Park Corridor will increase by 15,358 persons and increase by 12,872 employees by 2031 (representing an increase of 770% and 28% respectively). Furthermore DPE have identified two Priority Precincts at the north-western and south-eastern ends of the business park, these are Herring Road and North Ryde Station Priority Precincts respectively.

Despite there being a range of economic benefits associated with population and employment growth, there are challenges associated with urban renewal and growth. In urban planning terms, it is well accepted that growth puts pressure on infrastructure needs.

As infrastructure needs change (not just in quantum but also in their nature, e.g. where public open space was not considered to be required in employment areas like business parks but are now increasingly demanded by the market), funding mechanisms need to be able to respond. Current statutory mechanisms are limited in this respect.

Council has recognised the need to fund the delivery of new roads and public open space and has sought to do this via Amendment 1 to the Ryde LEP wherein bonus floorspace can be granted to proponents who deliver an acceptable package of infrastructure works.

There is presently no mechanism to fund the provision of public open space in Macquarie Business Park (no provision in s94 contributions plan) and even though Amendment 1 is well intentioned, it is conceivable that provision of infrastructure will be at an incremental rate.

This demonstrates a case for an alternate strategy to deliver required and social infrastructure to ensure the sustainability of Macquarie Park Corridor.

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Architectus has developed a strategic framework for the delivery of key items of social infrastructure in Macquarie Park Corridor.

As is observed in Green Square Urban Renewal Area and Green Square Employment Lands, delivery of key infrastructure seeks to leverage the residential property market. This framework recommends residential permissibility in the B3 Commercial Core and B7 Business Park zones subject to delivery of acceptable package of infrastructure works.

While the appropriation of land to public open space and key worker housing would mean less land available to accommodate new employment floorspace, the provision of items of key social infrastructure would undoubtedly result in sustaining Macquarie Park Corridor's competitive position as well as increasing its appeal as a business destination, leading to increased demand for floorspace.

The economic impacts of appropriation of some employment land to social infrastructure (public open space, key worker housing and childcare facilities) and residential uses are considered.

Socio-economic Impact Assessment

The existing improvements on the Site accommodate AstraZeneca, a biopharmaceutical company. Originally accommodating 446 workers at peak occupation, the Site is understood to currently accommodate circa 220 workers.

Direct Employment and Support Economic Activity

Once established and in steady state operations (i.e., whereby all facilities have been developed and long-term average worker density ratios prevail), the Site is expected to make a significant additional contribution to the local economy.

The redeveloped Site is expected to support on an ongoing annual basis:

- $844.7 million in output.
- $398.8 million contribution to GRP.
- $206.6 million in incomes and salaries paid to local workers.
- 2,433 FTE jobs (of which 1,083 are direct jobs).

Table E.1: Rezoning Case Operational Economic Impacts (per annum)

Impact	Output ($M)	GVA ($M)	Income ($M)	Employment (FTE)
Direct Impact	$457.4	$200.0	$100.1	1,083
Indirect Impact (Type I)	$181.6	$83.1	$43.7	460
Indirect Impact (Type II)	$205.7	$115.7	$62.8	889
Total Impact	**$844.7**	**$398.8**	**$206.6**	**2,433**

Note: Totals may not sum due to rounding. Includes estimates of existing economic activity.
Source: AEC

Construction of the Site (planned to be developed over a 4-6 year period) is estimated to directly inject around $386.5 million into local businesses in Ryde LGA. The injection is expected to support around $138.3 million in gross value added (GVA) activity within the Ryde LGA over the course of the 4 to 6 year construction period (including both direct and flow-on activity).

An estimated 1,103 FTE jobs for Ryde residents are estimated to be supported as a result of construction over the 4 to 6 year period (including direct and flow-on impacts), equating to an average of 180 to 180 FTE jobs per annum.

Childcare Facilities

There is currently a need for 6,016 childcare places in the LGA to service the resident population, yet only 5,465 places are provided. Furthermore, there is a need for 539 childcare places to service the workers in Macquarie Park Corridor, yet only 525 places are

provided. The Proposal would contribute to meeting the need for childcare places in Macquarie Park, this need expected to grow further in tandem with the worker population.

Public Open Space

The Proposal will provide a new sports field for public use. It is anticipated this field will primarily be used by workers and residents in the Macquarie Park Corridor, future residents of the Herring Road and North Ryde Station Priority Precincts and dwellings developed as part of this Proposal.

Assuming the sports fields have a service population of around 5,000 people, the sports field provided as part of this development can be estimated to return a social value of approximately **$200,000 per annum**.

Key Worker Housing

While 27% of workers in Macquarie Park earn more than $104,000 per annum, a large proportion (44%) earn less than $68,000, many of whom would be 'key workers'.

If key worker housing were made available at a discount of 25% to market rents, the difference between that paid and market rents represents social value to a key worker household. Computed at the average Ryde LGA rent of $520 per week, this equates to an annual value of $6,182 or nearly $180,000 in social value per dwelling[1]. The provision of 40 key worker dwellings would multiply to a value of **$7.2 million**.

Net Impacts

The proposed rezoning sought would lead to a reduction in the quantum of land zoned for employment generating land uses. Yet while the Site currently accommodates 220 employees, these workers will be relocated to a new commercial building (currently under construction) on the Site and as such no 'loss' of jobs. Instead, the construction of 20,000sqm of new commercial and retail space would enable an intensification of uses on the Site and the accommodation of more employees.

When fully operational, the total number of jobs accommodated on the Site is estimated at 1,083 (representing an increase of 863), representing an intensification of employment and much greater employment numbers than present should the rezoning occur.

Conclusion

While the appropriation of land to other uses would mean a reduction in employment land on the Site, the provision of key social infrastructure would result in sustaining Macquarie Park's competitive position as well as increasing its appeal as a business destination, leading to increased demand for floorspace.

It is apparent that the Proposal will provide significant benefit to the local area, delivering strong positive socio-economic impacts comparative to the status quo. This builds a strong case for the Proposal from a socio-economic perspective. As Macquarie Park grows the economic impact identified in this assessment will become even more significant.

[1] Capitalised at gross yield of 3.5%

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1. Introduction

1.1 Project Background and Overview

Macquarie Park Corridor sits in the Global Economic Corridor as identified in *A Plan for Growing Sydney*. The Global Economic Corridor is an area of concentrated employment, economic activity and other uses in centres, transport gateways and industrial zoned land extending from Port Botany and Sydney Airport, through Sydney CBD, north-west through Macquarie Park Corridor, and towards Norwest, Parramatta and Sydney Olympic Park.

Macquarie Park Corridor is located in the local government area of City of Ryde, about 12km north-west of the Sydney central business district and is one of Sydney's major business hubs. Macquarie Park Corridor contains three major employment anchors: Macquarie Business Park, Macquarie University and Macquarie University Hospital. Macquarie Park Corridor is serviced by three train stations, these include: Macquarie University Station, Macquarie Park Corridor Station and North Ryde Station.

Macquarie Park Corridor is set to experience significant population and employment growth. The NSW Bureau of Transport Statistics forecasts that the population in Macquarie Park Corridor will increase by 15,358 persons and increase by 12,872 employees by 2031 (representing an increase of 770% and 28% respectively). Testament to this growth outlook is the quantum of development already in the pipeline, at various stages of planning and development.

- Commercial proposals totalling some 450,000sqm of commercial floorspace.
- Residential proposals totalling more than 3,000 residential units.

Despite there being a range of economic benefits associated with population and employment growth, there are also challenges associated with urban renewal and growth. In urban planning terms, it is well accepted that growth puts pressure on infrastructure needs. These needs include access to amenities such as quality housing, transport networks, roads, schools, open space, hospitals and police and fire services.

Many business parks have transitioned from providing warehousing and light manufacturing space to include increasing amounts of office uses. As a result of the increasing amount of office space (and office workers) located in business parks, the overall composition of business parks has evolved to contain a range of convenience and recreational facilities, including restaurants, banks, medical centres, travel agencies as well as active and passive recreational facilities.

As business parks evolve, workers will be attracted to housing options in close proximity to their place of work (i.e. people will want to live and work locally). This has broader economic benefits as it promotes self-containment, improving health of the local economy.

1.2 Scope and Purpose

Architectus on behalf of Holdmark are preparing a Planning Proposal to rezone 66-82 Talavera Road, Macquarie Park Corridor ("the Site") from B7 Business Park to B4 Mixed Use and subsequently redevelop the Site and deliver the Concept Master Plan.

AEC Group (AEC) has been engaged by Holdmark to prepare a Socio-economic Impact Assessment (SEIA) to analyse the social and economic impacts likely to result from the proposed rezoning and subsequent delivery of the Concept Master Plan. The economic and social impacts that result from a redevelopment of the Site are analysed in the context of the proposed Concept Master Plan.

The Planning Proposal seeks to:

- Amend the land use controls for the site. Currently the land is zoned B7 Business Park. It is proposed that a B4 Mixed Use Zone be applied to the site, to allow for the site's development for public open space, residential, retail and commercial uses. Through the development process, open space would be dedicated back to Council and rezoned as RE1 Zone at a later stage when the boundaries of the open space are defined if required by Council;

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- Amend the current maximum building height controls from 30m to 120m; and
- Amend the current maximum FSR controls from 1.0:1 to 3.5:1.

The Planning Proposal seeks to enable the delivery of the Concept Master Plan, which will accommodate approximately 1,125 apartments, 40 key worker housing apartments, 16,000sqm GFA commercial floorspace and 4,000sqm GFA of retail floorspace, 1 childcare centre for 60 children and 1ha public open space.

1.3 Macquarie Park Corridor: Growth and Sustainability Research Study

AEC Group (AEC) was commissioned by Holdmark to undertake a research study titled *Macquarie Park Corridor – Growth and Sustainability.* The overarching objective of the Study was to provide a clear understanding of key and critical factors that underpin the success and competitiveness of business parks, including the complementary residential development that they generate. This understanding of key site selection factors assisted in understanding the sustainability of Macquarie Park's competitive position.

The importance of key infrastructure items in the Macquarie Park Corridor was investigated against current and future provision. Case studies, tenant/occupier surveys and a literature review collectively identify key tenant requirements (e.g. open space, affordable housing for workers, childcare facilities, etc.).

Given Macquarie Park's position on a growth trajectory, its position and ability to respond to infrastructure need and delivered required social infrastructure is imperative for its continued success.

The findings of the research study are elaborated on throughout the SEIA.

1.4 Purpose and Structure of the Study

The purpose of the SEIA is to consider whether the direct economic impacts of the proposed rezoning and development represent a net positive impact compared to the existing uses.

Chapter 2 analyses key State and local government policies relevant.

Chapter 3 reviews the Site, its current context within Macquarie Park Corridor and describes the Proposal as envisioned for future redevelopment of the Site.

Chapter 4 analyses the socio-economic profile of Macquarie Park and relevant catchment to understand its role in accommodating employment/economic activity. The employment analysis provides insight into the profile of current employment demand and future growth prospects. The Chapter also profiles existing residents in Macquarie Park.

Chapter 5 provides an overview of the economic trends/drivers impacting the Site and its broader context within Macquarie Park Corridor.

Chapter 6 assesses the need for social infrastructure in the Macquarie Park Corridor and analyses the effectiveness of the mechanisms in place which can fund this infrastructure.

Chapter 7 assesses the socio-economic impacts of the Proposal by investigating two scenarios, these include:

- *The Base Case:* the social and economic impacts of the Site in its existing use (i.e. no rezoning).
- *Rezoning Case:* This scenario assumes that the Site is rezoned and redeveloped in line with the proposed master plan.

Chapter 8 assesses the Net Community Benefit of the proposal and seeks to evaluate the socio-economic implications of the rezoning from a community perspective. It translates the key findings from Chapters 2 to 7 and applies them in the assessment of the Proposal against the Section 117 Direction.

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2. Planning and Policy Context

2.1 State Planning Policy

2.1.1 NSW State Plan (2011)

The NSW 2021 Plan (NSW DPC, 2011) aims to rebuild the NSW economy, provide quality services, renovate infrastructure, restore government accountability and strengthen NSW's local environment and communities.

The Plan comprises five sub-strategies. The main sub-strategy that is of relevance to this Assessment is 'Rebuild the Economy' with the following goals of particular importance:

- **Goal 1 Improve the Performance of the NSW Economy** - states that a strong economy generates opportunities for fulfilling jobs, choices and financial security. The target of the Plan is to grow employment by an average of 1.25% per year to 2020.
- **Goal 4 Increase the Competitiveness of Doing Business in NSW** – states that there should be an increase in business innovation. Furthermore, it is put forward that high performing businesses should be supported to innovate in order to further enhance productivity through Industry Action Plans. The plans will identify innovation drivers and barriers within key sectors (professional services, manufacturing, digital economy, tourism and events, and education and research).
- **Goal 5 Place Downward Pressure on the Cost of Living –** the aim of the goal is to reduce the pressure on household budgets where possible by providing support to people in need and dealing with the underlying causes of rising household costs. The State government plans to increase the supply of land for housing and provide incentives to help make housing in NSW more affordable and housing stock more appropriate for people's needs.

The Plan aims to improve housing affordability and availability and aims to:

- Continue to set dwelling targets for local councils outlined in subregional strategies.
- Partner with local councils to ensure that targets for housing and growth and the priorities within the subregional plans and regional plans are reflected in relevant planning proposals and in local planning instruments (local environmental plans).

2.1.2 A Plan for Growing Sydney (2014)

A Plan for Growing Sydney (NSW DP&E, 2014a) (the Plan) sets the strategic direction for Sydney towards 2031. The overarching vision is that by 2031, Sydney will be "a strong global city, a great place to live". The Plan is built around four key goals:

- A competitive economy with world-class services and transport.
- A city of housing choice with homes that meet our needs and lifestyles.
- A great place to live with communities that are strong, health and well connected.
- A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources.

It is considered goal 1, 2 and 3 are of most relevance to the SEIA and are analysed below. *Goal 4: A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources,* is focused on the natural environment and biodiversity and as such not considered relevant to the Concept Master Plan – which is an urban focused development.

Goal 1: A Competitive Economy with World-class Services and Transport

Of particular relevance to the SEIA is *Goal 1: A competitive economy with world-class services and transport.* One of the associated directions – *Direction 1.6: Expand the Global Economic Corridor* states that the Global Economic Corridor extends from Macquarie Park Corridor (where the Site is located) through the Sydney CBD to Port Botany and Sydney Airport, generating over 41 per cent of the NSW Gross State Product (GSP). This economic

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cluster is unique in Australia due to the extent, diversity and concentration of globally competitive industries.

Goal 2: A City of Housing Choice

Another goal of relevance is *Goal 2: A city of housing choice, with homes that meet our needs and lifestyles.* The following key directions/actions are of relevance to this Assessment.

- **Accelerate housing supply and local housing choices** (Direction 2.1/Action 2.1.1)
  The Plan states the Government is working to achieve its target of an additional 664,000 new dwellings by 2031. The Plan acknowledges that increasing housing supply and addressing housing affordability and choice will assist in reaching the target.

  Working with the market to deliver new housing

  Importantly the Plan acknowledges that Government and local councils need to understand and respond to the housing market in each and every Local Government Area. The housing market reflects consumer demand and willingness to pay for particular types of housing in particular locations.

  It is the role of the private sector to build new houses. The private sector will only develop housing on rezoned sites where there is sufficient consumer demand for it, at a price that provides a return to the developer. Local councils should assist housing production by identifying and rezoning suitable sites for housing.

- **Accelerate urban renewal across Sydney – providing homes closer to jobs** (Direction 2.2/Action 2.2.2)
  A Plan for Growing Sydney focuses new housing in centres which have public transport that runs frequently and can carry large numbers of passengers.

- **Improve housing choice to suit different needs and lifestyles** (Direction 2.3)
  The Plan states as the population ages, many people will choose to downsize their homes. Most people will prefer to remain in their communities – around 50 per cent of people looking to purchase a new house stay within their current Local Government Area. To respond to these issues, the Government will introduce planning controls that increase the number of homes in established urban areas.

  Action 2.3.3 Deliver more opportunities for affordable housing recognises the need meet the housing needs of people on very low, low and moderate incomes. People in lower income brackets that spend more than 30 per cent of their gross income on rent are said to be experiencing rental stress.

  The Plan states that in order to respond to these issues, the Government will introduce planning controls that increase the number of homes in established urban areas to take advantage of public transport, jobs and services.

Goal 3: Sydney's Great Places to Live

Goal 3 and the associated *Direction 3.1: Revitalise existing suburbs* emphasises that focusing new housing within Sydney's established suburbs brings real benefits to communities and makes good social and economic sense. This type of development lowers infrastructure costs; reduces the time people spend commuting to work or travelling between places.

Furthermore, *Direction 3.2* Create a network of interlinked, multipurpose open and green spaces across Sydney. *A Plan for Growing Sydney* aims to improve the quality of green spaces and create an interconnected network of open spaces and parks, tree-lined streets, bushland reserves, riparian walking tracks and National Parks.

2.1.3 Section 117 Direction (Environmental Planning and Assessment Act 1979)

Under Section 117(2) (S117(2)) of the Environmental Planning and Assessment Act 1979 the Minister for Planning and Infrastructure provides directions to planning authorities regarding proposals lodged with the DP&E.

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Of relevance to this SEIA is Section 1.1 Business and Industrial Zones which stipulates the objectives of S117(2) which are as follows:

- Encourage employment growth in suitable locations.
- Protect employment land in business and industrial zones.
- Support the viability of identified strategic centres.

Given that S117 (2) applies in this case, Council must:

- Give effect to the objectives of this direction.
- Retain the areas and locations of existing business and industrial zones.
- Not reduce the total potential floor space area for employment uses and related public services in business zones.
- Not reduce the total potential floor space area for industrial uses in industrial zones.
- Ensure that proposed new employment areas are in accordance with a strategy that is approved by the Director-General of the Department of Planning.

2.2 Local Planning Policy

2.2.1 Ryde Local Environmental Plan (2014)

The Ryde Local Environmental Plan (LEP) applies to most land within the Ryde LGA. The aim of the LEP is to regulate development of land within the LGA by providing land use and density controls.

Macquarie Park Corridor is subject to the B7 Business Park and B3 Commercial Core zones which are adjacent to the B4 Mixed Use zone. Together, these zones operate to reinforce the significant role of Macquarie Park Corridor as a major employment and economic hub. More particularly, the Site is zoned B7 Business Park, which generally frames the B3 Commercial Core zone. The objectives of the B7 Business Park zone are:

- To provide a range of office and light industrial uses.
- To encourage employment opportunities.
- To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area.
- To encourage industries involved in research and development.

The Site is subject to the following key planning controls:

- Building height: 30m; and
- FSR: 1:1.

The land surrounding the Site is zoned B4 Mixed Use and B3 Commercial Core. Set out below is the location of each zone and the FSR which applies.

- **B4 Mixed Use** is broadly bound by Herring Road and Balaclava Road to the north, M2 Motorway to the east, Byfield Street to the south and Epping Road to the west.

  The FSR of this land use zone ranges from 1:1, 1.5:1, 2:1 and 3:1.

- **B3 Commercial Core** is broadly bound by Byfield Street to the north, B7 Business Park land use zone to the east, Wickson Road to the south and Optus Drive and Epping Road to the west. The FSR of this land use zone ranges from 1:1, 1.5:1, 2:1 and 3:1.

  The FSR ranges for the B4 Mixed use zone and B3 Commercial Core zone provide greater densities compared to the B7 Business Park zone which is confined to an FSR of 1:1.

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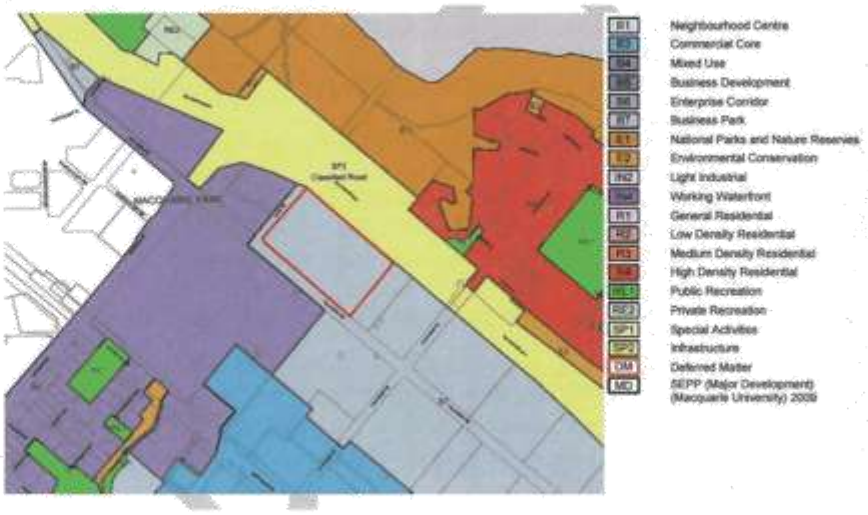
Figure 2.1: The Site Land Use Zoning



Source: Ryde Council (2014)

2.2.2 Ryde Local Environmental Plan 2014 (Amendment 1) Macquarie Park Corridor

Ryde Local Environmental Plan 2014 (Amendment 1) Macquarie Park Corridor (referred to as 'Amendment 1') is an amendment to the current RLEP 2014. The purpose of the amendment is to increase height and floor space ratio controls for the Macquarie Park Corridor to enable the implementation of new roads and parks that will support employment growth and the evolution of Macquarie Park Corridor from Business Park to specialised employment centre.

Amendment 1 provides an incentivised set of controls for the Macquarie Park Corridor which allow for an increase in height or FSR in return for monetary contributions and/or the delivery of public infrastructure including roads and open space. This infrastructure to be delivered is identified in the supporting documentation for Amendment 1. The Site does not contain any of this infrastructure to be delivered.

Under Amendment 1 the Site is subject to the following key planning controls:

- Maximum building height of 45m; and
- Maximum FSR of 1.5:1.

As the Site does not include any required infrastructure, it will be subject to payment of monetary contributions on a per sqm basis for each additional sqm above the current applicable FSR.

Delivery of public infrastructure including roads and open space will hinge on the redevelopment and take-up of bonus FSR on sites where these items of infrastructure have been identified.

2.3 Vision for Macquarie Park Corridor

A Plan for Growing Sydney identifies that Macquarie Park Corridor sits in the Global Economic Corridor. The Global Economic Corridor is an area of concentrated employment, economic activity and accommodates a range of other uses. These activities are accommodated in centres, transport gateways and industrial zoned land extending from Port Botany and Sydney Airport, through Sydney CBD, north-west through Macquarie Park Corridor, and towards Norwest, Parramatta and Sydney Olympic Park.

Furthermore, The Plan states that by 2030, there will be demand for around 190,000 new stand-alone office jobs: around 75% of these will likely seek to locate in Sydney's 10 major

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office markets. Many of these jobs will be outside Sydney CBD and North Sydney, in the eight suburban office markets of Chatswood, Macquarie Park Corridor, Norwest, Parramatta, Rhodes, St Leonards, Sydney Olympic Park and South Sydney, situated along the Global Economic Corridor.

With specific regard to the Macquarie Park Corridor, The Plan identifies the following priorities:

- Work with council to retain a commercial core in Macquarie Park Corridor for long-term employment growth.
- Work with council to concentrate capacity for additional mixed-use development around train stations, including retail, services and housing.
- Facilitate delivery of Herring Road, Macquarie Park Corridor Priority Precinct, and North Ryde Station Priority Precinct.
- Investigate potential future opportunities for housing in areas within walking distance of train stations.
- Support education and health-related land uses and infrastructure around Macquarie University and Macquarie University Private Hospital.
- Support the land use requirements of the Medical Technology knowledge hub.
- Investigate a potential light rail corridor from Parramatta to Macquarie Park Corridor via Carlingford.
- Investigate opportunities to deliver a finer grain road network in Macquarie Park Corridor.
- Investigate opportunities to improve bus interchange arrangements at train stations.
- Work with council to improve walking and cycling connections to North Ryde station.

The importance and significance of Macquarie Park Corridor is recognised in state and local planning documents, its future prosperity underpinned by the priorities of governments.

Supporting and Sustaining Growth

Despite the range of economic benefits associated with population and employment growth, urban and renewal and regeneration is not without its challenges. All forms of growth exert pressure on existing infrastructure networks, not just from a quantum but also from a suitability-for-needs perspective.

As areas renew and regenerate, the infrastructure needs of its workers and residents change, therefore demand for and access to amenities such as quality housing, transport systems, roads, schools, hospitals and police and fire services should be considered in the appropriate context.

Urbanisation also demands more emphasis be placed on social infrastructure, such as community centres, youth centres, parks and sporting fields, etc. so that urban renewal areas can contribute to reducing social disadvantage and maintaining social cohesion. As such, Amendment 1 aims to combat some of the pressures associated with population and employment growth.

The aim of Amendment 1 is to increase permissible height and floor space ratio controls in the Macquarie Park Corridor to enable the implementation of new roads and parks that will support employment growth and the evolution of Macquarie Park Corridor from Business Park to specialised employment centre.

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3. The Proposal

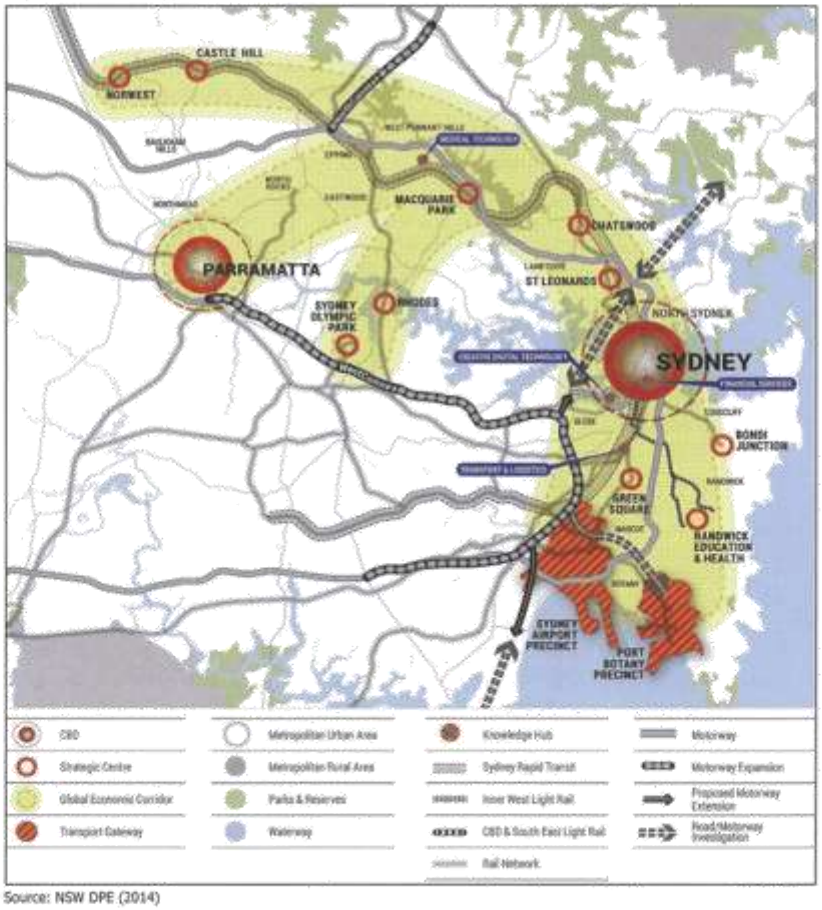
3.1 Location and Site Context

3.1.1 Macquarie Park Corridor

Macquarie Park Corridor is located in the local government area of City of Ryde. It is located 12km northwest of the Sydney central business district and it is one of Sydney's major business hubs. Macquarie Park Corridor contains three major employers: Macquarie Business Park, Macquarie University and Macquarie University Hospital. Macquarie Park Corridor is serviced by three train stations, these include: Macquarie University Station, Macquarie Park Corridor Station and North Ryde Station.

A Plan for Growing Sydney identifies Macquarie Park Corridor as within the Global Economic Corridor (refer to **Figure 3.1**). The Global Economic Corridor is an area of concentrated employment, economic activity and other uses in centres, transport gateways and industrial zoned land extending from Port Botany and Sydney Airport, through Sydney CBD, north-west through Macquarie Park Corridor, and towards Norwest, Parramatta and Sydney Olympic Park.

Figure 3.1: Strategic Context and Location of Macquarie Park Corridor



Source: NSW DPE (2014)

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Macquarie Park Corridor is a business precinct located just 12km north-west of the CBD, and is Sydney's second largest commercial office precinct after the Sydney CBD. Some of the growing list of tenants include: Microsoft, Sony, Optus, Johnson & Johnson and Goodman-Fielder.

Macquarie Park Corridor is continually evolving, over the past 20 years with the rezoning of 200 hectares of industrial land to create a thriving business centre. Macquarie Park Corridor is on the Chatswood to Epping Rail Line and a major stop for bus services from key centres such as Parramatta, North Sydney and Castle Hill.

The proposed Sydney Metro train line will connect to the proposed extension of the North West Rail Link at Chatswood, run under the city and connect to the Bankstown line at Sydenham. It's the first step in introducing next generation rapid, fast-service metro trains to Sydney CBD.

The park is accessible by car via the M2, M4, M7 and Lane Cove Tunnel. The Macquarie Centre also operates the Biz Park shuttle, which offers free transit between the Centre and around the business park.

Macquarie Park Corridor contains the following facilities and social infrastructure items that contribute to worker amenity, these include:

- Restaurants and cafés, retail facilities, i.e. Macquarie Centre.
- Fitness centres.
- Childcare centres.
- Public open space, i.e. Christie Park, Fontenoy Park, Tuckwell Park and Wilga Reserve.

The existing provision of social infrastructure items and adequacy of the same is discussed in further detail in Chapter 6.

3.1.2 The Site and Surrounds

Macquarie Park Corridor contains a range of land uses which are reflective of the different land use zones which subsist in the area. Under the Ryde Local Environmental Plan 2014, the eastern portion is zoned B4 Mixed Use, the core is zoned B3 Commercial Core and the land on either side of the core is zoned B7 Business Park.

The Site is located at 66-82 Talavera Road, Macquarie Park Corridor and is zoned B7 Business Park. The existing built form on the Site comprised:

- A 4-storey office building fronting Alma Road (6,988sqm);
- A conference centre (2,160sqm);
- Warehouse (8,974sqm) which has since been demolished for a new 6 storey commercial building;
- Private tennis courts;
- At grade parking.

A 6 storey commercial building on Talavera Road is currently under construction (following demolition of the warehouse), to comprise nearly 9,000sqm of office GFA on completion.

DPE have identified two Priority Precincts which are located at the north-western and south-eastern ends of the business park, these are Herring Road and North Ryde Station Priority Precincts respectively. Both of these precincts have been designated for substantial dwelling and population growth.

The area to the north west of Herring Road (Macquarie University) falls under the State Environmental Policy (Major Development) (Macquarie University) 2009 and is zoned SP2 Infrastructure (Educational Establishment) and B4 Mixed Use.

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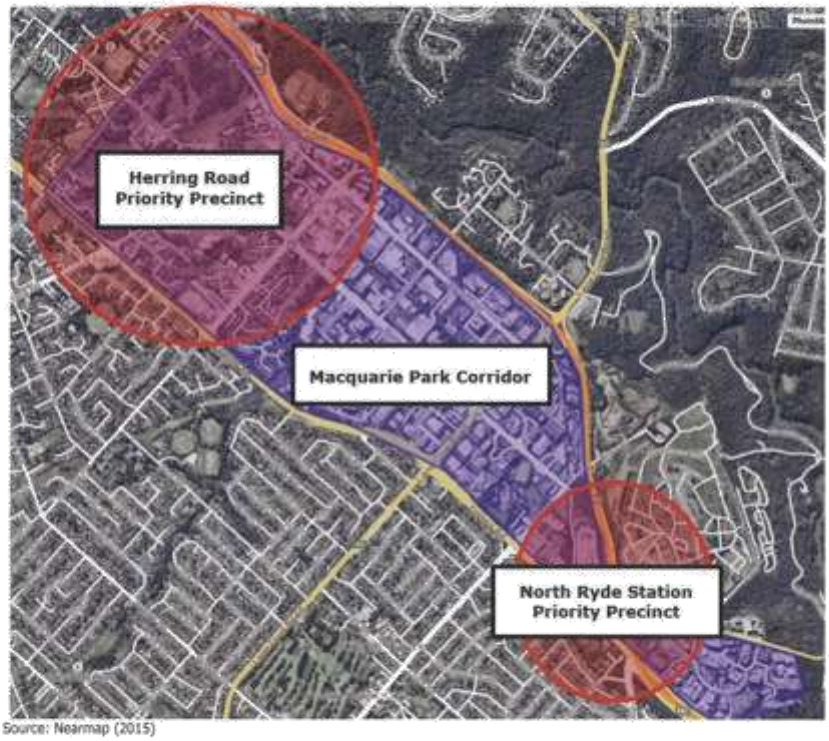
Figure 3.2: Map of Macquarie Park Corridor



Source: Nearmap (2015)

From its early association with Macquarie University, Macquarie Park Corridor has developed into a centre for research and technology activities. The occupiers are diverse within the range of land use zones.

- Occupiers in the B4 Mixed Use zone include Macquarie Retail Centre, Panasonic, Macquarie University residential colleges.
- Occupiers in the B3 Commercial Core zone include financial services firms, medical and pharmaceutical research and telecommunications companies. These include Orix, Johnson and Johnson, Novartis Pharmaceuticals and Foxtel.
- Prominent occupiers in the B7 Business Park zone include Toshiba, CSIRO, Komatsu, Astra Zeneca, Seiko and Optus.

As stated in section **2.2.1** the B3 Commercial Core zone has a greater variance of density controls (i.e. FSR 1:1, 1.5:1, 2:1 and 3:1) in comparison to the B7 Business Park zone which is designated with an FSR of 1:1. These built form controls are reflective of the built form on the ground in Macquarie Park Corridor.

There is generally greater density and taller buildings in the B3 Commercial Core zone, particular around Macquarie Park Station and Macquarie University Station and lower density development at the edge of the Corridor where the B7 Business Park zone is located.

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3.2 Rezoning and Proposed Redevelopment

The Planning Proposal seeks to amend the land use controls for the Site. Currently the land is zoned B7 Business Park. The Proposal envisages the following applied to 3.78ha of land currently zoned B7 Business Park:

- B4 Mixed Use zone.
- Amend the current maximum building height controls from 30m to 120m; and
- Amend the current maximum FSR controls from 1:1 to 3.5:1.

It is envisaged that once the land is rezoned it will accommodate the following (as contained in the Concept Masterplan):

- Approximately 1,125 apartments (as well as an additional 40 apartments for key worker housing).
- 20,000sqm of non-residential GFA:
  - 16,000sqm commercial floorspace; and
  - 4,000sqm retail floorspace.
- 1 childcare centre 700sqm for 60 children.
- 1ha of open space.

The socio-economic context within which the Site and proposed redevelopment operate is investigated in the next chapter.

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4. Socio-Economic Analysis

4.1 Employment Profile

In order to understand the employment and economic activity occurring in Macquarie Park Corridor (where the Site is located) the Bureau of Transport Statistics data (BTS, 2012) was used.

The BTS statistical boundaries do not align with the Site, accordingly the data collected relates to the broader precinct where the Site is located and considers a much larger employment catchment.

The specific employment profile of Site is therefore not reflected in the analysis. That said, the employment profile provides a contextual indication of employment structure of Macquarie Park Corridor.

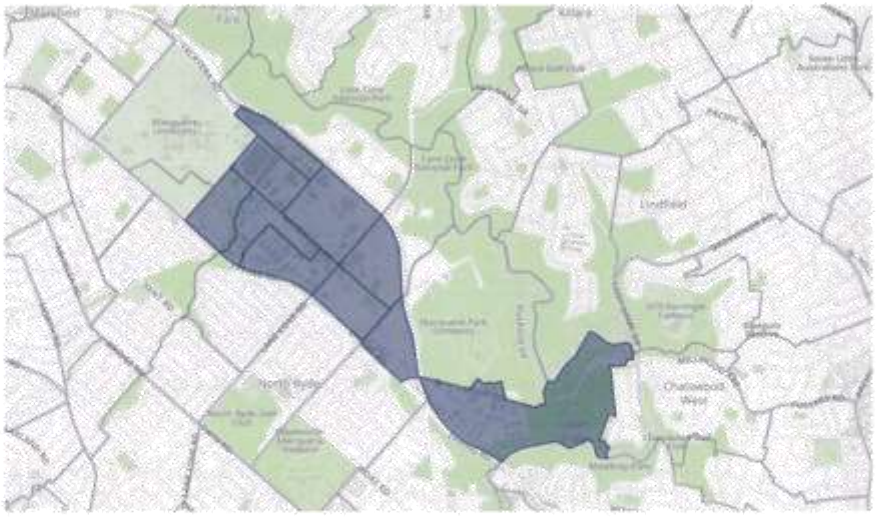
This section considers the employment profile of workers in the precinct by analysing types of employment categorised under Australian and New Zealand Standard Industrial Classification (ANZSIC). The ANZSIC has been developed jointly by the Australian Bureau of Statistics and Statistics New Zealand to improve the comparability of industry statistics between the two countries and the rest of the world.

The ANZSIC is a hierarchical classification of industry with four levels, namely Divisions (the broadest level), Subdivisions, Groups and Classes (the finest level). At the Divisional level (referred to as 1-digit ANZSIC), the main purpose is to provide a limited number of categories which provide a broad overall picture of the economy.

The Subdivision (2-digit ANZSIC), Group (3-digit ANZSIC) and Class (4-digit ANZSIC) levels provide increasingly detailed dissections of these categories to enable the compilation of more specific and detailed statistics (ABS, 2006).

Figure 4.1 depicts the statistical area analysed in relation to the Site.

Figure 4.1: Precinct Employment Analysis



Source: BTS (2012)

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4.1.1 Employment Profile

This section summarises key socio economic characteristics of Macquarie Park Corridor, combining different data sets, across various levels of geographies as outlined below:

Table 4.1: Data Sources

Data	Geography	Source
Employment by Industry	Macquarie Park Corridor Precinct/Ryde LGA	Bureau of Transport Statistics
Employment by Occupation	Macquarie Park Corridor Precinct/Ryde LGA	Bureau of Transport Statistics
Method of Transport to Work	Macquarie Park Corridor Precinct	Bureau of Transport Statistics
Employment by Income	Macquarie Park Corridor- Marsfield SA2/Ryde LGA	Bureau of Transport Statistics
Journey to Work (simple)	Macquarie Park Corridor Precinct	Bureau of Transport Statistics
Journey to Work (cross tabulated i.e. by origin by income, by origin by industry)	Ryde LGA	ABS

Source: AEC

Given that various databases have been utilised, totals from different datasets (i.e. employment by occupation, employment by industry) may not add up due to different rounding, statistical analysis and reporting techniques.

Employment Profile

Key employment data for Macquarie Park Corridor highlights that:

- Estimated employment of approximately 40,450 people in 2011.
- Wholesale trade (22.0%), information, media telecommunications (19.4%) and professional scientific and technical services (18.8%) are the largest employers.
- Key occupations include professionals (38.2%), managers (21.7%) and clerical and administrative workers (17.3%) reflective of its industry profile.

Table 4.2: Employment Profile Overview, Macquarie Park Corridor Precinct

Indicator	Macquarie Park Corridor
Total Employment (Number)	
2011	40,475
Key Industries (2011, % of Total Employment)	
Wholesale Trade	22.0%
Information, Media Telecommunications	19.4%
Professional, Scientific and Technical Services	18.8%
Key Occupations (2011, % of total)	
Professionals	38.2%
Managers	21.7%
Clerical and Administrative Workers	17.3%
Average Income* (2011, dollars)	$70,409

*Macquarie Park Corridor-Marsfield SA2
Source: BTS (2014)

The following sections investigate at a finer grain the composition of employment.

Employment by Industry

In 2011, Macquarie Park Corridor employed 40,475 workers, representing approximately 54% of those employed (74,500) across the Ryde LGA, demonstrating Macquarie Park Corridor's significance to the Ryde local economy.

Wholesale trade (22.0%), information, media telecommunications (19.4%) and professional scientific and technical services (18.8%) are the largest employers. Other sectors represented in Macquarie Park Corridor include manufacturing (12.0%), retail trade (6.3%) and health care and social assistance (6.0%). This highlights a broad industry mix,

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comprising white collar, blue collar and service based industries, though with a larger concentration of white collar dominated industries.

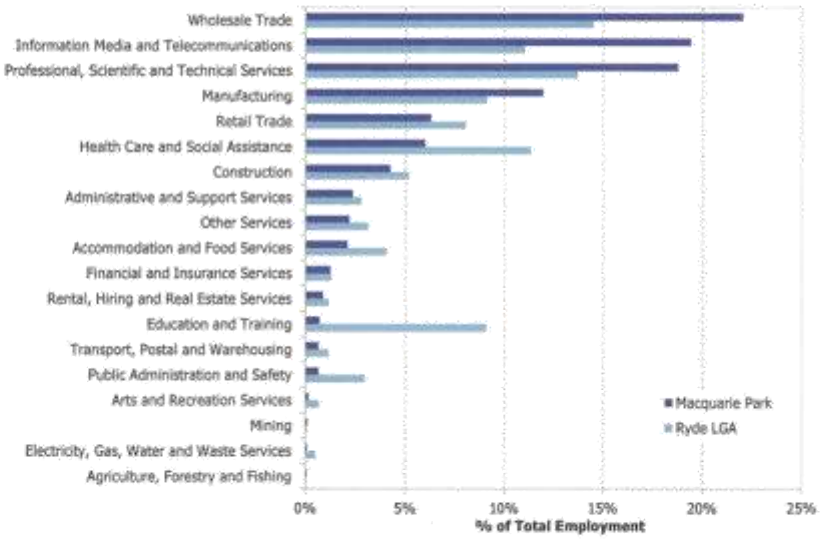
The Ryde LGA comprises an even broader industry mix, and in particular a larger proportion of workers in education and training and health care and social assistance.

Table 4.3: Employment by Industry, 2011 (19 Sector – 1-Digit ANZSIC)

Industry	Macquarie Park Corridor		Ryde LGA	
	Employment	% of Total	Employment	% of Total
Agriculture, Forestry and Fishing	29	0.1%	48	0.1%
Mining	44	0.1%	60	0.1%
Manufacturing	4,844	12.0%	6,787	9.1%
Electricity, Gas, Water and Waste Services	34	0.1%	378	0.5%
Construction	1,720	4.2%	3,879	5.2%
Wholesale Trade	8,923	22.0%	10,825	14.5%
Retail Trade	2,561	6.3%	5,999	8.0%
Accommodation and Food Services	848	2.1%	3,035	4.1%
Transport, Postal and Warehousing	265	0.7%	864	1.2%
Information Media and Telecommunications	7,860	19.4%	8,234	11.0%
Financial and Insurance Services	502	1.2%	964	1.3%
Rental, Hiring and Real Estate Services	352	0.9%	867	1.2%
Professional, Scientific and Technical Services	7,596	18.8%	10,221	13.7%
Administrative and Support Services	959	2.4%	2,087	2.8%
Public Administration and Safety	265	0.7%	2,210	3.0%
Education and Training	283	0.7%	6,782	9.1%
Health Care and Social Assistance	2,438	6.0%	8,453	11.3%
Arts and Recreation Services	61	0.2%	492	0.7%
Other Services	890	2.2%	2,344	3.1%
Total	**40,475**	**100.0%**	**74,527**	**100.0%**

Note: Totals may not add up to other BTS tables due to different databases utilised and rounding.
Source: BTS (2014)

Figure 4.2: Employment by Industry, Macquarie Park Corridor and Ryde LGA, 2011



Note: Place of Work Data.
Source: BTS (2014)

Employment by Occupation

The employment profile of Macquarie Park Corridor primarily comprises professionals (38.2%), managers (21.7%) and clerical and administrative workers (17.3%), reflecting a large representation of jobs across white collar dominated industries.

Table 4.4: Employment by Occupation, 2011 (1-digit ANZSIC)

Occupation	Macquarie Park Corridor		Ryde LGA	
	No.	%	No.	%
Managers	8,776	21.7%	13,101	17.6%
Professionals	15,455	38.2%	25,993	34.9%
Technicians and Trades Workers	4,001	9.9%	7,836	10.5%
Community and Personal Service Workers	759	1.9%	4,773	6.4%
Clerical and Administrative Workers	7,001	17.3%	11,901	16.0%
Sales Workers	2,943	7.3%	5,785	7.8%
Machinery Operators and Drivers	606	1.5%	1,883	2.5%
Labourers	939	2.3%	3,258	4.4%
Total	**40,479**	**100.0%**	**74,530**	**100.0%**

Note: Totals may not add up to other BTS tables due to different databases utilised and rounding.
Source: BTS (2014)

Average Income

The average yearly income in the Macquarie Park Corridor-Marsfield SA2 ($70,409) is higher than that across Ryde LGA ($64,445) in 2011, given larger proportion of workers with a yearly income of $104,000+ (highest income range bracket), respectively 27.3% in the former and 22.4% in the latter.

This is primarily expected to be influenced by a larger presence of white collar industries across Macquarie Park Corridor-Marsfield SA2, such as across professional, scientific and technical services, which often are associated with higher incomes.

Table 4.5: Income, Place of Work, 2011

Income	Macquarie Park Corridor - Marsfield SA2	Ryde LGA
	Percentage (%)	Percentage (%)
$0-$7,799	3.2%	4.4%
$7,800-$12,999	2.1%	3.0%
$13,000-$20,799	2.5%	3.5%
$20,800-$31,199	5.7%	8.0%
$31,200-$41,599	8.5%	10.4%
$41,600-$51,999	9.9%	10.7%
$52,000-$67,599	12.1%	12.1%
$67,600-$83,199	11.4%	10.4%
$83,200-$103,999	17.3%	15.1%
$104,000 or more	27.3%	22.4%
Total (%)	**100.0%**	**100.0%**
Average Income	**$70,409**	**$64,445**

Note: average income differs to that identified in 'Journey to Work' given the different level of geographies (Macquarie Park Corridor-Marsfield SA2/Ryde LGA) and sources (BTS/ABS respectively) used
Source: BTS (2014)

Macquarie Park Corridor comprises a broad industry mix, with a high concentration of white collar dominated industries, such as professional, scientific and technical services and information, media and telecommunications. Therefore, this leads to a higher proportion of white collar occupations, such as professionals and managers, as well as considerably high incomes. The industry mix provides good growth prospects for employment, with many white collar sectors forecast to grow significantly in Australia over the medium to long term.

Significantly, the ability to attract and retain a skilled local labour force is crucial in promoting investment and attracting additional such businesses to Macquarie Park.

4.1.2 Where Workers Live

Journey to work analysis answers key questions about commuting workers, such as: how many workers commute to a particular area, where they live, what industries they work in. Such analysis is useful, having significant implications for town planning, dwelling requirements, infrastructure demand, demand for retail and office space, employment land uses and many other aspects of a local/regional economy.

Journey to work data has been applied to Macquarie Park Corridor precinct to understand the flow of workers to the precinct and method of transport utilised.

- Macquarie Park Corridor comprises a low proportion of workers who live in the catchment LGA (Ryde LGA), with only 10.7% of employees working in the precinct *also* living in Ryde LGA.
- As such, nearly 90 out of every 100 workers employed in Macquarie Park Corridor are commuting to work from outside the Ryde LGA. Therefore, the LGA has potential to improve its containment rate and employ a larger proportion of residents living in the local area, to reduce commuting times and pressure on transport networks.
- Approximately an additional 35% of workers in Macquarie Park Corridor commute from surrounding LGAs, implying relatively short commuting patterns for these workers. However, 55% of workers commute from LGAs further afield implying longer commutes.
- The majority of workers rely on private vehicle transport to get to work, with approximately two thirds of workers travelling by car. Approximately 20% of workers take public transport to work, with opportunities to increase public transportation accessibility for workers travelling to Macquarie Park Corridor.

Table 4.6 outlines the origin of Macquarie Park Corridor workers, categorising them by the top 10 local government areas and indicating that just over 10% of Macquarie Park Corridor workers live in the Ryde LGA.

Table 4.6: Movement to Macquarie Park Corridor, 2011

Origin LGA	No.	% of Total
Ryde	4,330	10.7%
Hornsby	3,800	9.4%
The Hills Shire	2,998	7.4%
Blacktown	2,686	6.6%
Parramatta	2,441	6.0%
Ku-ring-gai	2,128	5.3%
Warringah	1,514	3.7%
Sydney	1,470	3.6%
Willoughby	1,234	3.0%
North Sydney	1,206	3.0%
Other LGAs	16,679	41.2%
Total	**40,487**	**100.0%**

Note: Totals may not add up to other BTS tables due to different databases utilised and rounding.
Source: BTS (2014)

Table 4.7: Method of Transport to Work, Macquarie Park Corridor 2011

Method of Travel	No.	% of Total
Car as driver	26,528	65.5%
Train	5,372	13.3%
Did not go to work	2,412	6.0%
Bus	2,208	5.5%
Car as passenger	1,612	4.0%
Other	2,343	5.8%
Total	**40,475**	**100.0%**

Note: Totals may not add up to other BTS tables due to different databases utilised and rounding.
Source: BTS (2014)

ITEM 5 (continued) **ATTACHMENT 6**

A large proportion of commuters to Ryde LGA are employed in white collar dominated industries such as professional, scientific and technical services and are employed as professionals and managers. The majority of commuters have also high incomes and are well educated.

In particular, journey to work analysis highlights that a higher proportion of those commuting to Ryde LGA are employed as professionals and managers, have higher incomes and are more educated than workers residing in Ryde LGA. Accordingly, even though there is a large proportion of highly paid jobs and a large proportion of white collar positions in Ryde LGA (and Macquarie Park Corridor), most of these appear to be better 'suited' to the socio-economic profile of commuters than residents itself.

This is further emphasised by relatively low containment rates, with most LGA residents commuting to work outside.

4.1.3 Self Containment and Self Suficiency

Self-sufficiency and self-containment measure the health of a local economy based on the number of jobs that it can provide.

Self-sufficiency measures the number of local jobs versus the labour force (i.e. the number of local jobs divided by the labour force).

Self-containment is a similar measure but provides an understanding of where local resident workers are employed. Self-containment is calculated by dividing the number of local residents that work locally by the total number of local residents that are employed.

Table 4.8: Self-sufficiency v Self-containment, 2011

Indicator	Units	Macquarie Park Corridor - Marsfield SA2	Ryde LGA
Self-Sufficiency	%	413.2%	130.2%
Self-Containment	%	24.9%	27.7%

Source: ABS (2012b 2012c and 2012d)

In 2011, the SA2 reported a high employment self-sufficiency rate of 413.2%, suggesting there were 4.132 local jobs for each local resident participating in the labour force (this was markedly higher than the LGA at 130.2%). The high self-sufficiency rate of Macquarie Park is no surprise given its major employment centre status as part of Sydney's Global Economic Corridor.

The SA2 has a low employment self-containment rate with just 24.9% of local residents who work, working in the local area. This is compared to the LGA which reports an employment self-containment rate of 27.7%.

Overall the Ryde LGA has a relatively high self-sufficiency rate of 130%. This suggests that there are 1.3 local jobs for each local resident participating the labour force. This is very high compared to the Sydney SD (85.2%) and NSW (82.3%).

In contrast to the high employment self-sufficiency rate, the Ryde LGA has a low employment self-containment rate with just over 27% of local residents who have a job also working in the local area. Overall, the LGA typically employs higher proportions of highly skilled workers (of who many many work in Macquarie Park). This indicates a mismatch of skills between residents and worker profiles, resident workers represented by greater proportions of blue collar and service workers, lower levels of education attainment and much lower individual incomes.

Housing options that are not only affordable but available will contribute to accommodating those workers in Macquarie Park whose incomes are more modest.

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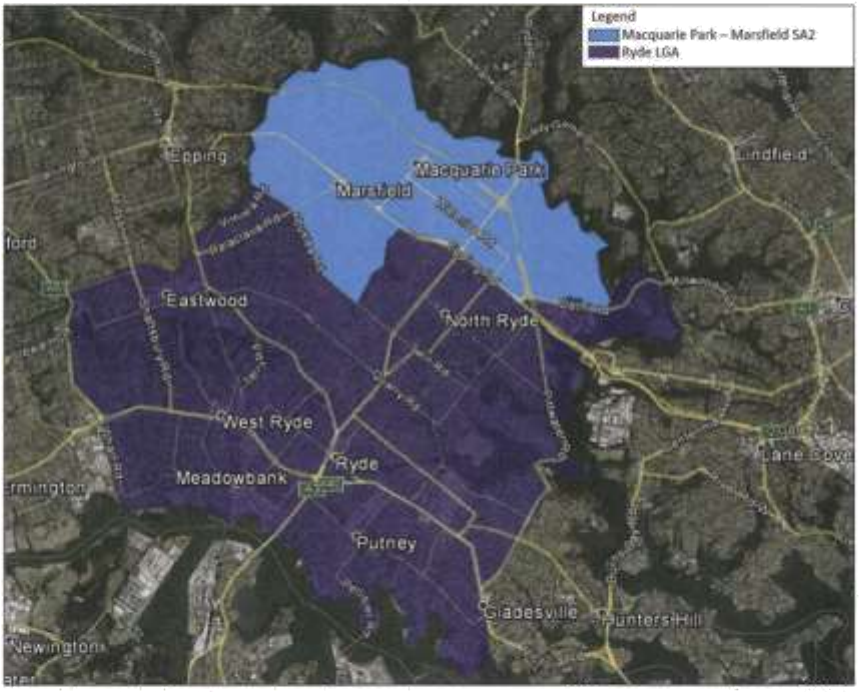
4.2 Socio-Demographic Analysis

This section provides a summary of key socio-demographic indicators for residents in the Macquarie Park Corridor - Marsfield SA2, using Ryde LGA as a benchmark.

The ABS statistical boundary SA2 does not align with the Site or Precinct, accordingly the data collected relates to a broader area and considers a much larger statistical catchment. That said, the population profile provides a contextual indication of population profile in the Macquarie Park Corridor – Marsfield SA2 and Ryde LGA.

The observations of Macquarie Park Corridor - Marsfield SA2 and Ryde LGA are taken to be a proxy for understanding the population profile of the characteristics of those residents who may reside in the proposed development. The Macquarie Park Corridor - Marsfield SA2 has been used as it is the smallest geographical area for which ABS time series data is available.

Figure 4.3: Macquarie Park Corridor-Marsfield SA2 and Ryde LGA



Source: ABS (2011), AEC, Google Pro

4.2.1 Population Growth

The SA2 had an estimated population of 19,192 people in 2011, representing an increase of approximately 2,052 people (or 1.1% annual average growth) between 2001 and 2011. In comparison, the LGA had an estimated population of 103,095 people in 2011, from an estimated population of approximately 94,244 people in 2001 (0.9% annual average growth).

ITEM 5 (continued) **ATTACHMENT 6**

Table 4.9: Estimated Population, Macquarie Park Corridor - Marsfield SA2 and Ryde LGA, 2001-2011

Area	2001	2006	2011	Change (2001-2011)		
				No.	%	Avg. Annual
Macquarie Park Corridor - Marsfield (SA2)	17,140	17,847	19,192	2,052	12.0%	1.1%
Ryde (LGA)	94,244	96,765	103,095	8,851	9.4%	0.9%

Note: This table is based on place of enumeration and excludes overseas visitors.
Source: ABS (2012a)

4.2.2 Population Age

Data on the breakdown of age profiles between the SA2 and the LGA indicate significant differences between the two areas. The SA2's population in 2011 is considerably younger with a median age of 33 years compared to 36 years for the LGA. The median age in both areas remained generally stable between 2001 and 2011.

The LGA's older median age is reflected through several key differences in the age profile of local residents when compared to the SA2. In 2011, the SA2 reported a higher proportion of working age residents 20-64 years compared to the LGA (70.1% and 64.0% respectively). Particularly, residents aged between 20-24 years in 2011 were represented almost twice as high in the SA2 compared to the LGA (16.0% and 8.7% respectively). Similarly, the SA2 has a greater proportion of residents in the 25-34 years bracket in 2011 compared to the LGA (21.0% and 16.4% respectively).

The relatively high proportion of young adults in the SA2 is likely explained by the presence of Macquarie University, the fifth largest University in NSW (Universities Australia, 2015), which resides within the SA2's boundaries and attracts a large number of students being accommodated in the area.

Despite its higher median age, a large proportion of residents in the LGA were aged 5-14 years in 2011, compared to the SA2 (10.3% compared to 5.9%).

Table 4.10: Age Brackets, 2001-2011

Age Bracket	Units	Macquarie Park Corridor - Marsfield (SA2)			Ryde (LGA)		
		2001	2006	2011	2001	2006	2011
0-4 years	%	4.6%	4.6%	5.2%	5.9%	5.7%	6.1%
5-14 years	%	8.0%	6.4%	5.9%	11.2%	10.9%	10.3%
15-19 years	%	6.3%	5.1%	5.1%	6.1%	5.7%	5.4%
20-24 years	%	11.9%	15.6%	16.0%	7.6%	8.7%	8.7%
25-34 years	%	21.7%	20.2%	21.0%	16.5%	15.4%	16.4%
35-44 years	%	15.5%	14.0%	13.3%	16.4%	15.8%	14.9%
45-54 years	%	12.1%	11.7%	10.6%	13.2%	13.6%	13.4%
55-64 years	%	7.8%	9.0%	9.2%	8.6%	9.9%	10.5%
65-74 years	%	5.2%	5.5%	5.8%	7.2%	6.6%	6.7%
75-84 years	%	4.2%	4.9%	4.6%	5.3%	5.7%	5.1%
85 years and over	%	2.6%	3.0%	3.4%	1.9%	2.1%	2.4%
Total	**%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Median Age	No.	33.0	33.0	33.0	36.0	37.0	36.0

Note: This table is based on place of enumeration and excludes overseas visitors
Source: ABS (2012a)

4.2.3 Educational Attainment

In 2011, bachelor degree level accounted for the highest proportion of educational attainment amongst residents for both the SA2 and LGA (43.4% and 30.5% respectively).

The SA2, which incorporates Macquarie University, is subsequently characterised by a relatively large proportion of residents with postgraduate degree level education attainment in 2011 compared to the LGA (20.7% and 16.1% respectively).

ITEM 5 (continued) **ATTACHMENT 6**

In 2011, disparity across the areas is most significant for certificate level educational attainment, accounting for only 15.8% of residents in the SA2 compared to 22.0% in the LGA.

Two key patterns have been observed in the changing educational attainment profiles of both areas between 2001 and 2011. First, a significant reduction in the proportion of residents holding a certificate as their highest level of education (down 8.4 percentage points over the period in the SA2 and down 10.4 percentage points in the LGA). Secondly, there has been a significant increase in the proportion of residents with post graduate degree level attainment (up 9.4 percentage points over the period in the SA2 and up 6.2 percentage points in the LGA).

Table 4.11: Educational Attainment, 2001-2011

		Macquarie Park Corridor - Marsfield (SA2)			Ryde (LGA)		
Educational Attainment	Units	2001	2006	2011	2001	2006	2011
Postgraduate Degree Level	%	11.3%	15.6%	20.7%	9.8%	12.7%	16.1%
Graduate Diploma	%	3.9%	3.7%	3.5%	3.9%	3.5%	3.6%
Bachelor Degree Level	%	41.7%	43.1%	43.4%	35.8%	38.9%	40.5%
Advanced Diploma/ Diploma Level	%	19.0%	19.5%	16.7%	18.0%	19.0%	17.8%
Certificate	%	24.1%	18.1%	15.8%	32.4%	25.9%	22.0%
Total	**%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Note: Graduate Diploma also includes Graduate Certificate Level
Note: This table is based on place of enumeration and is applicable to persons aged 15 years and over.
Source: ABS (2012a)

4.2.4 Household Composition and Ownership

An analysis of household structure is important to understand the household types that are attracted to the SA2 in comparison to the LGA.

- In 2011, the SA2 comprised of primarily family households (55.2% of all households), consistent with 2001.
- The proportion of lone person households has also remained relatively consistent over the period, at 29.6% in 2011.
- The LGA has experienced a marginal increase in family households as a proportion of total households, from 65.8% in 2001 to 66.8% in 2011. While a marginal decrease in lone person households, from 25.3% in 2001 to 24.3% in 2011.
- Group households have reported the highest growth rate between 2001 and 2011 for both areas. Group households have grown by an annual average rate of 1.8% in the SA2 over the period, compared to 1.3% for the LGA. In 2011, group households accounted for approximately twice the proportion of total households in the SA2 compared to the LGA (10.1% and 5.1% respectively).
- Growth in overall households between 2001 and 2011 has generally been higher for the LGA compared to the SA2 (0.6% and 0.2% respectively).
- In terms of household ownership, the SA2 reported a greater proportion of households rented, compared to the LGA. This disparity has declined slightly since 2001 but remains significant in 2011 with 45.9% of SA2 households rented, compared to 35.0% in the LGA. The LGA has traditionally reported a higher proportion of households owned outright, although this has declined considerably since 2001 in both the LGA and SA2.

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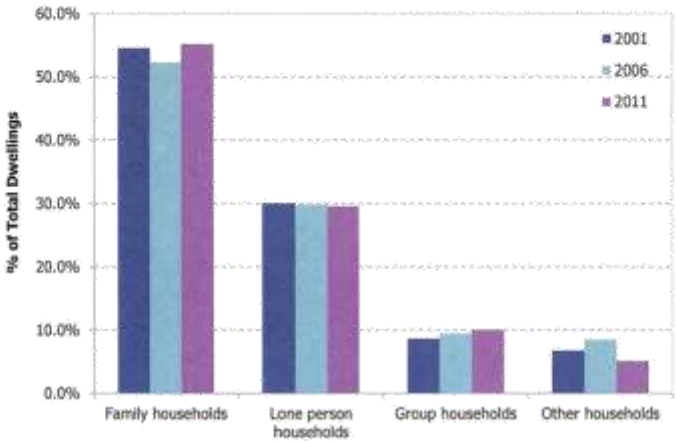
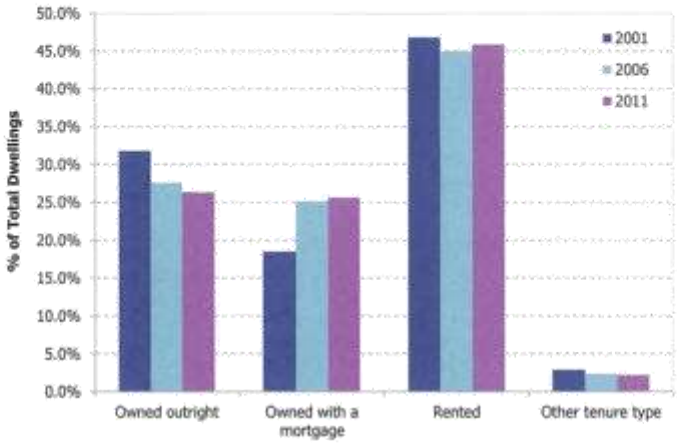
Figure 4.4: Household Composition, Macquarie Park Corridor-Marsfield SA2, 2001-2011



Source: ABS (2012a)

Figure 4.5: Household Ownership, Macquarie Park Corridor-Marsfield SA2, 2001-2011



Source: ABS (2012a)

4.2.5 Dwelling Structure

The SA2 has a considerably different dwelling structure mix compared to LGA:

- In 2011, the SA2 reported a significantly higher proportion of flat, unit or apartments (almost half of all dwellings at 44.9%) compared to LGA (32.6%).
- While the inverse is true for separate houses with the LGA reporting 52.1% of all dwellings being separate houses in 2011 compared to the SA2 (21.8%).
- Growth across dwelling structures in the SA2 has remained relatively flat between 2001 and 2011, with only flat, unit or apartment reporting a marginal annual average growth of 0.5%. While the LGA reported growth in semi-detached, row or terrace house, townhouses as well as flat, unit and apartment (average annual growth of 2.0% and 1.6% respectively over the period).

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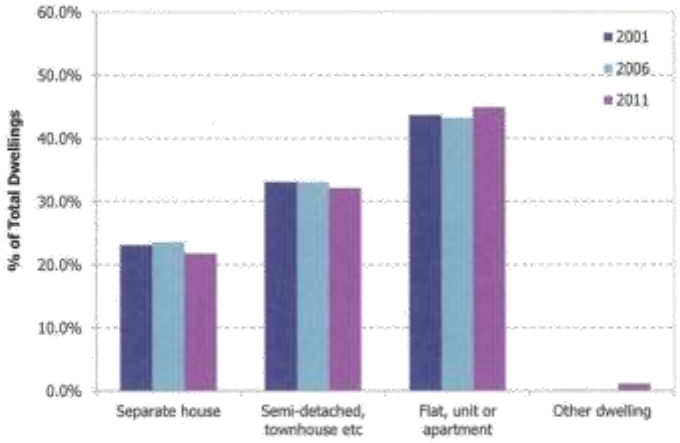
Figure 4.6: Dwelling Structure, Macquarie Park Corridor-Marsfield SA2, 2001-2011



Note: Semi-detached, townhouses etc includes row and terrace houses
Source: ABS (2012a)

4.2.6 Household Income

In 2011, the actual median household income in SA2 ($1,351 per week) is below the LGA's ($1,462 per week). Median household incomes in the LGA have grown at a slightly higher annual growth rate compared to the SA2 between 2001 and 2011 (3.6% and 2.6% respectively).

Table 4.12: Total Household Income (Weekly), 2001-2011

		Macquarie Park Corridor - Marsfield (SA2)			Ryde LGA		
Household Income	Units	2001	2006	2011	2001	2006	2011
Negative/Nil income	%	3.5%	8.5%	8.3%	2.6%	4.5%	4.9%
$1-$199	%	5.6%	3.4%	3.5%	5.4%	2.5%	2.4%
$200-$299	%	6.0%	8.1%	4.5%	6.4%	7.8%	4.5%
$300-$399	%	5.3%	6.1%	5.8%	5.9%	6.6%	5.8%
$400-$599	%	9.5%	8.8%	7.2%	12.0%	10.8%	7.9%
$600-$799	%	10.5%	8.9%	6.1%	12.9%	10.0%	7.9%
$800-$999	%	10.7%	7.8%	6.9%	11.0%	8.6%	8.3%
$1,000-$1,249	%	15.6%	13.0%	8.1%	13.4%	13.2%	9.6%
$1,250-$1,499	%	6.0%	8.8%	8.6%	6.4%	8.3%	8.8%
$1,500-$1,999	%	16.3%	10.9%	14.0%	13.9%	11.0%	13.1%
$2,000-$2,499	%	6.9%	5.9%	9.8%	6.0%	6.4%	8.9%
$2,500-$2,999	%	3.0%	6.3%	10.2%	2.7%	6.3%	9.2%
$3,000 or more	%	1.1%	3.5%	6.9%	1.4%	4.0%	8.7%
Total	**%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Median Household Income	$/week	$1,043	$1,126	$1,351	$1,023	$1,180	$1,462

Note: This table is based on place of enumeration
Source: ABS (2012a)

4.2.7 Employment

For comparison purposes, place of enumeration data has been used to approximate the employment profile of residents in the SA2 and LGA.

Key changes in the employment profile for people residing in the two areas across the census years 2001, 2006 and 2011 have been:

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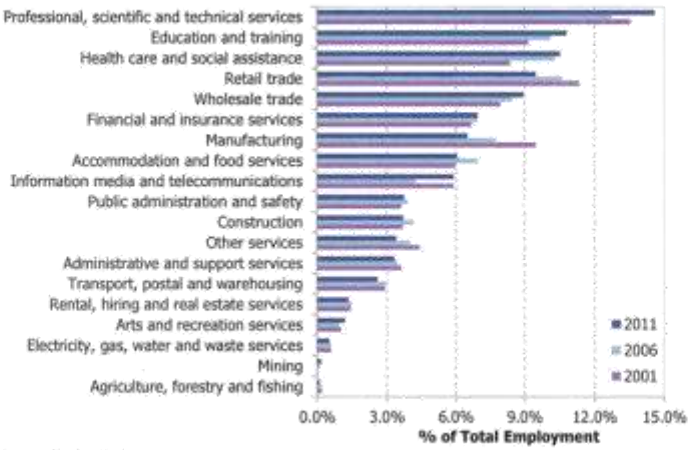
- In line with the national trend, there has been a significant increase in those employed in the health care and social assistance industry as a proportion of total employment. For the SA2, those employed in the health care and social assistance industry have increased from 8.4% of total employment, in 2001, to 10.5% in 2011 (compared to 9.8% and 11.8% respectively for the LGA).
- Another industry which has grown strongly over the period, in terms of its proportion of total employment for both areas, has been education and training. For the SA2, those employed in the education and training industry have increased from 9.2% of total employment in 2001 to 10.8% in 2011 (compared to 8.0% and 8.9% respectively for the LGA).
- In line with the national trend, there has been a significant reduction in those employed in the manufacturing industry. For the SA2, those employed in the manufacturing industry have declined from 9.5% of total employment in 2001 to 6.5% in 2011 (compared to 9.2% and 6.8% respectively for the LGA).
- A similar trend has been observed in the retail trade industry with employment declining from 11.4% in 2001 to 9.5% in 2011 for the SA2, while for the LGA, 10.6% to 9.6% respectively.

Figure 4.7: Employment by Industry, Macquarie Park Corridor-Marsfield SA2, 2001-2011



Source: ABS (2012a)

4.3 Need for the Proposal

The Macquarie Park workforce comprises a broad industry mix, with a relatively high concentration of white collar dominated industries, such as professional, scientific and technical services and information, media and telecommunications. Therefore, this leads to a higher proportion of white collar occupations, such as professionals and managers who are on considerably high incomes.

Although some 27% of workers in Macquarie Park earn more than 104,000 per annum, a large proportion of workers (44%) earn less than $52,000 per annum. The lower income workers would be the key beneficiaries of key worker and affordable housing on the Site.

Furthermore there would appear to be a misalignment of skills between Ryde residents and workers in Macquarie Park, the former more focused on service jobs. The inclusion of service and supporting sectors in Macquarie Park Corridor will not only provide amenity to the business park and contribute to its overall vitality and health, it would also provide more opportunities for local employment.

This section demonstrates a significant proportion of the resident and worker population are low income earners and as such are need of more affordable housing options.

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5. Economic Trends and Drivers

The Macquarie Park Corridor is positioned on a new growth trajectory, with significant growth in residents and employment expected to further strengthen its importance and significance as one of Sydney's economic engine rooms and Sydney's second largest commercial office precinct after the Sydney CBD.

Despite there being a range of economic benefits associated with population and employment growth, there are challenges associated with urban renewal and growth. In urban planning terms, it is well accepted that growth puts pressure on infrastructure needs.

This Chapter investigates the economic trends and drivers influencing business parks, how occupier requirements are transitioning and what this means for Macquarie Business Park.

5.1 The Evolution of Business Parks

Over the past number of decades, business parks have transitioned from accommodating warehousing and light manufacturing uses to include office uses in greater proportions.

As the proportion of office space provided in business parks increases and further to their location outside or on the fringe of the city, there is a growing need to provide a greater range of amenities for workers. This includes, *inter alia*, shops, restaurants, childcare centres, medical services, retail facilities and recreational space as well as housing in close proximity.

Business parks are beginning to resemble a CBD in many ways, combining a retail offer of shops, restaurants, banks and travel agencies as well as a recreational offer of gyms, swimming pool and playing fields. The availability of housing options in close proximity to accommodate the worker population is also an important factor.

5.1.1 Occupier/Tenant Requirements

As businesses continue to evolve in order to be competitive in the face of global and national pressures, the primary focus for accommodation selection is to reduce cost and increase efficiencies.

Businesses recognise that in order to keep their cost base lean, they need to ensure their largest cost element (i.e. employees) is effectively managed. Ensuring that employees are satisfied and happy in their working environment will not only assist staff retention rates but improve staff productivity levels. On this basis, worker amenity and employee wellbeing are critical factors that have come to the fore in recent years.

Worker Amenity

"Worker amenity" demanded by industry is over and above statutory requirements, more akin to those which are deemed social infrastructure items, i.e. childcare, gyms, public recreation space, etc.

Annual office tenant surveys are instrumental in identifying trends in tenants' leasing decision making with recent surveys indicating that overwhelmingly, occupier needs are focused on cost-cutting and achieving workspace efficiencies (Colliers International, 2012). That said, there is increasing importance placed on location selection for attracting and retaining staff and with a focus on staff health and employee wellbeing.

Employee Wellbeing

In addition to worker amenity, social research shows that greenspace in business parks is no less important for amenity and wellbeing (Gilchrist, Brown and Montarzino, 2014). The use of greenspace and visual access to them supports employee wellbeing, thus positively related to job performance and productivity.

Corporations are increasingly placing more importance on employee wellbeing. Employee satisfaction and wellbeing are seen as key factors in workplace productivity and retention of staff. This in turn has shaped how businesses select locations and configure their work space (Colliers International, 2012).

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Proximity of Housing

A number of key factors influence residential location choice, one of these is proximity to work. Research suggests that the time it takes to get to work is just as important as the job itself (Oxford Properties and Environics Research Group, 2013):

- 76% of respondents wanted a reasonable commute to the office. The majority of those surveyed said a commute time of less than 30 minutes was the appropriate travel time.
- 50% of respondents considered commute time to be the No. 1 factor in choosing one employer over another.
- The survey also found that once at the office, workers sought space that allowed them to work collaboratively with other employees, is close to shops and other amenities and is energy-efficient.

5.2 Macquarie Business Park: Present and Future

A Plan for Growing Sydney identifies that Macquarie Park Corridor sits in the Global Economic Corridor. The Plan identifies, *inter alia*, the following priorities:

- Work with council to retain a commercial core in Macquarie Park Corridor for long-term employment growth.
- Work with council to concentrate capacity for additional mixed-use development around train stations, including retail, services and housing.
- Investigate potential future opportunities for housing in areas within walking distance of train stations.

Since the completion of the Epping to Chatswood Rail Link in 2009 which resulted in the opening of three new stations (North Ryde, Macquarie Park Corridor and Macquarie University), the profile of Macquarie Park Corridor and its surrounds has lifted significantly.

Some 215,000sqm of new office space has been completed since January 2009 with strong residential growth driven on several fronts: increased appeal of the area, desire for workers to live close to their place of work and growth in Macquarie University's enrolment activity.

Future employment and residential growth expectations are equally strong with coordinated planning by state and local governments leading to significant development projects in the pipeline.

The NSW Bureau of Transport Statistics (BTS) forecasts that the population in Macquarie Park Corridor will increase by 15,358 persons and increase by 12,872 employees by 2031, representing an increase of 770% and 28% respectively from 2011.

Broadly, Macquarie Park Corridor's continued growth will be driven on three key fronts:

- **Macquarie Business Park**
  There is some 450,000sqm of commercial/retail floorspace in the pipeline in the business park and commercial core.
- **Herring Road and North Ryde Station priority precincts**
  The Herring Road Precinct has the potential to deliver 5,400 dwellings by 2031 and potentially 12,000 should all sites be developed. The North Ryde Station Precinct has the potential deliver 2,400 dwellings.
- **Macquarie University's growth plans**
  The university's growth over the last decade has been impressive, with growth in the 2003-2010 period amongst the highest of Australian universities.

  Macquarie University has significant expansion plans. A concept plan was approved for 400,000sqm of floorspace outside the Academic Core, 61,200sqm of floorspace within the Academic Core and 3,450 additional beds within the University Housing precinct.

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5.3 Need for the Proposal

The nature and composition of business parks has changed over the last two decades. A range of uses are now incorporated into business parks as worker convenience and amenity are of increasing importance for businesses and occupiers. Business parks increasingly aspire to provide the offer of a CBD location, Macquarie Business Park is no exception.

In addition to residential-driven demand, increasingly, employment hubs such as business parks are responding to demand from employers and employees for amenities such as recreational open space and childcare facilities. Flexible and inviting workplaces that are not only engaging within but engaging with the surrounding public domain are highly valued by business and occupiers.

The next chapter examines how these critical items of social infrastructure are planned for and delivered in Macquarie Park Corridor.

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6. Social Infrastructure Needs Assessment

This chapter assesses the need for social infrastructure in the Macquarie Park Corridor and analyses the effectiveness of the mechanisms in place which can fund this infrastructure.

Social infrastructure is the interdependent mix of facilities, places and spaces, programs that maintain and improve the standard of living and quality of life in a community. Social infrastructure includes: open space, child care centres, affordable housing, libraries and education facilities (i.e. TAFE).

6.1 Need for Social Infrastructure

It is well accepted that population growth drives the need for social infrastructure provision. As the resident population grows so too does demand for social infrastructure. Industry benchmarks based on resident population thresholds are often used in estimating the need for open space and community facilities.

In addition to resident-driven demand, increasingly, employment hubs such as business parks are responding to demand from employers and employees for amenities such as recreational and childcare facilities.

Whilst there is an abundance of literature on the relationship between residents and their social infrastructure needs, there appears to be a gap with regard to workers and *their* social infrastructure needs (with the exception of childcare provision).

6.1.1 Open Space

A common way of ascertaining social infrastructure requirements is by using planning benchmarks. There are some broadly accepted standards with regard to open space and social infrastructure which are widely used. However, there are two main challenges with using these standards.

- They have been developed to identify demand generated by *residents*, rather than workers.
- They are generic in nature and accordingly there are limitations with the standards themselves and how they have been derived.

In NSW the 'fixed' standard of 2.83ha of open space per 1,000 people is often applied. However, it should be noted that this standard is derived from the British seven acres per 1,000 residents standard from the early 1900's, which is considered to be outdated for contemporary planning, as it largely ignores that different types of open space is required to accommodate different needs.

The NSW Department of Planning conducted a study which found that the simple fixed, quantitative standard should be treated with caution given observed rates of provision in different parts of metropolitan Sydney.

Table 6.1 shows that about 5% of inner urban Sydney is classified as open space. If the 2.83 ha per 1,000 people standard was applied about 16% of inner urban Sydney would be devoted to open space. The reality is that the residents of inner urban Sydney have access to a range of recreational and leisure opportunities that the existing open space assets (including high quality urban public spaces and harbour and beach foreshores) manage to deliver (though there may be some pressure on outdoor sports areas).

In contrast, in suburban inner areas average actual provision is equivalent to the standard-derived provision while suburban outer areas demonstrate a reverse situation. Macquarie Park Corridor is considered a 'middle ring suburb' and hence a cross between the quoted "suburban inner" and "suburban outer" as depicted below.

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Table 6.1: Comparison of Actual Provision v Standard-derived Provision

Geographical Context	Percentage of Urban Residential Areas	
	Average Actual Provision	Provision based on 2.83ha/1,000 persons
Inner urban	5%	16%
Suburban inner	10%	10%
Suburban outer	26%	8%

Source: DoP, 2010

Chapter 5 outlined the evolution of business parks to incorporate a varied and mix of uses as the proportion of office space in business parks increases and occupier/tenant requirements evolve to demand more worker amenity and access to social infrastructure. Flexible and inviting workplaces that are not only engaging within but engaging with the surrounding public domain are highly valued by businesses and occupiers.

It would appear that by considering only resident-driven demand, open space standards have failed to keep pace with the evolution of business parks and the increase in amenity and social infrastructure requirements of businesses/employees.

6.1.2 Childcare Facilities

When looking at benchmarks for childcare provision, it is important to both establish and contrast *resident population* need and *worker population* need. The section below sets out industry used benchmarks to establish the need for childcare provision.

Resident Population

An analysis of ABS data of childcare demonstrates that the proportion of those aged 0-5 who attend formal childcare (i.e. long day care, family day care or occasional care) is in the order of 36.2% nationwide (ABS, 2014). Accurate data on pre-school enrolments can be difficult to obtain and there is uncertainty within the industry regarding its accuracy. However, ABS data demonstrates that in NSW 23% of children aged 0-5 years attend pre-school (ABS, 2014).

By combining the 2011 national proportion of children attending Long Day Care, Family Day Care, and Occasional Care and the proportion of children attending preschools in NSW, a total National/State benchmark of 60% of all children aged 0 to 5 attending some sort of formal care in 2011 can be established.

By way of comparison, the City of Sydney sets an aspirational benchmark of 80% of all children aged 0 to 5 years needing access to care. Based on current enrolments, State and National benchmarks (ABS Census) and the long waiting lists and outcomes of discussions with childcare providers, this seems like a reasonable comparative benchmark for the Ryde LGA.

Within the Ryde LGA there are 7,521 children aged 0-5 years (in 2011). Based on a benchmark of 80%, the LGA would needs 6,016 childcare places.

Worker Population

A Study conducted by Cred Community Planning (Cred Community Planning, 2013) for the City of Sydney in 2013 recommended several benchmarks be applied for worker/childcare provision:

- In Sydney CBD - 1 place for every 195 workers.
- Within the Village Groups (i.e. the areas surrounding the core of the Sydney CBD i.e. Crown and Baptist Street, Glebe Point Road and Oxford Street) - 1 place for every 75 workers.

Given Macquarie Park's status as a suburban commercial market, it is considered appropriate to apply the benchmark for the Village Groups. Based on the 1 place per 75 workers benchmark and based on 40,450 workers in 2011, Macquarie Park would be in need of 539 places to meet worker need.

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By applying childcare planning benchmarks to both resident population of Ryde LGA and worker population in Macquarie Park (as at 2011), there is existing demand for 6,016 childcare places across the LGA and 539 places in Macquarie Park. This does not consider future demand.

6.1.3 Key Worker Housing

Key worker housing is often used interchangeably with the term affordable housing. Key workers are the people in our community who are essential to our way of life but who usually do not earn a high income. This would include people such as nurses, teachers, police officers and other minimum wage workers in supermarkets, hospitality and so on. Common government indicators say that housing is affordable when a household does not have to spend more than 30% of their income to meet their housing costs. On that indicator many "key workers" struggle to find housing that they can afford.

Key worker housing can mean different things to different people and in different contexts, but is usually referred to by Housing Plus (Housing Plus, 2015) in terms of the cost of housing in comparison to other living expenses and household income. Key worker housing is accommodation which:

- Is reasonably adequate in standard and location for a lower or middle-income household; and
- Does not cost so much that such a household is unlikely to be able to meet other basic living costs on a sustainable basis.

Housing affordability is a function of incomes, property prices and interest rates. As property prices increase amid stagnant or falling income levels, affordability declines, i.e. fewer people are able to afford to purchase a home. To better understand the issue of housing affordability in Ryde LGA, the table below profiles household income bands and measures how much households can afford to spend on housing cost, whether rental or mortgage cost.

Worker Population

The Macquarie Park workforce comprises a broad industry mix, with a relatively high concentration of white collar dominated industries, such as professional, scientific and technical services and information, media and telecommunications. Therefore, this leads to a higher proportion of white collar occupations, such as professionals and managers who are on considerably high incomes.

Table 6.2: Income, Place of Work, 2011

Income	Macquarie Park Corridor - Marsfield SA2	Ryde LGA
	Percentage (%)	Percentage (%)
$0-$7,799	3.2%	4.4%
$7,800-$12,999	2.1%	3.0%
$13,000-$20,799	2.5%	3.5%
$20,800-$31,199	5.7%	8.0%
$31,200-$41,599	8.5%	10.4%
$41,600-$51,999	9.9%	10.7%
$52,000-$67,599	12.1%	12.1%
$67,600-$83,199	11.4%	10.4%
$83,200-$103,999	17.3%	15.1%
$104,000 or more	27.3%	22.4%
Total (%)	**100.0%**	**100.0%**
Average Income	**$70,409**	**$64,445**

Note: average income differs to that identified in 'Journey to Work' given the different level of geographies (Macquarie Park Corridor-Marsfield SA2/Ryde LGA) and sources (BTS/ABS respectively) used
Source: BTS (2014)

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Table 6.2 shows that although 27.3% of workers in Macquarie Park earn more than $104,000 per annum, a large proportion of workers (56%) earn less than $68,000 per annum. These lower income workers would be the primary beneficiaries of key worker housing provided on the Site.

Resident Population

The highlighted rows indicate the affordability thresholds associated with SA2 and Ryde LGA's average household income band ($70,525 and $76,024 per annum respectively), households have the capacity to purchase dwellings which are between $363,150-$389,089. This well below the median unit price in the Ryde LGA which is $630,000 (FACS, 2015).

Table 6.3: Household Income and Housing Affordability

Household Income	Household Income (weekly)	Rental (% of income)	Weekly Rental	Ownership (% income)	Monthly	Principal Loan	Deposit	Home Affordability
$20,000	$385	25%	$96	30%	$500	$70,743.45	$7,074	$77,818
$25,000	$481	25%	$120	35%	$729	$103,168	$10,317	$113,484
$30,000	$577	26%	$150	35%	$875	$123,801	$12,380	$136,181
$35,000	$673	27%	$182	37%	$1,079	$152,688	$15,269	$167,957
$40,000	$769	28%	$215	38%	$1,267	$179,217	$17,922	$197,138
$45,000	$865	30%	$260	40%	$1,500	$212,230	$21,223	$233,453
$50,000	$962	30%	$288	40%	$1,667	$235,812	$23,581	$259,393
$55,000	$1,058	30%	$317	40%	$1,833	$259,393	$25,939	$285,332
$56,368	$1,084	30%	$325	30%	$1,409	$199,383	$19,938	$219,322
$56,368	$1,084	30%	$325	40%	$1,879	$265,844	$26,584	$292,429
$60,000	$1,154	30%	$346	40%	$2,000	$282,974	$28,297	$311,271
$65,000	$1,250	30%	$375	40%	$2,167	$306,555	$30,655	$337,210
$70,000	$1,346	30%	$404	40%	$2,333	$330,136	$33,014	$363,150
$75,000	$1,442	30%	$433	40%	$2,500	$353,717	$35,372	$389,089
$80,000	$1,538	30%	$462	40%	$2,667	$377,298	$37,730	$415,028
$85,000	$1,635	30%	$490	40%	$2,833	$400,880	$40,088	$440,968
$90,000	$1,731	30%	$519	40%	$3,000	$424,461	$42,446	$466,907
$95,000	$1,827	30%	$548	40%	$3,167	$448,042	$44,804	$492,846
$100,000	$1,923	30%	$577	40%	$3,333	$471,623	$47,162	$518,785
$105,000	$2,019	30%	$606	40%	$3,500	$495,204	$49,520	$544,725
$110,000	$2,115	30%	$635	40%	$3,667	$518,785	$51,879	$570,664
$115,000	$2,212	30%	$663	40%	$3,833	$542,366	$54,237	$596,603
$120,000	$2,308	30%	$692	40%	$4,000	$565,948	$56,595	$622,542
$125,000	$2,404	30%	$721	40%	$4,167	$589,529	$58,953	$648,482
$130,000	$2,500	30%	$750	40%	$4,333	$613,110	$61,311	$674,421
$135,000	$2,596	30%	$779	40%	$4,500	$636,691	$63,669	$700,360
$140,000	$2,692	30%	$808	40%	$4,667	$660,272	$66,027	$726,299
$145,000	$2,788	30%	$837	40%	$4,833	$683,853	$68,385	$752,239
$150,000	$2,885	30%	$865	40%	$5,000	$707,435	$70,743	$778,178
$155,000	$2,981	30%	$894	40%	$5,167	$731,016	$73,102	$804,117
$160,000	$3,077	30%	$923	40%	$5,333	$754,597	$75,460	$830,056

*Note that proportion of income for home ownership is increased for higher income bands, higher income households having the ability to contribute a larger proportion of their income to mortgage payments without compromising on their quality of life.
Source: ABS (2011), AEC assumptions: 10% deposit, 7% interest rate, 25 year loan term

Table 6.4 tests the specific ability for Ryde LGA residents to pay for housing. Household income bands are tested for capacity and affordability thresholds.

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Table 6.4: Resident Household Incomes and Affordability Thresholds

Household Income	Household Income (weekly)	Incomes Distribution	Rental Income (% income)	Weekly Rental	O'ship (% income)	Monthly	Principal Loan	Deposit	Home Affordability
$20,748	$399	12.83%	25%	$100	30%	$519	$73,389	$7,339	$80,728
$31,148	$599	8.00%	25%	$150	35%	$908	$128,538	$12,854	$141,392
$41,548	$799	7.15%	26%	$208	35%	$1,212	$171,456	$17,146	$188,602
$51,948	$999	7.38%	27%	$270	37%	$1,602	$226,624	$22,662	$249,286
$64,948	$1,249	8.08%	28%	$350	38%	$2,057	$290,994	$29,099	$320,094
$77,948	$1,499	7.56%	30%	$450	40%	$2,598	$367,621	$36,762	$404,383
$103,948	$1,999	12.18%	30%	$600	40%	$3,465	$490,243	$49,024	$539,267
$129,948	$2,499	8.90%	30%	$750	40%	$4,332	$612,865	$61,286	$674,151
$155,948	$2,999	11.0%	30%	$900	40%	$5,198	$735,487	$73,549	$809,035
$181,948	$3,499	7.05%	30%	$1,050	40%	$6,065	$858,109	$85,811	$943,920
$207,948	$3,999	3.54%	30%	$1,200	40%	$6,932	$980,731	$98,073	$1,078,804
$208,000	$4,000	6.34%	30%	$1,200	40%	$6,933	$980,976	$98,098	$1,07[illegible]

Source: ABS (2011), AEC assumptions: 10% deposit, 7% interest rate, 25 year loan term

The following observations emerge:

- More than 63% of households in Ryde LGA cannot afford a dwelling greater than $600,000 (highlighted rows).
- At a price of $735,000, a 2-bedroom unit is within reach of only 28% of residents.
- At a price of $980,000, a 3-bedroom unit is within reach of only 6% of residents.

This analysis demonstrates that the issue of housing affordability is equally a critical one for the residents of Ryde LGA.

Housing Affordability

While information on specific occupations at various income bands is not available for workers in Macquarie Park, based on known average annual salaries for select occupations[2], it would be reasonable to conclude the 56% of workers in Macquarie Park who earn less than $68,000 are 'key workers'.

At these income levels, the analysis demonstrates there is a clear need for affordable housing options for both workers in Macquarie Park and residents of Ryde LGA.

6.2 Existing Provision of Social Infrastructure

This section considers existing provision of social infrastructure, making comparison to the assessed need as outlined in section 6.1.

Ryde Council has undertaken analysis of current open space provision in the LGA while AEC has undertaken an assessment of existing childcare provision. The findings of this research are outlined below.

6.2.1 Public Open Space

According to the Ryde Integrated Open Space Plan (Ryde Council, 2012), the Ryde LGA contains 355ha of open space while the suburb of Macquarie Park Corridor (which very closely aligns with the Macquarie Park Corridor Business Park) contains 17.6ha of open space.

[2] For example, nurses at average salary of $63,440, baristas at average salary of $21,996 (ABS, 2014b)

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Based on the standard of 2.83 ha per 1,000 people, the amount of open space currently required in the LGA is around **307.67ha** of open space. The LGA currently contains **355ha** of open space, so on the face of it would appear to be meeting resident population demand.

However after considering the substantial population growth *and* employment growth expected to 2031 (additional 44,306 residents and 25,595 workers respectively), there is no doubt the Ryde LGA and indeed Macquarie Park Corridor will require more open space.

Figure 6.1 visually shows the quantum of open space in each suburb within the Ryde LGA.

Macquarie Park is among those catchments that have relatively low provision of open space per 1,000 persons. Note that the provision of open space is calculated on a per capita resident basis, not taking into account the 40,000 worker population in Macquarie Park.

Figure 6.1: Ryde LGA Open Space Provision

NB. these figures include Level 1 open space and should be considered in conjunction with distribution and access (Refer to Figure IP.01) to gain a full understanding of Level 4 open space sufficiency

Source: Ryde Council (2012)

The Open Space Plan suggests there is presently an open space deficiency in the Macquarie Park Corridor that will be exacerbated by planned (*residential*) growth. The Plan further indicates that **two new major reserves** suitable for active and passive

recreation and several smaller open space areas are needed to support planned growth in Macquarie Park Corridor.

While Council's Open Space Plan identifies two new major reserves are needed to meet demand from future residential growth, this conceivably *understates* demand for open space from worker population growth, particularly in Macquarie Park.

6.2.2 Childcare Facilities

Within the Ryde LGA there are 7,521 children aged 0-5 years. Based on the analysis and adopting the benchmarks in **section 6.1.2**, the LGA should provide 6,016 places. However, a desktop audit conducted of childcare facilities and childcare places in the LGA found that the LGA currently provides 5,465 places, as such suggesting the LGA is undersupplied.

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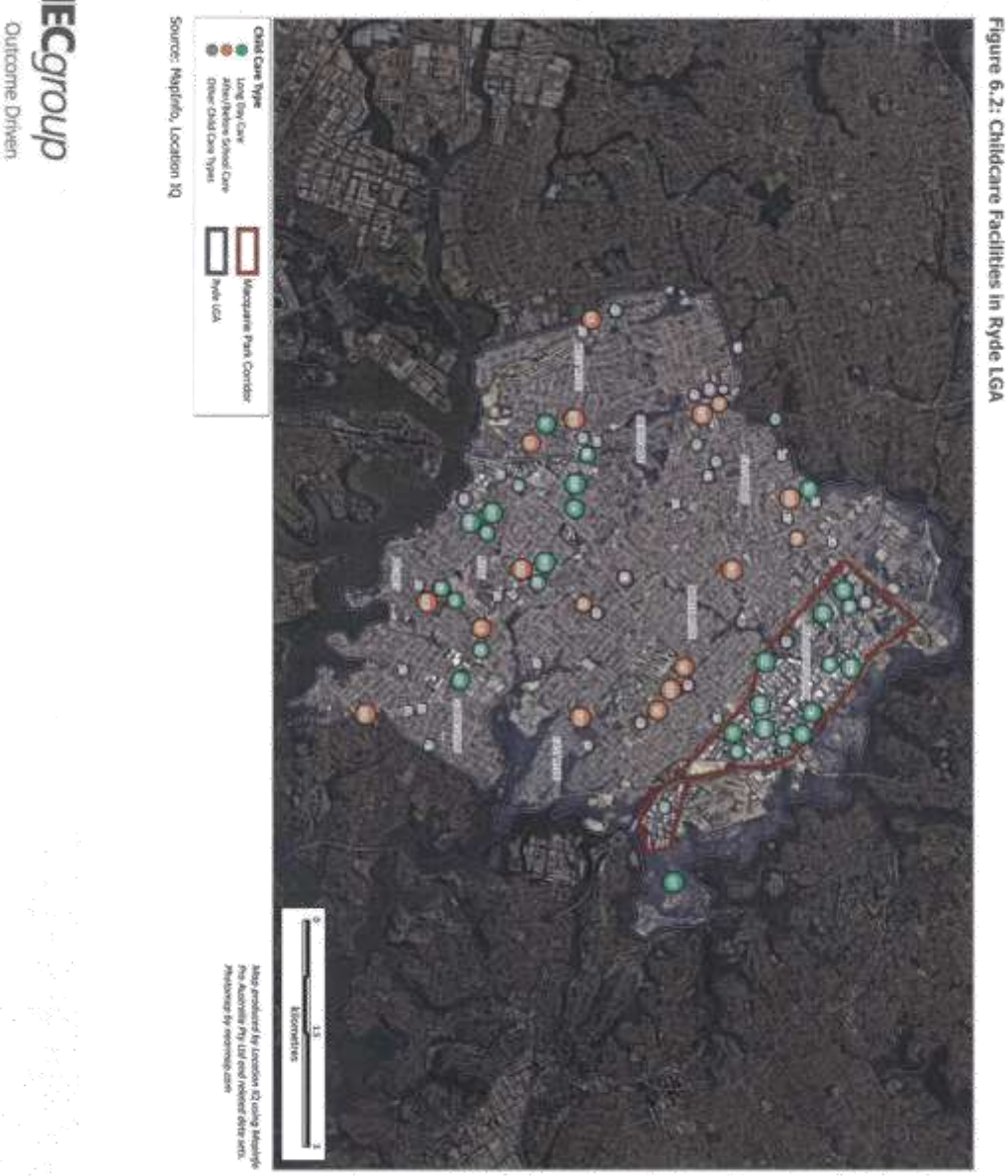

Source: MapInfo, Location IQ

Figure 6.2: Childcare Facilities in Ryde LGA

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Figure 6.2 depicts the location of current childcare facilities in Ryde LGA and Macquarie Park Corridor. Long day care facilities generally characterise existing childcare provision in Macquarie Park.

Based on a planning benchmark for workers, Macquarie Park Corridor is in need of 539 places to service the 40,450 workers. A desktop audit of existing childcare facilities indicates there are currently 525 childcare places in Macquarie Park Corridor, which represents a slight shortfall in childcare places required.

This analysis would suggest there is a current shortfall in childcare places provided in Ryde LGA and Macquarie Park Corridor. This shortfall will be amplified amid forecast population and employment growth.

It is estimated that by 2031 there will be 9,400 children aged 0-5 years across the LGA who will in turn demand 7,520 childcare places. This represents 2,055 places more than currently provided.

By 2031, the worker population in the Macquarie Park Corridor is expected to be in the order of 58,709 and will demand 783 childcare places. This is equates to 258 more places than currently provided.

6.2.3 Key Worker Housing

Housing that is within the financial capability of households is important for both residents and workers.

As Macquarie Park Corridor grows (significant employment growth as forecasted) and the number of jobs therein increases, the proportion of jobs for skilled, white collar workers will increase over time. There will also be an increase in the number of workers on lower incomes as new businesses and workers will generate demand for support services generally staffed by lower income earners. Examples of these support services employ childcare workers, retail and hospitality workers, cleaning workers, etc. Collectively, these lower income earners who are integral to the successful operation of employment hubs such as Macquarie Park Corridor are generally referred to as 'key workers'.

More specific to the Site and essential for supporting growth in Macquarie Park Corridor, the provision of key worker housing will be critical.

The City of Sydney Council recognises that in major employment centres (e.g. Sydney CND, Green Square Employment Lands) the provision of affordable housing is critical to the sustainability and long term health of these economies. Various affordable housing policies apply in select areas of the Sydney LGA wherein monetary contributions or contributions in-kind are sought for affordable housing outcomes.

Ryde City Council does not have an official affordable/key worker housing policy. In locations of significant employment hubs such as Macquarie Park, strategic and organised methods for procuring affordable housing/key worker housing is critical.

6.3 Delivering Required Social Infrastructure

The delivery (funding) of public infrastructure has changed significantly over the past few decades, the burden shifting from government budgets to an array of public-private arrangements and user pays charges. The various methods of funding infrastructure are collectively known as the development contributions system, broadly including mechanisms such as s94 and s94A development contributions, affordable housing contributions, special infrastructure contributions and planning agreements.

This section explores the various methods available for funding and delivering the social infrastructure required to support Macquarie Park's growth and sustain its competitive position.

Statutory Mechanisms

Statutory mechanisms are aimed at facilitating the provision of 'incremental' infrastructure, i.e. as new development occurs.

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- **Section 94 development contributions**
  These contributions can only be imposed following the preparation of a contributions plan which details the local infrastructure needed and draws the nexus between infrastructure need and new development. In recent years these contributions have been capped ($20,000 in established areas and $30,000 in greenfield areas).
- **Section 94A development levy**
  This was introduced to allow development contributions to be levied in areas of sporadic development, e.g. regional areas where development is slow/sporadic and established urban areas where development is mainly 'infill' and sporadic in nature.

  Imposition of a percentage levy on development does not require councils to prepare a contributions plan akin to s94, particularly due to the nexus required to be established under s94 between development and increased demand for public amenities and public services. A s94A development contributions plan is still required, and which outlines the priorities for the expenditure of the contributions with reference to a works schedule.
- **Planning agreements**
  Negotiated between a developer and consent authority, often where there is no contributions plan or if a change to planning controls is sought (e.g. land use zone, density).
- **Affordable housing levy**
  Levy payable to council in designated areas where the availability of affordable housing is reduced or development results in a need for affordable housing.
- **Special infrastructure contribution**
  Applicable in the growth centres.

Statutory mechanisms are generally centred on the principle of inclusionary zoning, where mandatory contributions are 'included' for all development within a defined area.

These statutory mechanisms were designed to facilitate provision of local infrastructure on an incremental basis and are generally effective where new infrastructure need is predictable, easily identified and quantified.

They are less effective in circumstances of urban renewal development where the required infrastructure is less 'local' in nature and/or where existing infrastructure may require augmentation due to age or is inadequate by contemporary planning standards. It is for these reasons that many local councils are increasingly relying on incentive-based infrastructure funding mechanisms.

Incentive-based Mechanisms

Incentive-based infrastructure funding mechanisms can be incredibly effective if conceived and implemented well, as demonstrated by the Green Square Community Infrastructure Floorspace (formerly known as the Green Square Bonus FSR System).

Since its implementation over a decade ago, significant public domain and community infrastructure works have been delivered in Green Square. Today, the Sydney DCP 2012 outlines a list of "community infrastructure" that can be delivered in exchange for, subject to a merits assessment, "additional floorspace" in Green Square. These community infrastructure items include public streets, pedestrian and bike networks and public open spaces.

The large scale renewal of Green Square (led by and cross-subsidised by the residential market) has been effective in delivering substantial amounts of community infrastructure. *But for* the permissibility of residential uses in Green Square, the rate of infrastructure delivery would conceivably have been much slower.

Most recently, the City of Sydney has recognised that the rezoning of the Green Square Employment Lands from industrial to mixed business uses will result in an increased need for affordable housing in the area. To this end, The City has put in place an incentive-based approach to procure affordable rental housing in "Investigation Areas". This includes leveraging the residential market to cross-subsidise the provision of new affordable housing units.

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The strength of the residential market in recent years has been unparalleled. This is due to a combination of factors, including a low supply period over the 2004-2008 period which resulted in severe pent-up demand. The strength of this property market has been harnessed effectively in Green Square where The City has obtained a significant level of public benefit in new and renewed infrastructure, and seeks to continue to do so for affordable housing outcomes in the employment lands.

Delivery of public benefit in areas that are non-residential in nature is expected to be more incremental and not to the same rate of delivery as witnessed in Green Square. The Macquarie Park Corridor Planning Proposal, whilst seeking to deliver similar infrastructure items as the Green Square Community Infrastructure Floorspace, will conceivably deliver infrastructure at a more moderate pace than witnessed in Green Square. 'Lumpy' infrastructure items such as large open spaces could take a long time to deliver.

Delivering infrastructure in areas experiencing rapid urban renewal and resultant population growth should have regard to:

- Optimising the value of infrastructure from limited resources by ensuring these assets are flexible to adapt to changing needs over time.
- Keeping up with leading practice and emerging models of service and facility provision.
- Providing infrastructure for the range of needs of new communities, when it's needed.
- Applying standards and benchmarks in ways that produce practical, realistic and equitable outcomes for local, district and regional social infrastructure.

As infrastructure needs change (not just in quantum but also in their nature, e.g. where public open space was not considered to be required in employment areas like business parks but are now increasingly demanded by the market), funding mechanisms need to be able to respond. Current statutory mechanisms are limited in this respect.

In the case of Macquarie Park Corridor where employment and residential growth are expected to increase exponentially in the coming years, it is therefore crucial that any infrastructure funding mechanism implemented is effective in delivering needed infrastructure, including, *inter alia*, public open space, childcare facilities, affordable housing, etc. As identified earlier, the effectiveness of incentive-based mechanisms depends on the land use category that is expected to drive contributions as well as the rate of development.

6.4 Macquarie Park Corridor Planning Framework

Architectus has developed a strategic planning framework which recommends permissibility of residential uses in the B3 and B7 Zones in Macquarie Park Corridor, ***but only*** where certain open space, key worker housing, and quantum of non-residential GFA can be delivered. This should be done by a rezoning, and subject to an agreement being in place between Council and the owner for the delivery of the new park to Council's reasonable requirements.

Under this framework, Council could consider a rezoning application for sites that can achieve *all* of the following criteria.

- **Public open space**
  Provide either new open space shown in the Draft Macquarie Park Corridor DCP 2014 or a new 1 hectare minimum public open space, designed to Council's reasonable requirements.

  Where a site proposes to deliver the 1 hectare minimum open space, the site must be larger than 3 hectares, thereby allowing for a 2ha development site for mixed uses.

  The open space must have a frontage to a major road (Waterloo Road, Talavera Road, Wicks Road or Herring Road) and one secondary street.

  The proposed open space should satisfy specified design criteria and be dedicated to Council on completion.
- **Non-residential floorspace**
  Provide a minimum of 20,000sqm GFA of non-residential floorspace.

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- **Key worker housing**
  Deliver key worker housing (or Affordable Housing) at the rate of 3% of total dwellings provided.

  Up to 15% of the open space (1,500sqm) can be used to deliver the required key worker housing.
- **Childcare facilities**
  Provide privately run childcare facilities suitable for 60 children.
- **Public domain**
  Delivery of all other required public domain on the site including roads and through site links as nominated in the Draft Macquarie Park Corridor DCP 2014.

6.5 Need for the Proposal

There is current unmet demand for open space in Macquarie Park Corridor, as identified by the Ryde Integrated Open Space Plan (Ryde Council, 2012). The Plan indicates that two new major reserves suitable for active and passive recreation and several smaller open space areas are needed to support planned growth in Macquarie Park Corridor. This deficiency is *even before* considering future demand generated by an increase in resident and worker population.

Council's s94 development contributions plan **does not** provide for public open space by non-residential development, implicit in this is the presumption that only residential users demand public open space. As indicated by contemporary tenant/occupier requirements, this presumption is now outmoded.

Council has recognised the need to fund the delivery of new roads and public open space and has sought to do this via the Macquarie Park Corridor Planning Proposal (via Amendment 1 to the Ryde LEP) wherein bonus floorspace can be granted to proponents who deliver an acceptable package of infrastructure works.

Amendment 1 to the Ryde LEP 2014 is in force. As such, proponents of bonus floorspace in Macquarie Park Corridor will be required to deliver items of infrastructure including new roads and open space. At current contribution rates ($250/sqm of bonus FSR), the contributions received and subsequent delivery of identified infrastructure could conceivably be at a ***modest*** pace, given that these are dependent on industry take-up of bonus ***commercial*** floorspace. Unlike in Green Square, where the rapid rate of delivery of public benefit was driven by development of ***bonus residential*** floorspace.

Furthermore, there is no official mechanism through which key worker housing can be provided, leaving the crucial and basic item of social need to the private market. This demonstrates a case for an alternate strategy to deliver required and social infrastructure to ensure the sustainability of Macquarie Park Corridor.

Architectus has developed a strategic framework for the delivery of key items of social infrastructure in Macquarie Park Corridor. As is observed in Green Square Urban Renewal Area and Green Square Employment Lands, delivery of key infrastructure seeks to leverage the residential property market. This framework recommends residential permissibility in the B3 Commercial Core and B7 Business Park zones subject to delivery of acceptable package of infrastructure works.

While the appropriation of land to public open space and key worker housing would mean less land available to accommodate new employment floorspace, the provision of items of key social infrastructure would undoubtedly result in sustaining Macquarie Park Corridor's competitive position as well as increasing its appeal as a business destination, leading to increased demand for floorspace.

The economic impacts of appropriation of some employment land to social infrastructure (public open space, key worker housing and childcare facilities) and residential uses are examined in the next chapter.

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7. Socio-Economic Impact Assessment

This chapter assesses the socio-economic impacts of the Proposal by investigating two cases, these include:

- The Base Case: the current social and economic impacts of the Site and existing use as a means for comparison with the Rezoning Case.
- Rezoning Case: This scenario assumes that the Site is rezoned and redeveloped in the manner envisioned in the Concept Master Plan.

The likely social and economic impacts assessed under the Rezoning Case are based on the Concept Master Plan being delivered. The Planning Proposal does not seek approval for this Concept Master Plan, but the social and economic benefits could be secured during the rezoning process through the implementation of Architectus's strategic framework for rezoning in Council's local planning policies and through mechanisms such as a VPA.

7.1 Introduction and Approach

The following sections examine the estimated economic activity supported through the operational and construction phases of the Proposal. The economic impacts have been assessed at the Ryde LGA level.

An Input-Output model, including the development of a series of specific regional Input-Output transaction tables, was developed to reflect the economic structure of the Ryde LGA (refer to Appendix A).

Input-Output modelling describes economic activity through the examination of four types of impacts which are defined and described in the table below.

Table 7.1: Economic Indicators

Indicator	Description
Output	Refers to the gross value of goods and services transacted, including the costs of goods and services used in the development and provision of the final product. Output typically overstates the economic impacts as it counts all goods and services used in one stage of production as an input to later stages of production, hence counting their contribution more than once.
Gross Value Added (GVA)	Refers to the value of output after deducting the cost of goods and services inputs in the production process. GVA defines the true net contribution and is subsequently the preferred measure for assessing economic impacts.
Income	Measures the level of wages and salaries paid to employees of the industry under consideration and to other industries benefiting from the Project.
Employment	Refers to the part-time and full-time employment positions generated by the economic shock, both directly and indirectly through flow-on activity, and is expressed in terms of Full-Time Equivalent (FTE) positions. One FTE job is defined as one person working full time for a period of one year.

Source: AEC

Input-Output multipliers can be derived from open (Type I) Input-Output models or closed (Type II) models. Open models show the direct effects of spending in a particular industry as well as the indirect or flow-on (industrial support) effects of additional activities undertaken by industries increasing their activity in response to the direct spending.

Closed models re-circulate the labour income earned as a result of the initial spending through other industry and commodity groups to estimate consumption induced effects (or impacts from increased household consumption).

The estimates of economic activity consider both Type I and Type II flow-on impacts though it should be noted that Type II impacts are commonly considered to overstate economic activity.

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7.2 Base Case: The Existing Use and No Rezoning

7.2.1 Economic Impact

Prior to acquisition by Holdmark, the buildings on the Site originally comprised an office building (6,988sqm), conference centre (2,160sqm) and warehouse building (8,974sqm) to a total of 18,122sqm floor area. The remainder of the Site consists of significant at-grade car parking areas and two grassed tennis courts.

The warehouse building is to be demolished for the construction of a new 6 storey office building (9,000sqm). For the purposes of this SEIA, the buildings originally on the Site (18,122sqm) are assessed as the existing use of the Site (this excludes the warehousing building).

The existing improvements on the Site accommodate AstraZeneca, a biopharmaceutical company. Originally accommodating 446 workers at peak occupation, the Site is understood to currently accommodate circa 220 workers.

In line with global restructuring of its research and development activities, AstraZeneca's floorspace requirements have changed - the conference facility and warehouse building now surplus to requirements. At its North American headquarters campus in Fairfax, Delaware, space requirements contracted by a third following a consolidation of research and development activities in overseas locations (DelawareOnline, 2015).

Reduced focus on on-shore manufacturing and increased import activity has resulted in a change in AstraZeneca's floorspace requirements, not inconsistent with trends witnessed in the pharmaceutical industry. The changing face of the pharmaceutical industry is discussed in further detail below.

The economic contribution of the Site is characterised by:

- Direct employment sustained by the occupier business (AstraZeneca).
- The economic value add of existing employment.

Direct Employment and Supported Economic Activity

It is understood that Astra Zeneca currently employs 220 workers on the Site understood to be mainly accommodated in the existing 4 storey office building. This is equivalent to a relatively low employee density ratio of 1 worker per 32sqm. Calculated on total floor area (18,122sqm) the number of existing employees equates to 1 worker per 82sqm of floorspace.

Current economic activity supported at the Site through AstraZeneca's operations are estimated to support (including direct and indirect activity) annually:

- $235.0 million in output.
- $89.5 million contribution to GRP.
- $48.0 million in incomes and salaries paid to local workers.
- 553 FTE jobs.

Table 7.2: Current Economic Activity Supported

Impact	Output ($M)	GVA ($M)	Income ($M)	Employment (FTE)
Direct Impact	$133.1	$40.5	$20.7	220
Indirect Impact (Type I)	$55.2	$22.8	$13.1	131
Indirect Impact (Type II)	$46.6	$26.2	$14.2	202
Total Impact	**$235.0**	**$89.5**	**$48.0**	**553**

Note: Totals may not sum due to rounding.
Source: AEC

As a result of direct employment on the Site, industry value add and direct wages, the total economic value add of the business currently located on the Site is estimated at $194.3 million per annum.

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When considering the indirect impacts of these 220 direct jobs on the Site, the broader economic activity supported is much greater.

Evolution of Pharmarceutical Industry

Businesses in Australia's pharmaceutical product manufacturing industry are increasingly limiting their involvement to the later stages of the manufacturing process, i.e. packaging and dispensing. Over the five years through 2014-2015, a number of players have closed down manufacturing plant capacity in favour of locations in China and Singapore. One of the latest closures was GlaxoSmithKline's tablet facility in Boronia, VIC in 2013 (IBISWorld, 2015).

Major companies in the pharmaceutical industry include Pfizer, GlaxoSmithKline, AstraZeneca, Aspen and Merck Sharp & Dohme.

The pharmaceutical industry in Australia is increasingly becoming a net importer of completed product given the globally competitive industry, resulting to cuts in local manufacturing base capacity.

As are its global counterparts, the Australian pharmaceutical industry is contending with the fallout associated with the patent cliff, where some of the world's highest selling drugs have lost or are due to lose patent protection.

In the short term, industry revenue is expected to contract by 2.6% over 2014-15 as the industry continue its transformation. This is expected to occur amid marginal revenue growth, declining research and development (R+D) productivity, increasing competitive pressures and rising safety concerns. Global industry rationalisation will continue to have implications for the level of pharmaceutical manufacturing and R+D in Australia (IBISWorld, 2014d).

The contraction and consolidation of the Australian pharmaceutical sector has resulted in a number of departures around the country (Sigma Pharmaceuticals and Merck in Melbourne) and cutbacks to manufacturing capacity (GlaxoSmithKline in Melbourne and Pfizer in Sydney). As companies focus on the later stages of the manufacturing process, the need for floorspace evolves to that which is more marketing and administration focused.

Over the next few years the pharmaceutical industry is therefore likely to witness reduction in manufacturing employment; offset by employment in administration, marketing and research & development (R+D). The floorspace requirements of these functions will therefore be different, likely to comprise less manufacturing and storage floorspace for raw materials, rather more office-based floorspace for higher order and more knowledge based functions. Employment density ratios per sqm of floorspace are accordingly expected to be higher, i.e. more employees per square metre of floorspace.

The changing floorspace requirements of AstraZeneca are consistent with global and national trends witnessed in the pharmaceutical industry. Traditional manufacturing and warehousing facilities are increasingly replaced by office-type floorspace and high-tech warehouse and storage facilities. These contemporary facilities typically accommodate more employees per square metre and represent a more intensive use of space.

Feasibility of Redevelopment and Renewal

A challenge in infill and brownfield areas is the tension between land uses and for uses to be accommodated within scarce lands that are not only suitable but available.

Existing buildings and their configuration are also challenges for any redevelopment. As a consequence, development feasibility is a major hurdle for large scale renewal in infill/ brownfield locations unless there is a change of use or the site is redeveloped to a 'higher and better' use.

A 'higher and better use' is often associated with residential development, however it is useful to consider this concept in the context of a use that is either a densification or intensification of existing built form.

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- **Densification of Use**
  This refers to an increase in density, typically associated with greater floorspace or heights. Measures of density can be represented by FSR, building heights and setbacks, site coverage ratios, etc. Building densities vary by geographic region, higher density buildings generally located on higher value lands.

  Not all uses respond to density. Industrial uses are not generally one of those uses that respond to density in the manner that residential or commercial uses do. That said, some developers have been able to achieve increased densities by combining various uses within a building including industrial functions.

- **Intensification of Use**
  An intensification of use is not necessarily accompanied by an increase in floorspace density. Increased intensification can occur without increased density and can be measured in any one of the following metrics:

  - Increased economic and employment activity (e.g. more employees per sqm, more output per sqm, etc.).
  - More efficient use of land and resources.
  - Extending the lifespan of available industrial lands.

  Intensification can occur in different ways for different industries and sectors, from greater use of technology and augmentation with higher building ceilings to more intense employee/floorspace ratios (generally associated with more office-type floorspace).

In instances where employee density ratios are already high, e.g. 1 employee per 15sqm of space for office-based uses, in order to be feasible, a redeveloped use either needs to represent a more intensive use of the space or a more dense use of the space. In the case of the Site, the changing floorspace requirements of AstraZeneca has meant a shift to a more intense use, i.e. with more employees per sqm of space. Accordingly land and resources are utilised more efficiently.

Likelihood of Redevelopment

A common misconception is that if land is zoned, vacant and undeveloped that it will be available for immediate development. In practice, this can be far from reality as the development potential of land is often influenced collectively by environmental, market or ownership factors that can together, impede development.

The capacity of urban zoned land to accommodate new development can be thought of as two-fold: planning capacity and market capacity.

- **Planning capacity** refers to the physical ability of land to be developed, taking into account permissibility under planning framework.
- **Market capacity** refers to issues of commercial viability whether pricing levels, market acceptance/resistance, development costs which are influenced by environmental and site constraints, etc. make development a commercial proposition, i.e. if development is financially feasible.

While planning capacity (or "theoretical capacity") is important for understanding development potential, '**market capacity**' is equally important as it underpins whether development occurs.

The Site is currently zoned B7 Business Park and designated with an FSR of 1:1, currently improved to FSR 0.5:1. The B7 Business Park zone permits with consent the following uses: childcare centres, light industries, neighbourhood shops, office premises, passenger transport facilities, respite day care centres, restaurants or cafes and warehouse or distribution centres.

Assuming demolition of all buildings and a comprehensive redevelopment of the Site under current planning controls (to FSR 1:1), the Residual Land Value of the Site is assessed at $19.9m. This is lower than its current value of $30.7m. This suggests that there is little incentive for the Site to be redeveloped, as the site value associated with a new use should exceed the 'as is' site value in order to displace the existing use.

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Given the configuration of the site and building layout, the permitted uses are unlikely to facilitate a more attractive use to displace the existing use and facilitate a comprehensive redevelopment. The highest and best use of the Site under the existing zoning is likely to already be secured. On that basis, assuming the Site is not rezoned and remains subject to existing planning controls, comprehensive redevelopment of the Site is unlikely to occur.

7.2.2 Social Infrastructure and Impact

From a social perspective, the limited impetus for redevelopment and renewal in the Base Case would result in an ongoing deficiency in social infrastructure provision in Macquarie Park, that is, open space provision, childcare places and key worker housing.

Given that the amenity of a locality is an important factor in its attraction as a place to work, an ongoing deficiency in open space and childcare places provision will be a continued challenge for the future success and sustainability of the Site as well as Macquarie Park Corridor as a whole.

The social impacts of the Base Case should be considered in the context of the evolution of business parks outlined in Chapter 8, wherein business parks are increasingly incorporating a range of uses in order to provide greater worker amenity:

- **Inclusion of multi-use facilities**
  Business parks are evolving to comprise a full offer of services facilities, successful business parks are accommodating a range of uses, including medical, support business services, retail, recreational, residential, leisure and hotel accommodation.
- **Greater tenant emphasis placed on worker amenity and employee wellbeing**
  Tenant requirements are evolving to place more importance on employee satisfaction and wellbeing, with less on ESD and building sustainability which are increasingly considered as 'givens'. Access to gyms, swimming pools, green space, childcare facilities, affordable housing, etc. is becoming increasingly important. Tenant expectations are almost akin to replicating a CBD location.

The existing planning controls are unlikely to result in a comprehensive redevelopment of the Site in the short to medium term. The current deficiencies in open space and childcare places in Macquarie Park will continue to be a challenge to overcome given the limitations in mechanisms available to fund and deliver items of social infrastructure.

7.3 Scenario 2: Rezoning Case (Operational Phase)

The Rezoning Case seeks to leverage the residential property market to provide land to key items of social infrastructure. These include open space, childcare facilities and key worker housing.

This section assesses the socio-economic impacts of rezoning the Site to B4 Mixed Use to accommodate:

- Approximately 1,125 apartments (as well as 40 additional key worker apartments);
- 16,000sqm commercial floorspace;
- 4,000sqm retail floorspace;
- 1 childcare centre 700sqm for 60 children;
- 1ha public open space.

It is acknowledged that social and economic impacts occur both during the construction phase and post the construction phase (operational phase). This examines firstly those impacts during the operational phase (post-construction) and then construction impacts.

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7.3.1 Economic Impact

Model Drivers

Estimates of direct operational phase activity have been developed utilising Gross Floor Area (GFA) and employment density ratios. For modelling purposes, potential operational activities associated with the redeveloped site were allocated to the most relevant I-O industries, based on ANZSIC categories.

Based on the derived employment levels, estimates for direct output were developed using the output to employment ratios outlined in the I-O transaction table developed for Ryde LGA as part of this project (see Appendix A).

It should be noted that in developing these estimates of activity, a 'steady state' of operations (whereby all facilities have been developed and long-term average worker density rates prevail) has been assumed.

Table 7.3: Operational Turnover Estimates

Activity/ ANZSIC Allocation	GFA (sqm)	Worker Ratio*	FTE Employment	Estimated Turnover ($m)
Retail				
Retail Trade	4,000	30	133	$17.8
Commercial				
Human Pharmaceutical and Medicinal Product Manufacturing (Existing)	3,000	14	220	$133.1
Professional, Scientific and Technical Services	5,200	18	289	$71.1
Wholesale Trade	2,600		144	$49.9
Information Media and Telecommunications	2,600		144	$126.8
Manufacturing	1,300		72	$43.7
Other Services	1,300		72	$14.3
Child Care				
Residential Care and Social Assistance Services	700	90	8	$0.9
Total	**20,700**	**19**	**1,083**	**$457.4**

*Worker ratios adjusted for GFA estimates considering industry references are typically in terms of lettable area, not gross floor area
Note: Totals may not sum due to rounding.
Source: AEC

The economic impact is considered in five years' time at which point the development is assumed to be completed and fully occupied and operational. The positive and negative economic impacts of the Rezoning Case are examined individually below.

Direct Employment and Support Economic Activity

All jobs associated with the existing use (equivalent to 220 full and part-time employees) would be accommodated in two floors of the new 6 storey commercial building (3,000sqm). This equates to an average employee density of 1 worker per 14sqm GFA.

The Proposal would also provide 13,000sqm of additional commercial floorspace and by applying assumed proportion of industry occupiers, an average employment density ratio of 1 worker per 18sqm would imply new accommodation for 721 workers.

New retail operations on the Site would sustain some employment. Retail floorspace provision is likely to be dispersed across the development, allowing for a small supermarket (1,500sqm-2,000sqm) and small retail specialties (e.g. newsagency, restaurants/cafés, hairdressing salon, etc.). At an average employment density ratio of 1 worker per 30sqm some 133 workers could be accommodated in the proposed retail floorspace.

Once established and in steady state operations (i.e., whereby all facilities have been developed and long-term average worker density ratios prevail), the Site is expected to make a significant additional contribution to the local economy.

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The redeveloped Site is expected to support on an ongoing annual basis:

- $844.7 million in output.
- $398.8 million contribution to GRP.
- $206.6 million in incomes and salaries paid to local workers.
- 2,433 FTE jobs.

Table 7.4: Rezoning Case Operational Economic Impacts

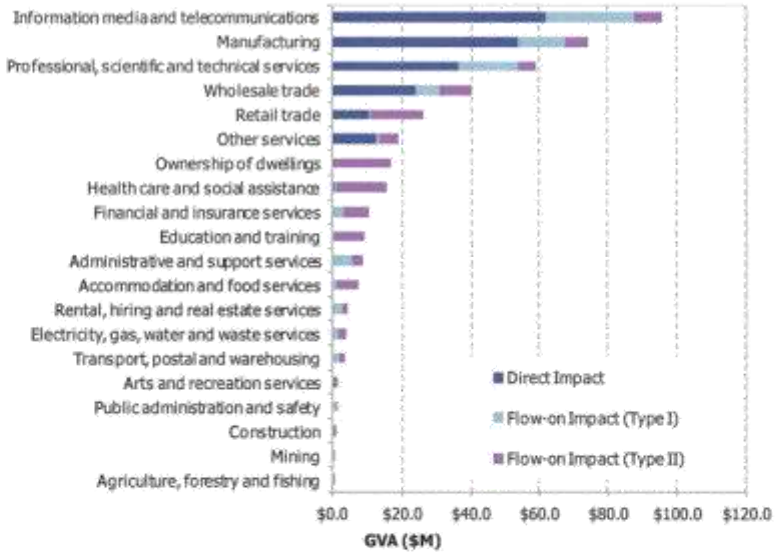
Impact	Output ($M)	GVA ($M)	Income ($M)	Employment (FTE)
Direct Impact	$457.4	$200.0	$100.1	1,083
Indirect Impact (Type I)	$181.6	$83.1	$43.7	460
Indirect Impact (Type II)	$205.7	$115.7	$62.8	889
Total Impact	**$844.7**	**$398.8**	**$206.6**	**2,433**

Note: Totals may not sum due to rounding. Includes estimates of existing economic activity.
Source: AEC

Major industry beneficiaries of the operational phase of the development within the Ryde LGA include (in Gross Value Add, GVA terms per annum):

- Information media and telecommunications ($95.6 million).
- Manufacturing ($74.3 million).
- Professional, scientific and technical services ($59.0 million).
- Wholesale trade ($40.4 million).

Figure 7.1: Operational GVA Impacts by Industry



Source: AEC

Retail Demand and Impact

The Rezoning Case envisages new retail space in the order of 4,000sqm to be dispersed across the Site. A small format supermarket (1,500sqm-2,000sqm) and specialty retail stores could be accommodated within this floorspace provision.

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The addition of new residents on the Site will generate retail expenditure that will be available to be captured by retail facilities on the Site, in Macquarie Park and Ryde LGA. For the purposes of this SEIA we have assumed:

- New residential units will have an average household size of 2.6 persons per dwelling which is commensurate with the average dwelling occupancy rate in the Ryde LGA (2011 Census). This equates to a total residential population of 2,925 upon completion.
- New residents will demand retail floorspace of 2.2sqm per person[3]. This is based on the industry benchmark of 2.1sqm retail floorspace per person in 2011, which is assumed to increase by 0.1sqm per capita every five years in line with the historic trend and as outlined by the NSW Draft Centres Policy (DPE, 2009). By applying a rate of 2.2sqm per person of retail demand, 2,925 future residents would support 6,435sqm of additional retail floorspace in five years' time.

On this basis, the provision of 4,000sqm retail space as part of the Rezoning Case is justified in the context of demand growth. The residual demand would be available to support existing and new retail facilities beyond the Site.

This analysis does not purport to imply that all of the retail demand generated by residents on the Site will be directed to future facilities on it, but rather the overall contribution it will make.

7.3.2 Social Infrastructure and Impacts

Research shows that business parks have transitioned from providing warehousing and light manufacturing space to include increasing amounts of office uses. As a result of the increasing amount of office space (and office workers) in business parks, the overall composition of business parks has evolved to contain a range of facilities, including restaurants, banks, medical centres and even travel agencies. These facilities are similar to those that might be found in a CBD.

The emphasis on worker amenity and employee satisfaction is growing and will, conceivably establish itself as a given just like building 'green sustainability' and ESD standards have. This is not surprising as employee costs form a major proportion of an organisation's operational costs.

Many office parks and business parks have declined in appeal as occupiers seek to ensure their employees are satisfied in their work environment and are consequently able to achieve high retention rates. There are numerous instances where office buildings have suffered from high vacancies and declining rents as tenants vacate in search of locations that offer better worker amenity and employee satisfaction. Examples include Pymble and Frenchs Forest.

Childcare Facilities

Chapter 6 identified a need for additional childcare places given an existing under-provision of childcare places in Macquarie Park Corridor and across the Ryde LGA.

There is currently a need for 6,016 childcare places in the LGA to service the resident population, yet only 5,465 places are provided. Furthermore, there is a need for 539 childcare places to service the workers in Macquarie Park Corridor, yet only 525 places are provided.

The Proposal would contribute to meeting the need for childcare places in Macquarie Park, this need expected to grow further in tandem with the worker population.

Public Open Space

According to the Ryde Integrated Open Space Plan (Ryde Council, 2012), the Ryde LGA contains 355ha of open space while the suburb of Macquarie Park Corridor (which very closely aligns with the Macquarie Park Corridor Business Park) contains 17.6ha of open space.

[3] Industry accepted benchmark to represent retail demand by residents

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After considering the substantial population growth and employment growth expected to 2031 (additional 44,306 residents and 25,595 workers respectively, NSW BTS 2014), there is no doubt the Ryde LGA and indeed Macquarie Park Corridor will require more open space.

Council's Open Space Plan identifies a present open space deficiency in the Macquarie Park Corridor, indicating that **two new major reserves** suitable for active and passive recreation and several smaller open space areas are needed to support planned growth in Macquarie Park Corridor. This assessment considers planned residential growth only and does not take into account worker population demand.

The provision of 1ha of open space on Site (including 8,250sqm sports field/pitch) will ensure that the deficiency of open space in the Macquarie Park Corridor is mitigated, amenity for workers is improved and open space for existing and future residential population is provided. Within the Macquarie Business Park, new residential dwellings in the priority precincts could also benefit from access to the proposed public open space, increasing opportunities for leisure, exercise and social interaction.

There is extensive literature on the value and social benefits of public open space. Statistically significant relationships have been found in a number of studies between proximity to public parks and open space and an increase in residential property values (Bolitzer and Netusil, 2000; Crompton, 2004; Espey and Owusu-Edusei, 2001). Typically these studies have found the majority of price impacts occur within a 150m to 180m radius of the park/open space, but can extend as far as 350m to 400m from the park/open space.

Studies examining the impacts on residential property values provide an indication of the value placed on parks and open space by those residing nearby. However, they do not provide an indication of the value people place on the existence of parks and open space (i.e. the amenity value people place on knowing parks and open space exist). Some studies have attempted to address this by examining the willingness of people to pay to maintain the existence of a park or natural area (Breffle *et al*., 1998; McConnell and Walls, 2005). While the value people place on preserving open space varies based on the type of open space and proximity to residences, these studies show the positive value people place on public open space.

Valuing the Social Contribution of Sports Fields

The Proposal will provide a new sports field for public use. It is anticipated this field will primarily be used by workers and residents in the Macquarie Park Corridor, future residents of the Herring Road and North Ryde Station priority precincts and dwellings developed as part of this Proposal.

A study in Victoria regarding the socio-economic impacts of water restrictions on turf sports grounds (Weller and English, 2009) examined the willingness of people to pay to preserve a sports field. While the survey approach prevented a definitive value to be estimated, survey results indicate a minimum willingness to pay of around $35 per person in 2009 dollar terms (or around $40 inflating to 2015 dollars using CPI (ABS, 2015)).

According to the draft local development contributions guidelines by the NSW Department of Planning (DoP, 2009), turf sports grounds typically cater for populations varying between 2,500 and 25,000, depending on its primary use. Assuming the sports fields have a service population of around 5,000 people, the sports field provided as part of this development can be estimated to return a social value of approximately $200,000 per annum.

Beyond the value directly attributable to primary users of the sports field, existence of the open space would have positive impacts for lifting and enhancing Macquarie Park's reputation as a business destination.

As social infrastructure (e.g. open space, childcare facilities) is increasingly demanded by occupiers of business parks, it would appear that open space and social infrastructure standards have failed to keep pace with the evolution of business parks and the increase in requirements of businesses/employees. The delivery of social infrastructure in Macquarie Park Corridor is no exception and the Proposal would help to mitigate this.

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Key Worker Housing

While 27% of workers in Macquarie Park earn more than $104,000 per annum, a large proportion (44%de) earn less than $68,000, many of whom would be 'key workers'.

If key worker housing were made available at a discount of 25% to market rents, the difference between that paid and market rents represents social value to a key worker household. Computed at the average Ryde LGA rent of $520 per week, this equates to an annual value of $6,182, or nearly $180,000 in social value per dwelling[4]. The provision of 40 key worker dwellings would multiply to a value of $7.2 million.

7.3.3 Consequential Economic Impacts

An upshot of the Proposal is the development of 1,125 residential units on the Site. As the provision of residential is considered to be a 'facilitator' of the broader proposal which is comprised of a redeveloped commercial building, dedicated public open space and sports fields and childcare facilities, the consequential impacts of housing on the Site are also outlined.

Contribution of Housing

The Sydney metropolitan area is experiencing significant demand for housing and growing housing affordability issues, largely as a result of population growth. As a response State government is focused on ensuring that the planning system facilitates increased housing development.

'A Plan for Growing Sydney' (the Plan) sets out State government objectives for the Sydney metropolitan area over the period of the Plan (2011 to 2031). The Plan states have the accelerated delivery of new housing is a major goal with approximately 664,000 additional homes required in the 20 year period, equivalent to 33,200 new homes per annum. This is in response to population growth of 1.58 million.

Table 7.5 compares building approvals in the Sydney metropolitan area over the last four years to targeted approvals based on State government guidance. It indicates a significant and widening shortfall between the number of dwellings required and the number being approved. There is an imperative to increasing housing supply.

Table 7.5: Sydney Residential Building Approvals versus Targets

	2011-12	2012-13	2013-14	2014-15 YTD
Building Approvals	15,591	21,097	23,456	14,411
Building Targets	33,200	33,200	33,200	33,200
Annual Shortfall	-17,609	-12,103	-9,744	-18,789
Cumulative Shortfall	-17,609	-29,712	-39,456	-58,245

Source: ABS (2015), NSW DP&E (2014)

The priority for new housing delivery is established areas, particularly those with access to transport infrastructure and in particular centres. This maximises the use of existing infrastructure and lowers the need to develop new greenfield land. New housing delivery is recognised as boosting economic activity, supporting the viability of infrastructure and stimulating business investment opportunities.

The provision of 1,125 apartments (as well as 40 key worker housing apartments) in the Ryde LGA constitutes a strong positive economic impact.

Contribution towards Easing Housing Affordability

The Sydney metropolitan area is in the midst of a housing affordability crisis. The Plan recognises that house prices in Sydney are high comparative to other Australian capitals and that government can assist to place downwards pressure on price rises through facilitating greater volumes of supply. In particular, additional units are noted as ensuring more people can access residential product which matches their lifestyle and budget.

[4] Capitalised at gross yield of 3.5%

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Ryde is slightly less affordable compared to the wider Sydney metropolitan area. The latest Housing Sales and Rent Report (FACS, 2015) indicates that the median price of a unit in Ryde LGA in March quarter 2015 was $630,000 compared to a Greater Sydney median of $620,000 and a Sydney Middle Ring (within which Ryde LGA is situated) of $620,000.

Over the last five years since March quarter 2010, based on the latest FACS data the median price of a unit in Ryde LGA has increased by $145,000 or 23%. By contrast the average price increases in the Sydney metropolitan area was 37% over the same period and in the Sydney Middle Ring it was 43%. Even though housing prices in Ryde LGA are increasing at a slower rate in comparison to the Sydney metropolitan area and Middle Ring, initiatives to increase the volume of supply in Ryde LGA will nevertheless help moderate the already high median house prices.

Increasing the volume of housing supply is a government imperative because it assists to ensure affordability by tempering the pace of house price growth. The provision of dwellings on the Site would help to achieve this and constitutes a strong positive economic impact.

Providing Housing Choice

A Plan for Growing Sydney identifies the need to accelerate housing supply and local housing choice (Action 2.1.1) and acknowledges that increasing housing supply and addressing housing affordability and choice will assist in reaching the target.

Importantly the Plan acknowledges that Government and local councils need to understand and respond to the housing market in each and every Local Government Area. The housing market reflects consumer demand and willingness to pay for particular types of housing in particular locations. It is the role of the private sector to build new houses. The private sector will only develop housing on rezoned sites where there is sufficient consumer demand for it, at a price that provides a return to the developer. Local councils should assist housing production by identifying and rezoning suitable sites for housing.

Furthermore the Plan states that housing choice should be improved to suit different needs and lifestyles (Direction 2.3). The Plan acknowledges that research indicates a current shortage of semi-detached houses across Sydney and a shortage of apartments in the middle and outer areas of the city. This is affecting the capacity of people to buy or rent a home. The Plan states that in order to respond to these issues, the Government will introduce planning controls that increase the number of homes in established urban areas to take advantage of public transport, jobs and services.

The Proposal would assist in the meeting these actions and directions by providing greater housing choice by increasing the supply of units in the Ryde LGA, which is at present dominated by detached dwellings.

Providing Homes Close to Jobs and Amenity

Providing homes close to jobs, public transport, civic functions, retail and entertainment options is a community benefit. Doing so lowers the needs for residents to travel to access employment and the other services they require and promotes public transport use. As a result negative externalities of travel in terms of lost time commuting, monetary expenses of travel, pollution, congestion, traffic, noise and so on are minimised. For this reason A Plan for Growing Sydney aims to provide homes closer to jobs (Direction 2.2/Action 2.2.2) and focus new housing in centres which have public transport that runs frequently and can carry large numbers of passengers.

Ryde LGA is an ideal place to concentrate new housing development. Rezoning of the Site and subsequent development as of 1,125 apartments (as well as 40 key worker housing apartments) in this location in addition to new employment opportunities on site constitutes a strong positive economic impact.

7.3.4 Other Impacts

Efficient and Effective Use of Infill Land

By enabling a more economically efficient use of the Site to be achieved and by delivering much needed higher density residential development in close proximity to important transport nodes, the Rezoning Case would maximise the development potential of this infill

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site. In doing so it would assist to achieve planning policy aims by concentrating new development on locations most capable of accommodating it. It may assist to alleviate pressure for new housing development in locations less suitable for such uses, such as outer lying suburbs or greenfield sites not well connected to public transport infrastructure, services, jobs and retail uses. The Rezoning Case would ensure efficient and effective use of land.

Traffic Impacts

The provision of new residential uses on the Site will facilitate greater demand for public and private transport for future residents. It is situated close to the major public transport nodes (Macquarie Park Corridor Station and Macquarie University Station) which offers extensive rail and bus connections which will reduces the requirement for new residents to have private vehicles.

The development application process will require detailed consideration of the traffic, transport and access implications by suitably qualified experts. Redevelopment would not proceed unless Council is satisfied that traffic, transport and access arrangements are acceptable and could be appropriately accommodated by the road network. It is assumed that steps would be taken to limit and/ or mitigate any potential adverse impacts identified. The overall economic impact for the purposes of this SEIA is therefore assumed to be neutral – neither positive nor negative.

Community Safety

Upon completion the level of activity generated on the Site during both the day and evening periods across the working week and weekends would be greatly enhanced. Combined with appropriate design and lighting measures this activity would facilitate a high level of perceived safety and security. The activity generated on the Site would also have a positive flow on effect to surrounding uses and may enhance existing levels of passive surveillance and therefore perceived security in the precinct.

7.4 Scenario 2: Rezoning Case (Construction Phase)

Model Drivers

Estimates of overall development costs were adapted by AEC from cost estimates provided by WT Partnership, build costs and contingencies, professional fees and project management.

For modelling purposes the capital outlay was disaggregated into relevant industries represented in the Input-Output model (based on Australian and New Zealand Standard Industrial Classification (ANZSIC) industries). This breakdown was developed based on assumptions by AEC regarding the most appropriate ANZSIC industries for each activity as highlighted in the table below.

Table 7.6: Construction Costs Allocation (Incl. Contingency)

Item	Cost $M	ANZSIC Industry Allocation
Retail	$9.2	Non-Residential Building Construction
Commercial	$41.2	Non-Residential Building Construction
Residential	$334.6	Residential Building Construction
Open Space	$4.2	Construction Services
Professional Fees	$38.5	Professional, Scientific and Technical Services
Total	**$427.5**	

Source: AEC

Only the construction activity expected to be undertaken within the Ryde LGA has been included in the economic impact assessment. For the purposes of this assessment it was assumed:

- Approximately 50% of the direct expenditure on construction activity would be sourced from local businesses and labour (including construction and professional services activity).

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- Approximately 25% of purchases on goods and services (supply chain related activity) made by construction-related businesses sourced from outside the Ryde LGA would be spent within the local economy (i.e., 25% of the Type I flow-on activity associated with non-local construction companies is assumed to represent additional local activity in Ryde LGA).
- Approximately 5% of wages and salaries paid to construction-related workers sourced from outside the region would be spent on local goods and services, such as food and beverages (i.e., 5% of the Type II flow-on activity associated with non-local workers is assumed to represent additional local activity in Ryde LGA).

The Planning Proposal does not seek approval for any construction works. However, the construction of the concept master plan in its current form would be likely to result in the following and economic impacts.

Construction Impacts

The construction phase associated with the development is expected to support the following economic activity through direct and flow-on impacts:

- $386.5 million in additional output.
- $138.3 million in GVA.
- $85.7 million in incomes and salaries paid to households.
- 1,103 FTE jobs.

The construction of redevelopment on the Site is estimated to directly generate $213.8 million in industry output for businesses in Ryde LGA. Estimates of the economic contribution to the Ryde LGA both directly and indirectly (through flow on activity) from the rezoning and subsequent development of the Site is outlined in **Table 7.7**.

A total of around $138.3 million in gross value added (GVA) activity is estimated to be supported within the Ryde LGA over the course of the 4-6 year construction period, including both direct and flow-on activity.

An estimated 1,103 FTE jobs for Ryde residents are estimated to be supported as a result of construction over the 4-6 year period (including direct and flow-on impacts), equating to an average of approximately 180 to 280 FTE jobs per annum.

Table 7.7: Construction Phase Impacts ($2015)

Impact	Output ($M)	GVA ($M)	Income ($M)	Employment (FTE)
Direct Impact	$213.8	$49.8	$35.4	446
Indirect Impact (Type I)	$92.7	$43.5	$25.8	310
Indirect Impact (Type II)	$80.1	$45.0	$24.4	346
Total Impact	**$386.5**	**$138.3**	**$85.7**	**1,103**

Note: Totals may not sum due to rounding.
Source: AEC

Major industry beneficiaries of the construction phase of the development within the Ryde LGA include:

- Construction (gross value add of $45.5 million).
- Professional, scientific and technical services ($22.4 million).
- Wholesale trade ($9.0 million).
- Manufacturing ($8.0 million).

These industry beneficiaries are depicted in **Figure 7.2**.

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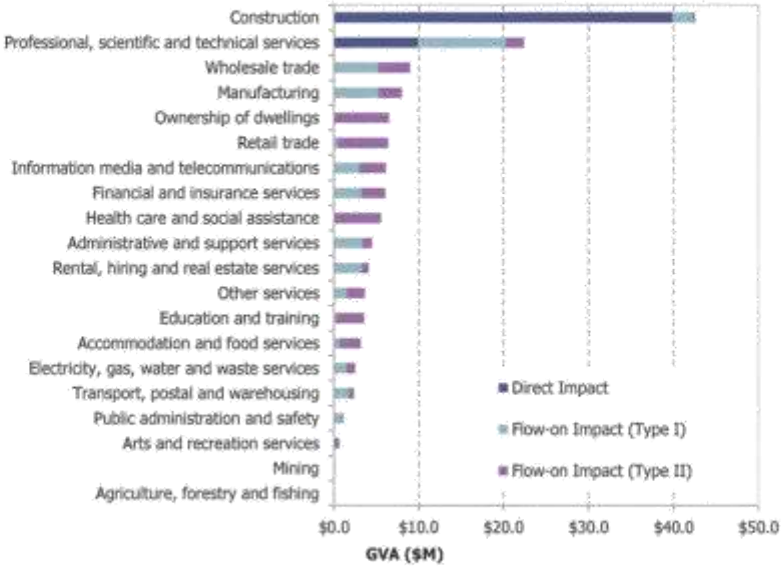
Figure 7.2: GVA Impacts by Industry ($M)



Source: AEC

Other Construction Impacts

There are a number of other impacts with economic and productivity implications expected to occur during the construction phase. These include:

- **Business Impacts**
  It is anticipated that the small number of businesses located along Talavera Road would experience some impact to their operation during construction as a result of disturbances such as noise, vibration and traffic. For the most part however, the negative impacts for businesses would be confined to the construction period and eliminated upon completion of work. Appropriate management plans should be implemented during construction to ensure that any potential impacts to businesses located within close proximity of the Site would be minimised.

  Notwithstanding the potential for adverse impacts to some business during the construction phase, other businesses may experience economic benefits as a result of the construction process. Businesses that are most likely to experience positive impacts during the construction phase are those that service the construction industry including recruitment agencies, development consultants, manufacturers and suppliers of building materials, food and beverage retailers.

- **Traffic Impacts**
  The construction process has the potential to disturb local pedestrian and traffic flows, as well as the ease of access to surrounding uses. Access to the Site for construction traffic would be through predominantly business areas. As such those operating businesses in the vicinity of the Site could potentially be impacted by a temporary and minor increase in traffic congestion at various times during construction.

  These issues could be addressed in more detail and properly mitigated in a Construction Management Plan. For example, one means to mitigate impacts generated by construction related traffic could be to establish alternate access routes that work together to disperse traffic, consequently minimising congestion in any one location.

  By employing appropriate mitigation measures it is anticipated that traffic and accessibility impacts would be relatively contained both temporally and geographically.

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Social Impacts

There are a number of social impacts that could occur during the construction phase including:

- **Amenity**
  During the construction process the proposed development has the potential to adversely affect the amenity of sensitive receivers within the local area. Sensitive receivers generally relate to residents but may also include childcare centres, community, recreational facilities and businesses.

  Owing to potential noise, dust and traffic disturbances, those most likely to be impacted during the construction of the project would be to residential and recreational uses surrounding the Site.

  A range of mechanisms can be applied to minimise impacts to residential amenity. Such mechanisms are employed by most building contractors and implemented through a Construction Management Plan. Such plans tend to focus on issues such as demolition and construction staging, noise, air and water quality, construction traffic management, pedestrian safety and site management. They include simple but effective measures such as screening, noise mitigation at source and varying work hours. It is considered that in addition to the screening provided by the construction site, the existing vegetation would also provide screening.

- **Community Safety**
  During construction, the perception of safety and security of the Site could be a community concern. The lack of activity on the Site (particularly during evening periods) and the presence construction material can result in reduced passive surveillance and an increased number of dark or hidden areas. This can lead to increased fears of anti-social behaviour an exacerbate anxiety and social stress amongst the community.

  These perceived fears and thereby impacts as a result of the proposed development are likely however to be short term and limited to the construction period. Furthermore they can often be minimised or avoided through the implementation of a bespoke Construction Environment Management Plan and measures such as on site security, appropriately located lighting and the securing of work related machinery and tools.

- **Community Facilities**
  As there are no hospitals, schools, recreational facilities or aged care facilities in the immediate vicinity of the Site (i.e. within 400m) it is not anticipated the proposed development would detrimentally impact any community facilities by way of noise, dust, overshadowing, privacy, safety or access.

7.5 Summary of Each Scenario

A summary of the positive and negative impacts and attributes of the Base Case and Rezoning Case are summarised in **Table 7.8**.

Table 7.8: Summary of Each Scenario

Scenario	Strengths	Weaknesses
Base Case (Existing Uses and No Rezoning)	• Provides employment land (i.e. B7 Business Park) • Accommodates 220 jobs	• Accommodates employment in older style office building (on existing ratio of 1 worker per 32sqm) • Underutilised and redundant buildings (conference centre and warehouse) that do not meet contemporary floorspace requirements • Site is 'underutilised' with low worker floorspace ratios • Unlikely to be comprehensively redeveloped in short to immediate term as not financially feasible under existing planning controls • Ongoing deficiency of key social infrastructure items (open space, childcare facilities and key worker housing)

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Scenario	Strengths	Weaknesses
Rezoning Case	• Despite a smaller site area for employment uses, the Rezoning enables an intensification of use, i.e. accommodates 1,083 jobs (an additional 863 jobs) • More economically efficient use of the Site • Contributes to social infrastructure provision (meeting undersupply of open space and childcare places) • Contributes to enhancing overall worker amenity and strengthening Macquarie Park's competitiveness and future sustainability • Enable a far greater level of social interaction and community engagement on the Site through provision of active/passive open space • Contributes to meeting housing and employment targets • Eases housing affordability by providing key worker housing • Provides a greater mix of housing choice and type	• Opportunity cost of employment land that could accommodate increased employment uses

Source: AEC

While the appropriation of part of the Site to public open space and key worker housing would mean less land available to accommodate new employment floorspace, the provision of items of key social infrastructure would undoubtedly result in sustaining Macquarie Park Corridor's competitive position as well as increasing its appeal as a business destination, leading to increased demand for floorspace.

Increased demand for employment floorspace in Macquarie Park Corridor would in turn result in take-up of Council's bonus FSR provisions as envisaged under the Macquarie Park Corridor Planning Proposal. Development to greater FSRs than provided for under the Ryde LEP 2013 would ultimately result in increased overall employment densities in Macquarie Business Park.

The ultimate delivery of additional jobs (in increased overall employment densities) would support NSW Government and Council objectives of strengthening Macquarie Park Corridor's position in the Global Economic Corridor.

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8. Assessment of Net Impacts

8.1 Net Community Benefit Test

To compare the outcome of the Base Case versus the Rezoning Case, each of the identified impacts compared to the Base Case are summarised and ranked based on the rating system outlined in **Table 8.1**.

Table 8.1: Economic Impact Rating Matrix

Severity of Impact	Score	Explanation
Strong Positive Impact	+3	The scenario would make a strong positive contribution towards this impact compared to the Base Case
Slight Positive Impact	+1	The scenario would make a slight positive contribution towards this impact compared to the Base Case
Neutral Impact	0	The scenario would make neither positive or a negative contribution towards this impact compared to the Base Case
Slight Negative Impact	-1	The scenario would make a slight negative contribution towards this impact compared to the Base Case
Strong Negative Impact	-3	The scenario would make a strong negative contribution towards this impact compared to the Base Case

Source: AEC

Table 8.2 identifies all of the economic impacts and derives a total score for the Rezoning Case using the Base Case as the starting point of '0'. The higher the positive score the greater the net positive economic impact from a community perspective, the lower the score the greater the adverse economic impact.

Table 8.2: Economic Impact of Base Case versus Rezoning Case

Impact	Base Case	Rating	Rezoning Case	Rating
Employment & Economic Impact				
Jobs	220	0	1,083	+3
Direct Value Add	$193 mill	0	$757.5 mill	+1
Retail Impact				
Support Retail Demand	n.a.	0	6,435sqm	+1
Social Infrastructure Impact				
Open Space	1,000sqm (2 x tennis courts)	0	10,000sqm (including sports field)	+3
Childcare	n.a.		60 places	+3
Housing Impact				
Housing supply	n.a.	0	1,125	+3
Homes close to jobs	n.a.	0	Yes	+3
Construction				
Output	n.a.	0	$386 mill	+3
Jobs	n.a.	0	1,103	+3
Wages and Salaries	n.a	0	$86 mill	+3
Total		**0**		**26**

Source: AEC

The Rezoning Case would deliver a clear, strong positive economic impact comparative to the Base Case.

The Rezoning Case has only allowed for the redevelopment of the Site as envisaged under the Proposal. As Macquarie Park Corridor grows the economic impact identified in this Assessment would be even greater.

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8.2 Section 117 Direction

The Section 117(2) direction was previously highlighted in section 2.1.3, with Section 1.1 Business and Industrial Zones identified as being relevant. The objectives are identified below together with their consideration in the context of the proposed Master Plan.

Table 8.3: Consistency with Section 117(2) Objectives

No.	Objective	Rezoning Scenario
1	Encourage employment growth in suitable locations	The Site is improved with several buildings – some of which are aged, redundant and ill-suited to contemporary requirements. Whilst still occupied, the 4 storey commercial building accommodates jobs at relatively low worker density ratios (circa 1 per 32sqm). The Rezoning Case would trigger redevelopment of the Site with modern commercial and retail facilities that would be likely to more efficiently accommodate workers. The provision of a large amount of open space on-site (including playing fields), childcare facilities and key worker housing will all contribute to addressing current under-provision and shortfall as well as contribute to Macquarie Park's market appeal, competitiveness and ability to grow sustainably. For these reasons, the Rezoning Case complies with this Objective.
2	Protect employment land in business and industrial zones	Given the configuration of the site and building layout, the permitted uses are unlikely to facilitate a more attractive use to displace the existing use and facilitate a comprehensive redevelopment. The highest and best use of the Site under the existing zoning is likely to already be secured. On that basis, assuming the Site is not rezoned and remains subject to existing planning controls, comprehensive redevelopment of the Site is unlikely to occur. The land use zoning sought would lead to a reduction in the quantum of land zoned for employment generating land uses in the Ryde LGA. Yet while the Site currently accommodates 220 employees, these workers will be relocated to a new commercial building on the site and as such no 'loss' of jobs. Instead, the construction of a modern 6 storey commercial building would enable an intensification of uses on the site, potentially accommodating more than 800 employees in total. The total number of jobs generated on the Site is estimated at 1,083 jobs (representing an increase of 863 jobs), it is important to note this represents a much greater intensification of employment on the Site and a much higher ratio of employment of 1 worker per 32sqm of floorspace should the rezoning occur. While the appropriation of land to other uses would mean a reduction in employment land on the Site, the provision of key social infrastructure would result in sustaining Macquarie Park's competitive position as well as increasing its appeal as a business destination, leading to increased demand for floorspace. The Rezoning Case complies with this Objective.
3	Support the viability of identified strategic centres	The Rezoning Case would consolidate new homes, jobs and investment at Macquarie Park Corridor in accordance with *A Plan for Growing Sydney* which states that Macquarie Park Corridor could accommodate additional mixed-use development around train stations, including retail, services and housing. The Rezoning Case would increase the quantum of retail expenditure generated by workers and residents and provide a net positive addition to the pool of expenditure available to be captured by local businesses. For these reasons, the Rezoning Case would fulfil this Objective.

Section 117 Directions set out five requirements for planning authorities to consider when preparing a planning proposal that will affect land within an existing or proposed business or industrial zone. This are considered below in relation to the Rezoning Case.

Table 8.4: Planning Authority Considerations

Consideration	Achieved?	Explanation
Give effect to the objectives of this direction	Yes	**Table 8.3** has established that the objectives of the Direction would be achieved via the Rezoning Case.
Retain the areas and locations of existing business and industrial zones	Yes	The Rezoning Case would reduce the quantum of land used for employment uses in Ryde LGA, but as identified in this SEIA proposed uses on the Site would help sustain Macquarie Park's

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Consideration	Achieved?	Explanation
		competitive position and appeal as a business destination leading to increase demand for floorspace. This in turn would result in take-up of Council's bonus FSR provisions under Amendment 1. Take-up of the bonus FSR provisions and development to greater densities would result in increased overall employment.
Not reduce the total potential floor space area for employment uses and related public services in business zones	Yes	The Rezoning Case would increase the quantum of floorspace used for employment uses from 18,000sqm to 20,000sqm and additional enable a more intense use of the land than is currently experienced.
Not reduce the total potential floor space area for industrial uses in industrial zones	Yes	N/A
Ensure that proposed new employment areas are in accordance with a strategy that is approved by the Director-General of the Department of Planning	Yes	As established in this SEIA, the Rezoning Case is consistent with State and local government objectives to support jobs, economic development, efficient and effective use of land and accelerate housing supply in suitable locations. It complies with this condition.

Conclusion

While the appropriation of land to other uses would mean a reduction in employment land on the Site, the provision of key social infrastructure would result in sustaining Macquarie Park's competitive position as well as increasing its appeal as a business destination, leading to increased demand for floorspace.

It is apparent that the Proposal will provide significant benefit to the local area, delivering strong positive socio-economic impacts comparative to the status quo. This builds a strong case for the Proposal from a socio-economic perspective. As Macquarie Park grows the economic impact identified in this assessment will become even more significant.

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Appendix A: Input-Output Methodology

Input-Output Model Overview

Input-Output analysis demonstrates inter-industry relationships in an economy, depicting how the output of one industry is purchased by other industries, households, the government and external parties (i.e. exports), as well as expenditure on other factors of production such as labour, capital and imports. Input-Output analysis shows the direct and indirect (flow-on) effects of one sector on other sectors and the general economy. As such, Input-Output modelling can be used to demonstrate the economic contribution of a sector on the overall economy and how much the economy relies on this sector or to examine a change in final demand of any one sector and the resultant change in activity of its supporting sectors.

The economic contribution can be traced through the economic system via:

- **Direct impacts**, which are the first round of effects from direct operational expenditure on goods and services.
- **Flow-on impacts**, which comprise the second and subsequent round effects of increased purchases by suppliers in response to increased sales. Flow-on impacts can be disaggregated to:
    - **Industry Support Effects (Type I)**, which represent the production induced support activity as a result of additional expenditure by the industry experiencing the stimulus on goods and services in the intermediate usage quadrant, and subsequent round effects of increased purchases by suppliers in response to increased sales.
    - **Household Consumption Effects (Type II)**, which represent the consumption induced activity from additional household expenditure on goods and services resulting from additional wages and salaries being paid within the economic system.

These effects can be identified through the examination of four types of impacts:

- **Output**: Refers to the gross value of goods and services transacted, including the costs of goods and services used in the development and provision of the final product. Output typically overstates the economic impacts as it counts all goods and services used in one stage of production as an input to later stages of production, hence counting their contribution more than once.
- **Value added**: Refers to the value of output after deducting the cost of goods and services inputs in the production process. Value added defines the true net contribution and is subsequently the preferred measure for assessing economic impacts.
- **Income**: Measures the level of wages and salaries paid to employees of the industry under consideration and to other industries benefiting from the project.
- **Employment**: Refers to the part-time and full-time employment positions generated by the economic shock, both directly and indirectly through flow-on activity, and is expressed in terms of full-time equivalent (FTE) positions.

Input-Output multipliers can be derived from open (Type I) Input-Output models or closed (Type II) models. Open models show the direct effects of spending in a particular industry as well as the indirect or flow-on (industrial support) effects of additional activities undertaken by industries increasing their activity in response to the direct spending.

Closed models re-circulate the labour income earned as a result of the initial spending through other industry and commodity groups to estimate consumption induced effects (or impacts from increased household consumption).

Model Development

Multipliers used in this assessment are derived from sub-regional transaction tables developed specifically for this project. The process of developing a sub-regional transaction table involves developing regional estimates of gross production and purchasing patterns

ITEM 5 (continued) **ATTACHMENT 6**

based on a parent table, in this case, the 2012-13 Australian transaction table (ABS, 2015a).

Estimates of gross production (by industry) in the study area were developed based on the percent contribution to employment (by place of work) of the study area to the Australian economy (ABS, 2012), and applied to Australian gross output identified in the 2012-13 Australian table.

Industry purchasing patterns within the study area were estimated using a process of cross-industry location quotients and demand-supply pool production functions as described in West (1993).

Where appropriate, values were rebased from 2012-13 (as used in the Australian national IO transaction tables) to 2015 values using the Consumer Price Index (ABS, 2015b).

Modelling Assumptions

The key assumptions and limitations of Input-Output analysis include:

- **Lack of supply-side constraints**: The most significant limitation of economic impact analysis using Input-Output multipliers is the implicit assumption that the economy has no supply-side constraints, so the supply of each good is perfectly elastic. That is, it is assumed that extra output can be produced in one area without taking resources away from other activities, thus overstating economic impacts. The actual impact is likely to be dependent on the extent to which the economy is operating at or near capacity.
- **Fixed prices**: Constraints on the availability of inputs, such as skilled labour, require prices to act as a rationing device. In assessments using Input-Output multipliers, where factors of production are assumed to be limitless, this rationing response is assumed not to occur. The system is in equilibrium at given prices, and prices are assumed to be unaffected by policy and any crowding out effects are not captured. This is not the case in an economic system subject to external influences.
- **Fixed ratios for intermediate inputs and production (linear production function)**: Economic impact analysis using Input-Output multipliers implicitly assumes that there is a fixed input structure in each industry and fixed ratios for production. That is, the input function is generally assumed linear and homogenous of degree one (which implies constant returns to scale and no substitution between inputs). As such, impact analysis using Input-Output multipliers can be seen to describe average effects, not marginal effects. For example, increased demand for a product is assumed to imply an equal increase in production for that product. In reality, however, it may be more efficient to increase imports or divert some exports to local consumption rather than increasing local production by the full amount. Further, it is assumed each commodity (or group of commodities) is supplied by a single industry or sector of production. This implies there is only one method used to produce each commodity and that each sector has only one primary output.
- **No allowance for economies of scope**: The total effect of carrying on several types of production is the sum of the separate effects. This rules out external economies and diseconomies and is known simply as the "additivity assumption". This generally does not reflect real world operations.
- **No allowance for purchasers' marginal responses to change**: Economic impact analysis using multipliers assumes that households consume goods and services in exact proportions to their initial budget shares. For example, the household budget share of some goods might increase as household income increases. This equally applies to industrial consumption of intermediate inputs and factors of production.
- **Absence of budget constraints**: Assessments of economic impacts using multipliers that consider consumption induced effects (type two multipliers) implicitly assume that household and government consumption is not subject to budget constraints.

Despite these limitations, Input-Output techniques provide a solid approach for taking account of the inter-relationships between the various sectors of the economy in the short-term and provide useful insight into the quantum of final demand for goods and services, both directly and indirectly, likely to be generated by a project.

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In addition to the general limitations of Input-Output Analysis, there are two other factors that need to be considered when assessing the outputs of sub-regional transaction table developed using this approach, namely:

- It is assumed the sub-region has similar technology and demand/ consumption patterns as the parent (Australia) table (e.g. the ratio of employee compensation to employees for each industry is held constant).
- Intra-regional cross-industry purchasing patterns for a given sector vary from the national tables depending on the prominence of the sector in the regional economy compared to its input sectors. Typically, sectors that are more prominent in the region (compared to the national economy) will be assessed as purchasing a higher proportion of imports from input sectors than at the national level, and vice versa.

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