RACHEL FORSTER HOSPITAL SITE RESIDENTIAL DEVELOPMENT

PITT STREET, REDFERN

Assessment of Traffic and Parking Implications

June 2007

Reference 06321

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1. INTRODUCTION

This report has been prepared on behalf of the Redfern Waterloo Authority (RWA) as an accompaniment to a Part 3A Concept Plan Application to the Department of Planning for the redevelopment of the former Rachel Forster Hospital site into a high quality residential development (Figure 1).

The Rachel Forster Hospital was closed in 2000 and apart from a Community Health facility which operates from the building fronting Albert Street the site has largely remained disused since the hospital's closure.

The purpose of this report is to:

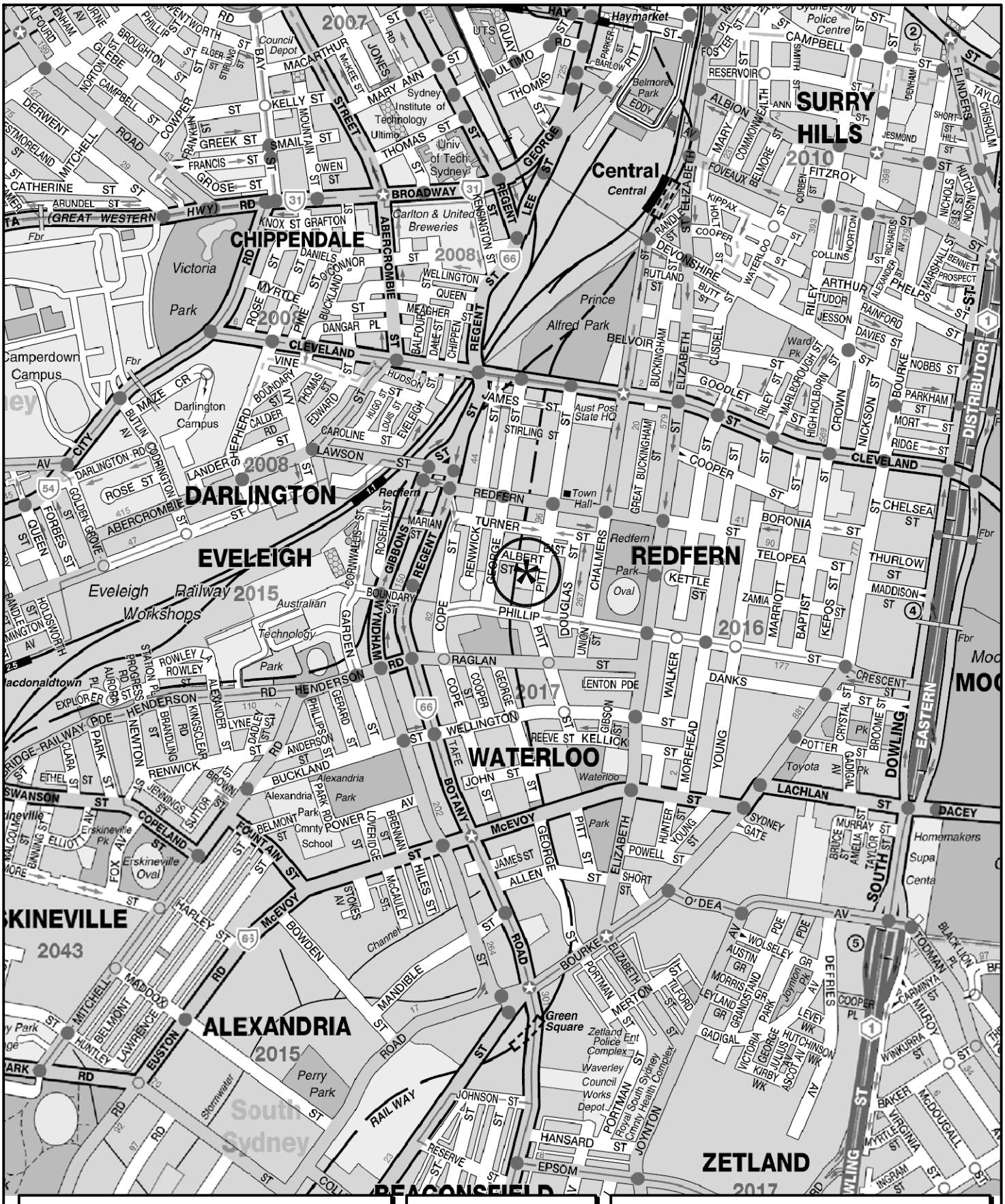
* describe the site and the concept development scheme

* describe the road network serving the site, the prevailing traffic conditions and public transport circumstances

* assess the adequacy of the proposed parking provision

* assess the potential traffic implications

* assess the suitability of the proposed vehicle access, internal circulation and servicing arrangements.



LEGEND

N

LOCATION

FIG 1

2. PROPOSED DEVELOPMENT SCHEME

2.1 SITE AND CONTEXT

The development site (Figure 2) encompasses a 0.7 ha property which until 2000 was occupied by the Rachel Forster hospital. Since the hospital's closure the majority of the site has been disused, with the only operating facility being a community health facility which utilises the building which fronts Albert Street. Most, if not all of the buildings associated with the former hospital use have been retained, a number of which are of heritage significance.

The site has frontages to western side of Pitt Street (96 metres) and southern side of Albert Street (76 metres) whilst vehicular access is facilitated by the provision of 4 driveways of which three are located on the Pitt Street frontage.

The surrounding landuses predominantly comprise of a mix of contemporary medium/high density residential and older terrace style housing. Other notable landuses in the vicinity of the site include:

* the Redfern retail/commercial strip on both Redfern Street (to the north) and Regent Street (to the west)

* the former Redfern Public School which occupies a large parcel of land on the corner of George Street, Phillip Street and Cope Street. This site is understood to be the subject of redevelopment by the Indigenous Land Corporation to create a National Indigenous Development Centre

* the high rise housing commission development on the southern side of Phillip Street

LEGEND

N

SITE

FIG 2

* the large Australian Technology (Business) Park which is situated less than 800 metres to the west of the site

* Redfern Railway Station which is located some 500 – 600 metres north-west of the site

* the South Sydney Rugby League Club and large Redfern Park a short distance to the east, with both fronting Chalmers Street.

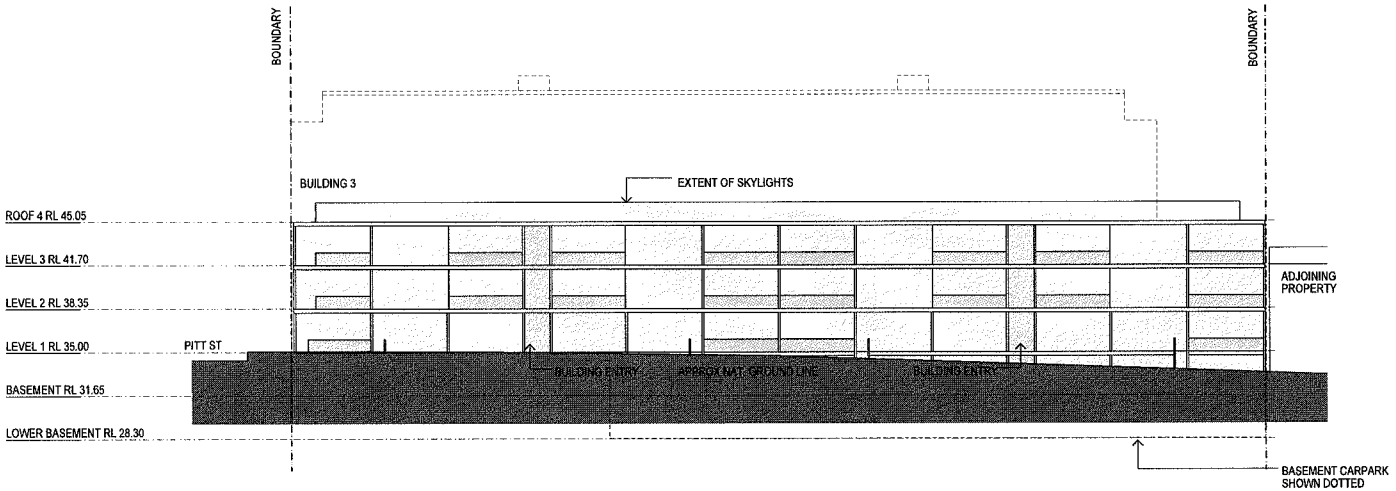
2.2 CONCEPT DEVELOPMENT SCHEME

The concept development scheme involves the demolition of non-heritage related structures/features on the site and the construction of a high quality residential development with basement level carparking. The concept scheme provides for in the order of 14,000m^2 of floorspace and an FSR of 2:1, which will enable a development comprising in the order of 150 dwellings. The final mix of apartments does not form part of this application and will ultimately be determined in a subsequent Project Application, the following apartment mix has been assumed as part of this assessment:

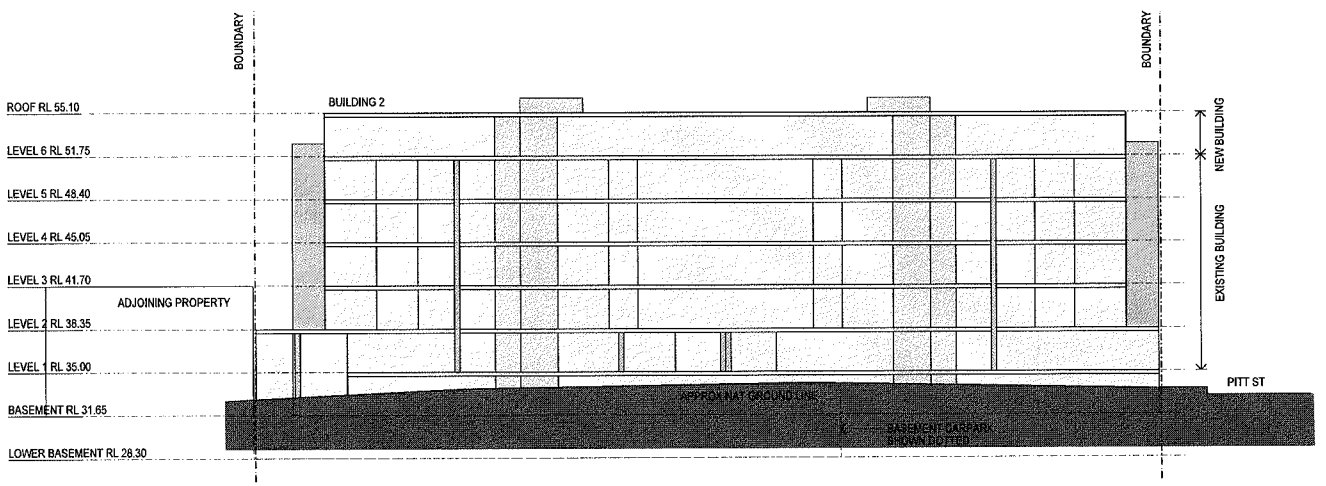
81 x one-bedroom apartments (<60m^2)
18 x one-bedroom apartments (>60m^2)
36 x two-bedroom apartments (<100m^2)
11 x two-bedroom apartments (>100m^2)
4 x three-bedroom apartments (>140m^2)

Basement level parking accessed from an existing driveway on Pitt Street is to be provided for in the order of 160 vehicles. On-site servicing facilities are also proposed through the provision of an area adjacent to the carpark access roadway. The size of this area is quite generous, having a theoretical capacity to accommodate up to more than one truck at a time.

Architectural details of the concept development scheme are provided on the plans prepared by Lippmann Associates which accompany the Concept Plan Application and are reproduced in part overleaf.



NORTH ELEVATION



SOUTH ELEVATION

EXISTING BUILDING

PROPOSED NEW BUILDING

BALCONY / COURTYARD AREARS

SERVICE AREAS

PROJECT CONCEPT PLAN OF REDEVELOPMENT OF RACHEL FORSTER HOSPITAL

ELEVATIONS - SOUTH & EAST

SCALE:200 @ A1

20/03/2007

A 011

Lippmann

Masterplanning
Architecture
Interiors

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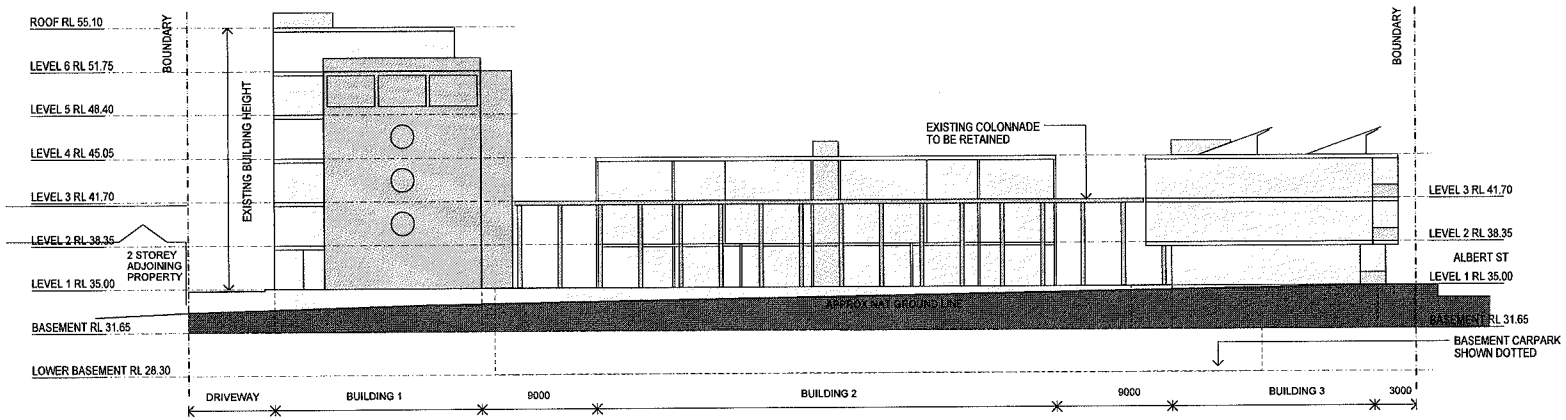
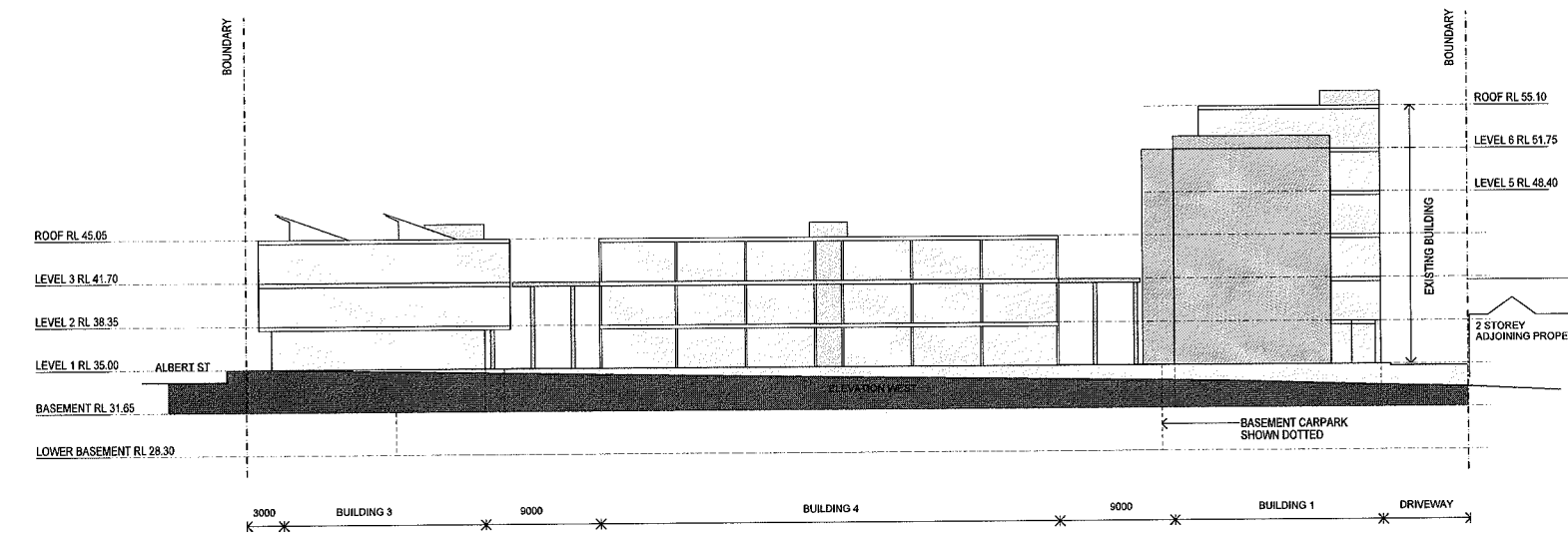


EAST ELEVATION



WEST ELEVATION

PROJECT CONCEPT PLAN OF REDEVELOPMENT OF RACHEL FORSTER HOSPITAL

ELEVATIONS - EAST & WEST

SCALE:200 @ A1

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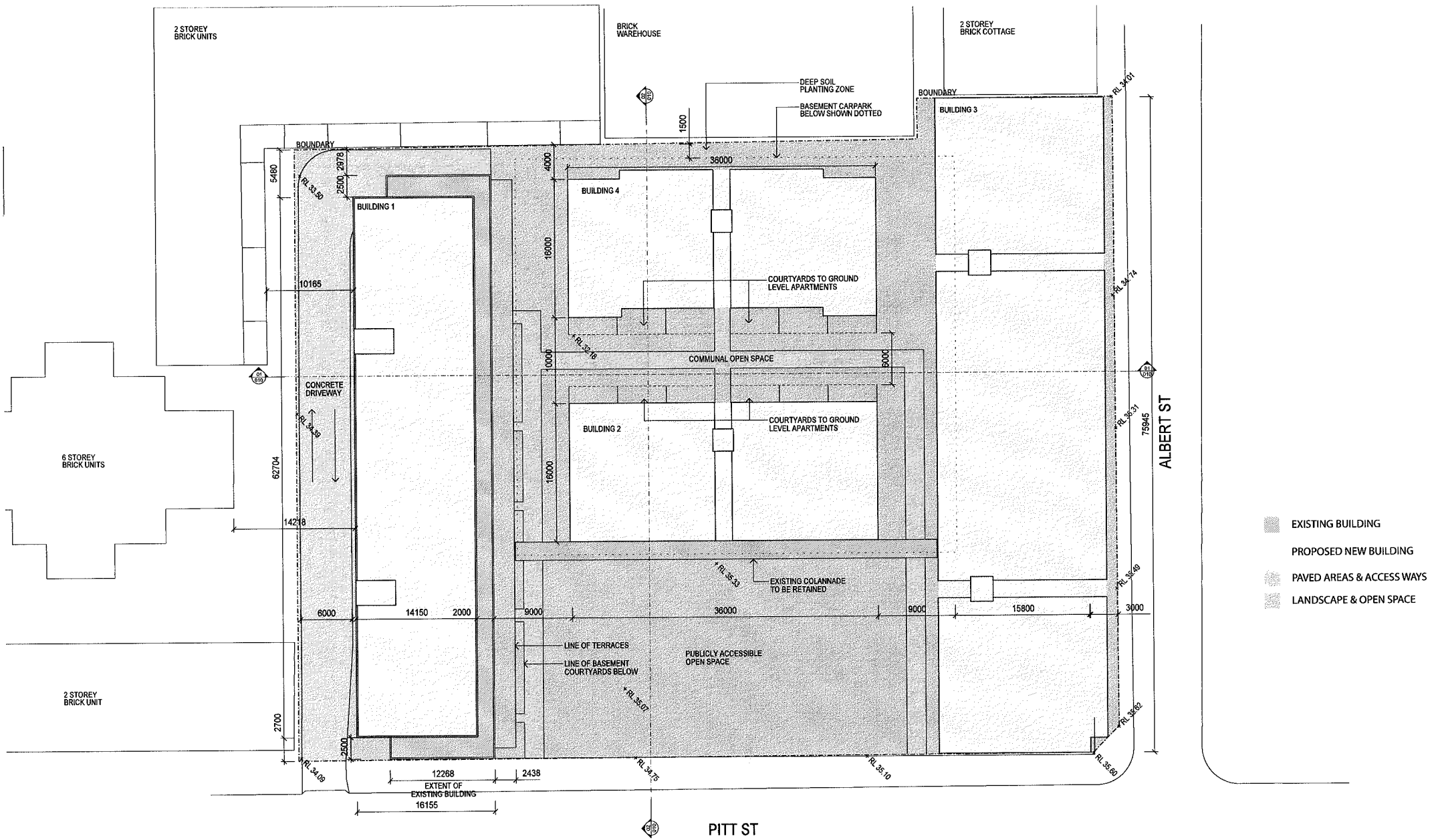

EXISTING BUILDING

PROPOSED NEW BUILDING

PAVED AREAS & ACCESS WAYS

LANDSCAPE & OPEN SPACE

PROJECT CONCEPT PLAN OF REDEVELOPMENT
OF RACHEL FORSTER HOSPITAL

SITE PLAN

SCALE:200 @ A1

20/03/2007

A 001

SITE AREA	6923 m2
MAXIMUM GFA	13,846 m2
MAXIMUM FSR	2 : 1

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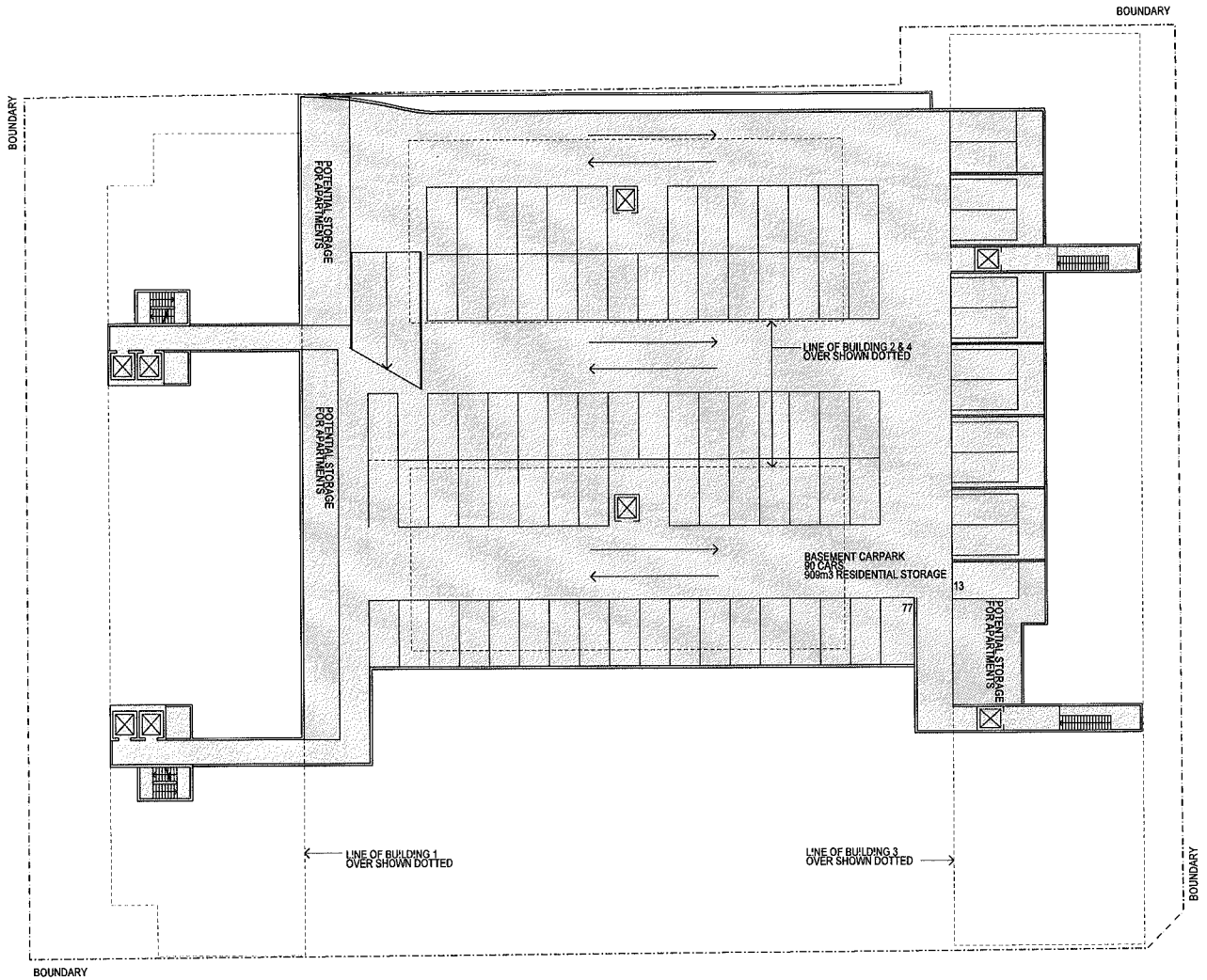

SERVICE AREAS

BASEMENT CARPARKING

RESIDENTIAL STORAGE AREAS

PROJECT CONCEPT PLAN OF REDEVELOPMENT OF RACHEL FORSTER HOSPITAL

LOWER BASEMENT FLOOR PLAN

SCALE:200 @ A1

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A 002

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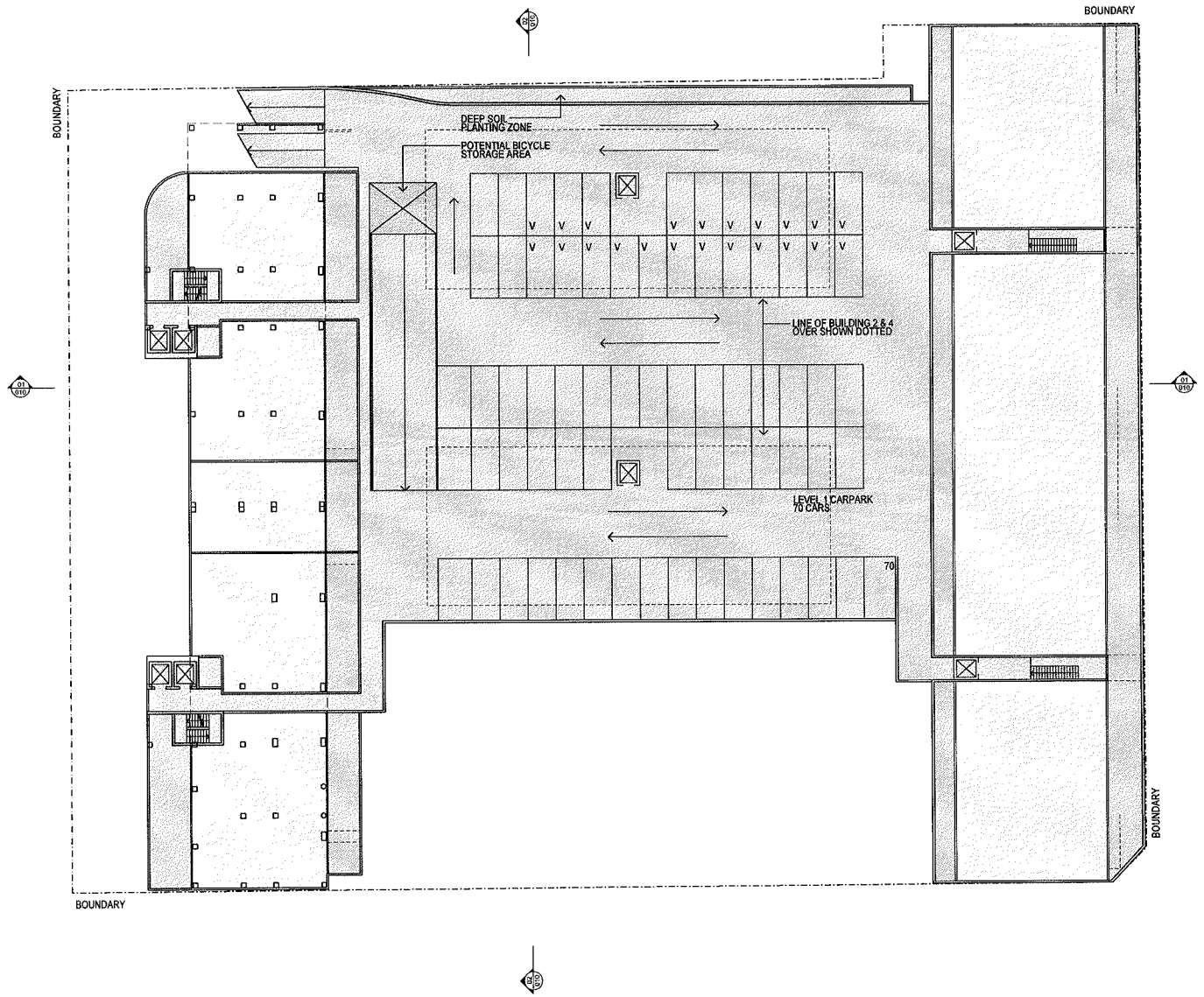

PROJECT CONCEPT PLAN OF REDEVELOPMENT OF RACHEL FORSTER HOSPITAL

BASEMENT FLOOR PLAN

SCALE:200 @ A1

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A 003

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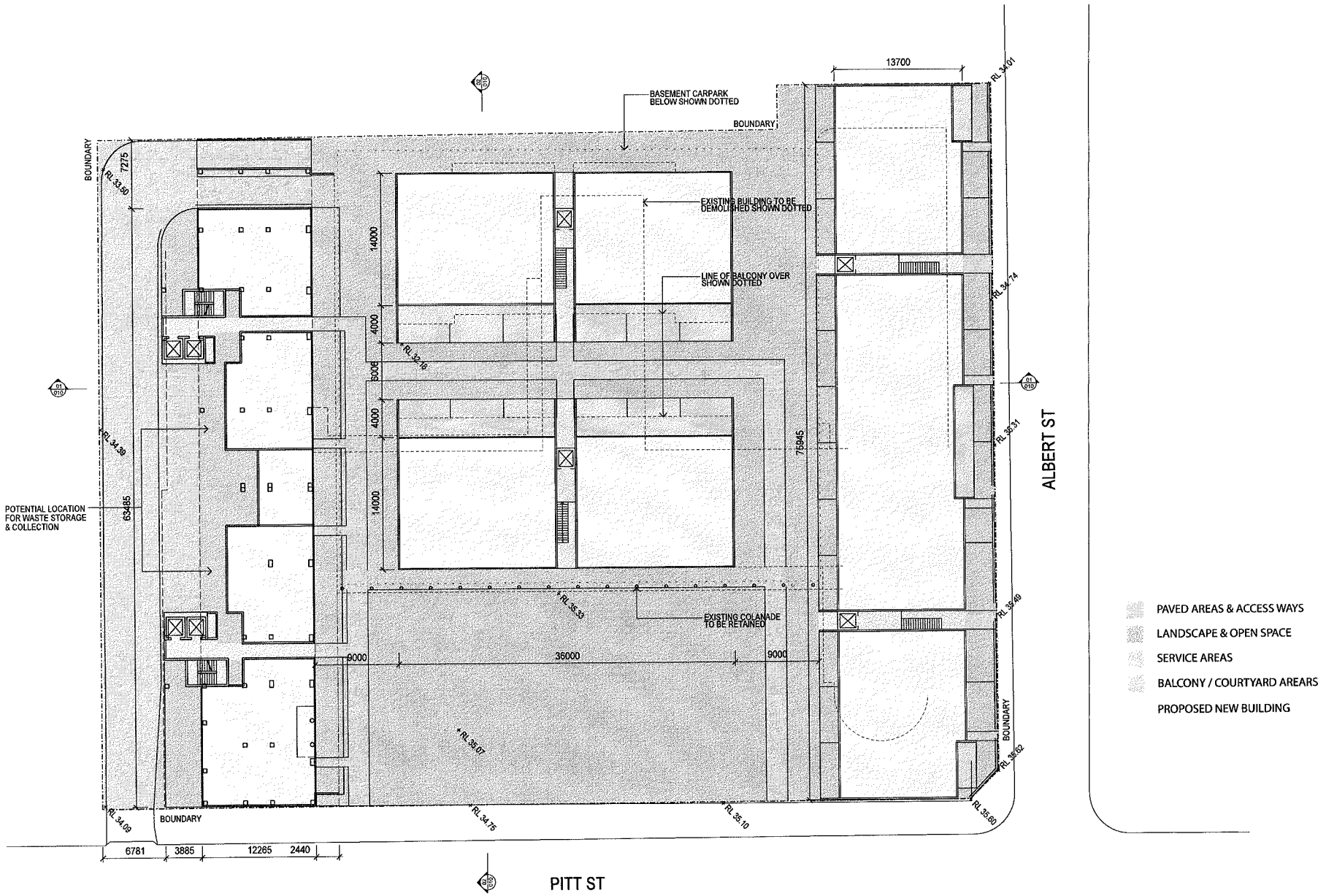

PROJECT CONCEPT PLAN OF REDEVELOPMENT OF RACHEL FORSTER HOSPITAL

LEVEL 1 FLOOR PLAN

SCALE:200 @ A1

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A 004

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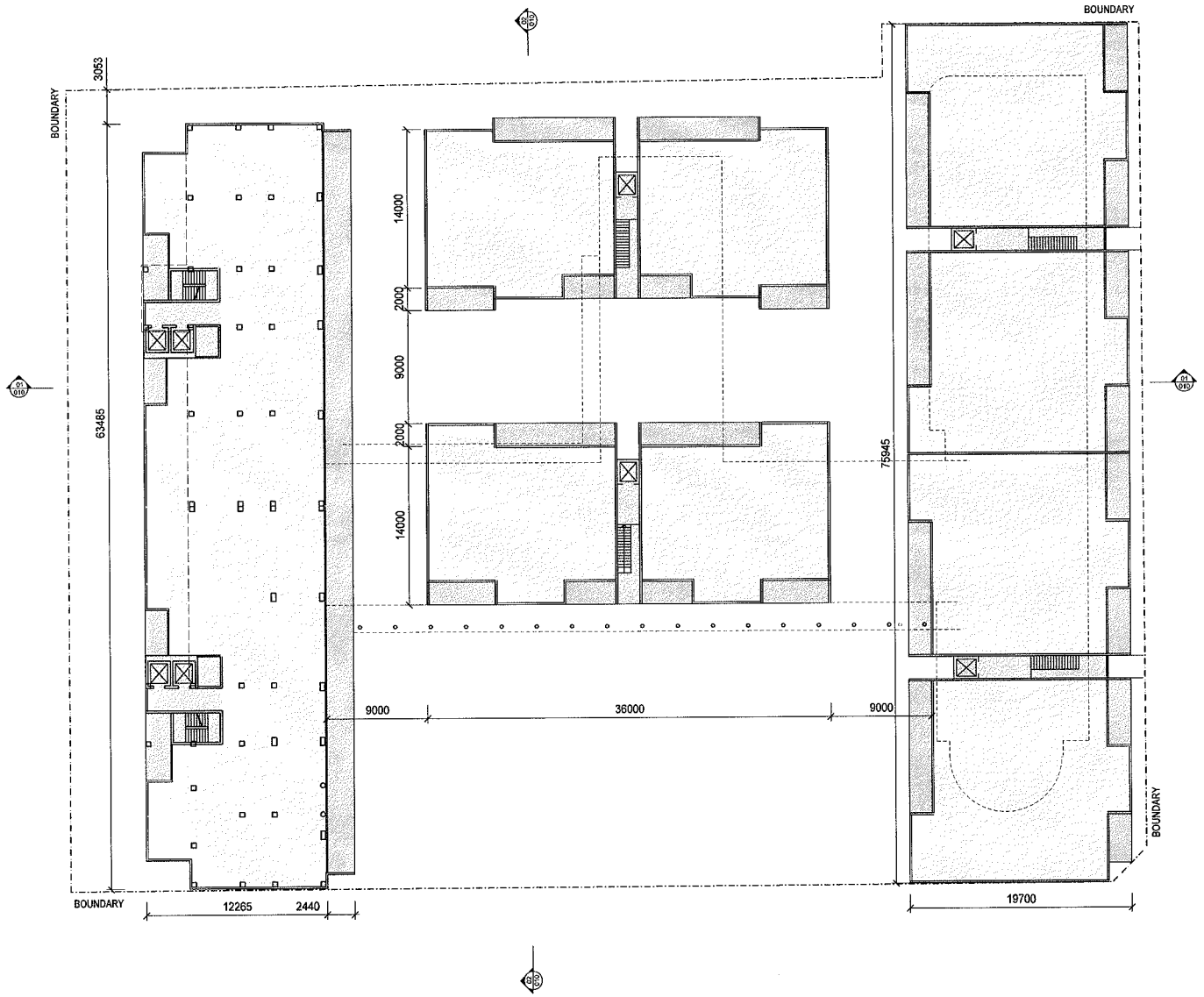

PROJECT CONCEPT PLAN OF REDEVELOPMENT
OF RACHEL FORSTER HOSPITAL

LEVEL 2 FLOOR PLAN

SCALE:200 @ A1

20/03/2007

A 005

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3. EXISTING ROAD NETWORK AND TRANSPORT CIRCUMSTANCES

3.1 ROAD NETWORK

The road network serving the site (Figure 3) comprises:

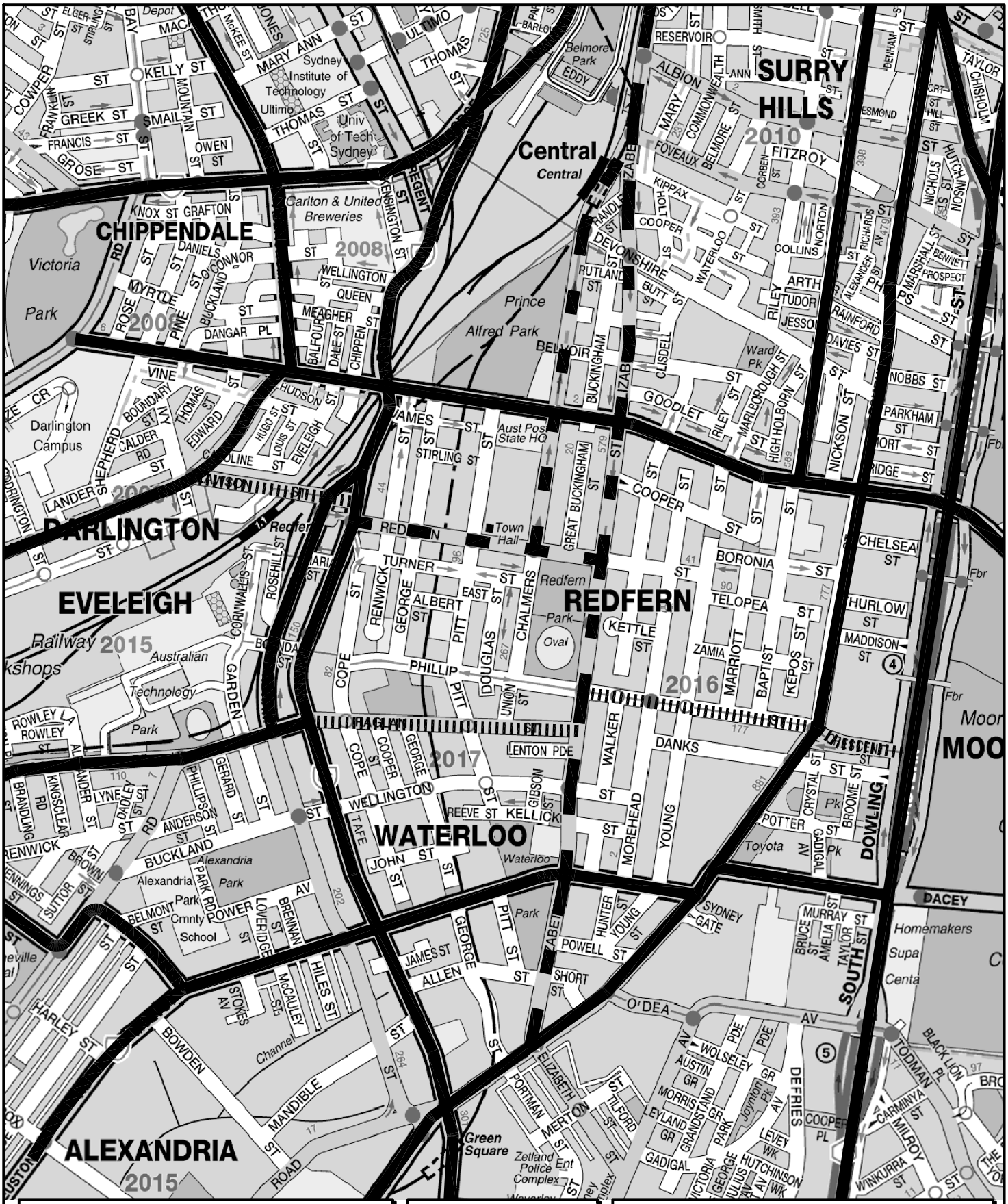
* *Cleveland Street* – a State Road and east/west arterial route linking with Anzac Parade in the east and City Road in the west

* *Elizabeth Street* – a Regional Road and north/south sub-arterial route which provides connection between the City and suburbs such as Surry Hills, Waterloo, Redfern and Alexandria

* *Chalmers Street* – Regional Road and one-way (northbound) sub-arterial route which functions between Redfern Street and Eddy Avenue to the north. To the south of Redfern Street, Chalmers Street is a local ONE WAY (northbound) street with angle parking provided on its eastern side

* *Regent Street/Botany Road* – a State Road and north/south arterial route which provides connection between the City and suburbs such as Redfern, Alexandria, Mascot and Botany. The route functions as a ONE WAY (southbound) road between Lawson Street and Henderson Road with the corresponding northbound carriageway utilising the parallel corridor of Wyndham Street/Gibbons Street

* *Redfern Street* – a Regional Road and sub-arterial route between Elizabeth Street and Chalmers Street and major collector route between Chalmers Street and Regent Street



LEGEND

- ARTERIAL
- SUB-ARTERIAL
- COLLECTOR

N

ROAD NETWORK

FIG 3

* *Cope Street* – a local 12.8 metre wide access road which functions in a ONE WAY (southerly) direction north of Turner Street and TWO WAY south thereof. Angle parking is provided on its eastern side north of Phillip Street

* *Pitt Street* – a local 12.8 metre wide north/south road which functions between Kettle Street in the south and Cleveland Street to the north

* *Phillip Street* – a local east-west street of variable width which functions generally as a two-way street other than between Chalmers Street and Pitt Street where it operates in a ONE WAY westerly direction.

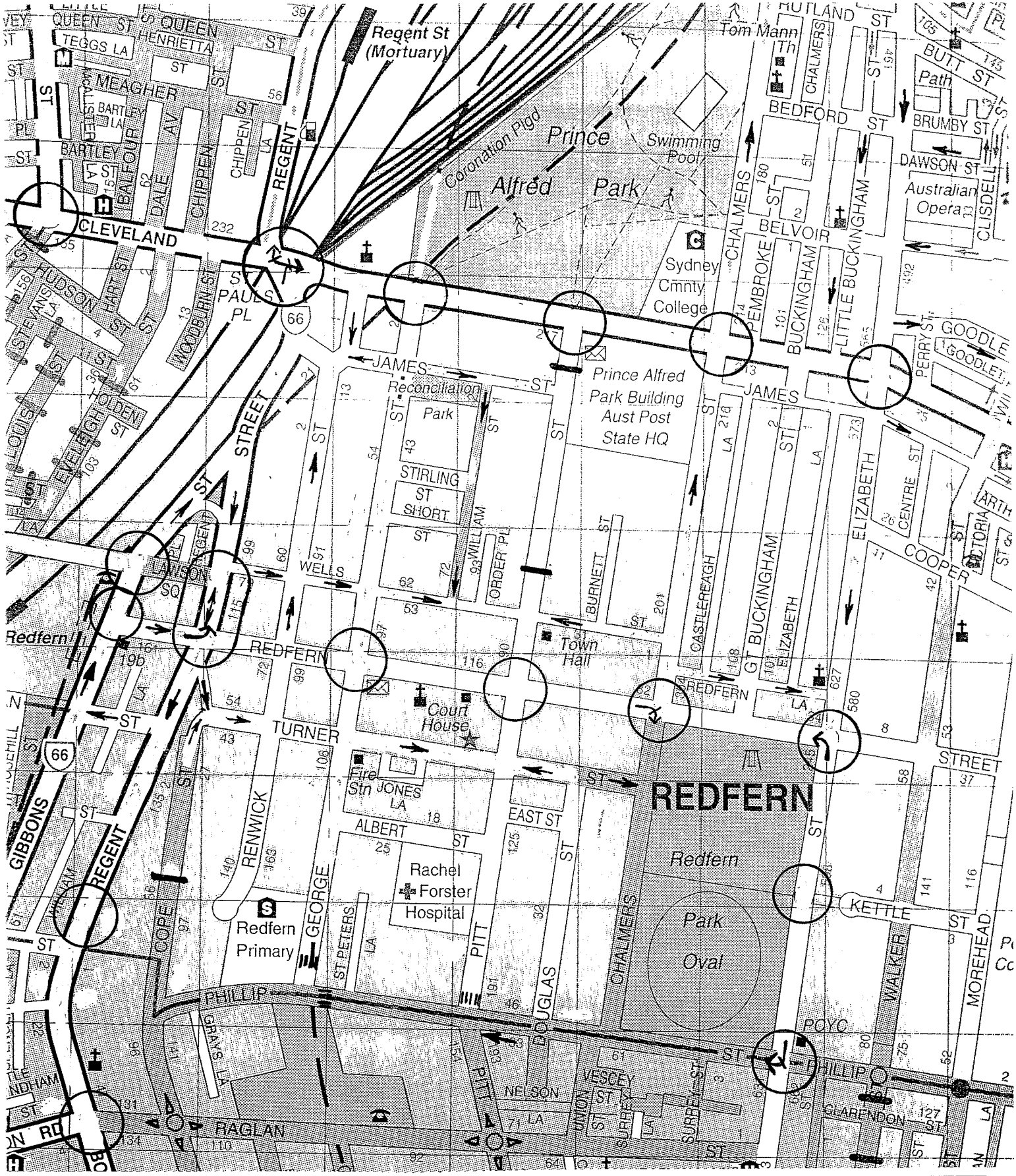
Albert Street is a local 6 metre wide street which functions in a ONE WAY (westerly) direction between George Street and Pitt Street.

3.2 TRAFFIC CONTROLS

The traffic controls which have been introduced to the road network both within and in the immediate vicinity of the Study Area are detailed in Figure 4 overleaf and comprise:

* the traffic signal control at the intersection of:
  - Redfern Street and Regent Street
  - Regent Street and Lawson Street
  - Redfern Street and George Street
  - Redfern Street and Pitt Street
  - Regent Street and Raglan Street
  - Regent Street north of Boundary Street

* the ONE WAY traffic restrictions in:
  - Chalmers Street north of Redfern Street (northbound)
  - Phillip Street (westbound) between Chalmers Street and Pitt Street
  - Wells Street (eastbound) between Regent Street and Pitt Street
  - Wells Street (westbound) between Pitt Street and Chalmers Street
  - Turner Street (eastbound) between Cope Street and Pitt Street



LEGEND

- TRAFFIC SIGNALS
- ONE WAY
- PERMITTED MOVEMENT
- SPEED HUMP
- NO RIGHT TURN
- ROUNDABOUT

N

TRAFFIC CONTROLS

FIG 4

- Turner Street (westbound) between Douglas Street and Pitt Street
- Albert Street (westbound) between George Street and Pitt Street
- Renwick Street (northbound) between Redfern Street and James Street
- Regent Street (southbound) between Cleveland Street and Raglan Street
- Wyndham Street/Gibbon Street (northbound) north of Henderson Road
- Redfern Street (eastbound) between Gibbons Street and Regent Street
- Cope Street (southbound) between Regent Street and Turner Street

* the roundabout at the intersections of Raglan Street and Cope Street and Raglan Street and Pitt Street

* the NO RIGHT TURN restrictions in:
  - Redfern Street (eastbound) at Chalmers Street
  - Elizabeth Street (northbound) at Redfern Street
  - Elizabeth Street (southbound) at Phillip Street

* the traffic calming devices and 3 TONNE load limit restriction in Pitt Street

* the GIVE WAY control in:
  - Renwick Street at Redfern and Turner Streets
  - Turner Street at George and Pitt Streets
  - Wells Street at Pitt Street
  - George Street and Phillip Street

* the STOP control in:
  - Renwick Street at Redfern and Turner Streets
  - Turner Street at George and Pitt Streets
  - Wells Street at Pitt Street
  - Redfern Street (eastbound) at Regent Street
  - Wells Street at George Street
  - Cope Street (northern approach) at Phillip Street
  - Phillip Street at Pitt Street

* the marked footcrossings in:
  - George Street north of Phillip Street
  - Phillip Street east of George Street
  - Pitt Street north of Phillip Street

* the extensive use of LEFT-TURN PERMITTED ON RED signage at signalised intersections of Pitt/Redfern Streets and George/Redfern Streets.

3.3 TRAFFIC CONDITIONS

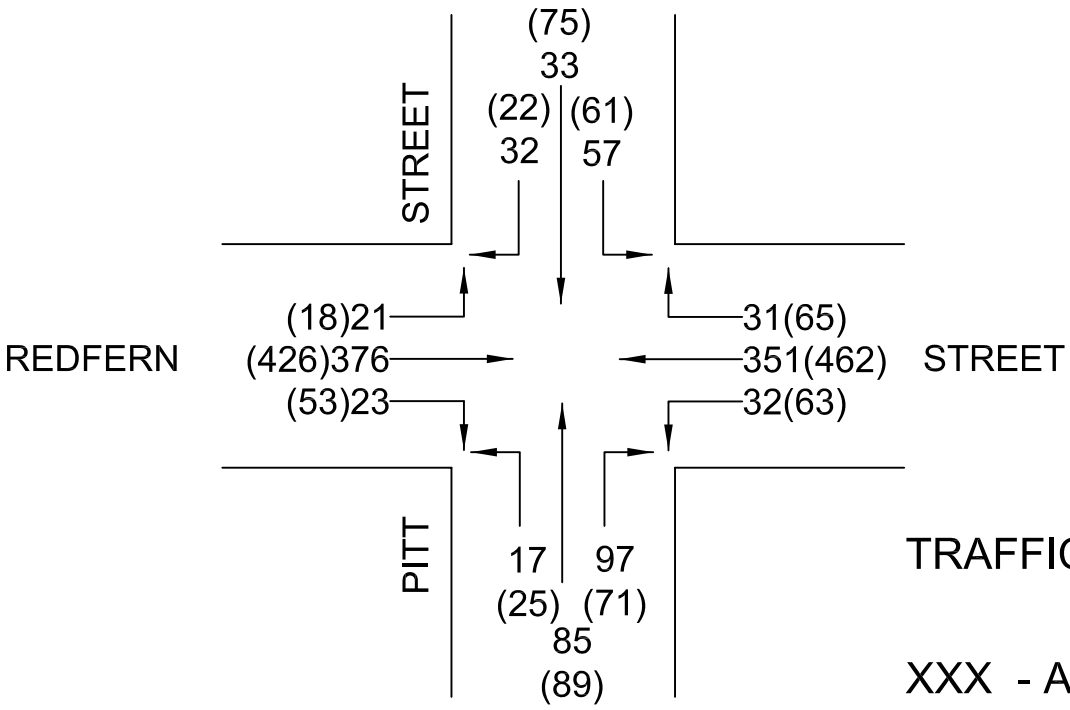
An indication of the prevailing traffic conditions on the road network in the vicinity of the site is provided by traffic volume data published by the Roads and Traffic Authority with respect to the arterial roads and from surveys undertaken at a more local level as part of this assessment.

The Roads and Traffic Authority data is expressed in the form of Average Annual Daily Traffic (AADT) and relevant to the site are the following:

Location	AADT	
	1999	**2002**
Botany Road, south of Raglan Street	27,536	25,331
Regent Street, South of Cleveland Street	53,854	48,856
Cleveland Street, east of George Street	44,317	43,696
McEvoy Street, east of George Street	15,995	18,037
Wyndham Street, south of McEvoy Street	13,793	14,839

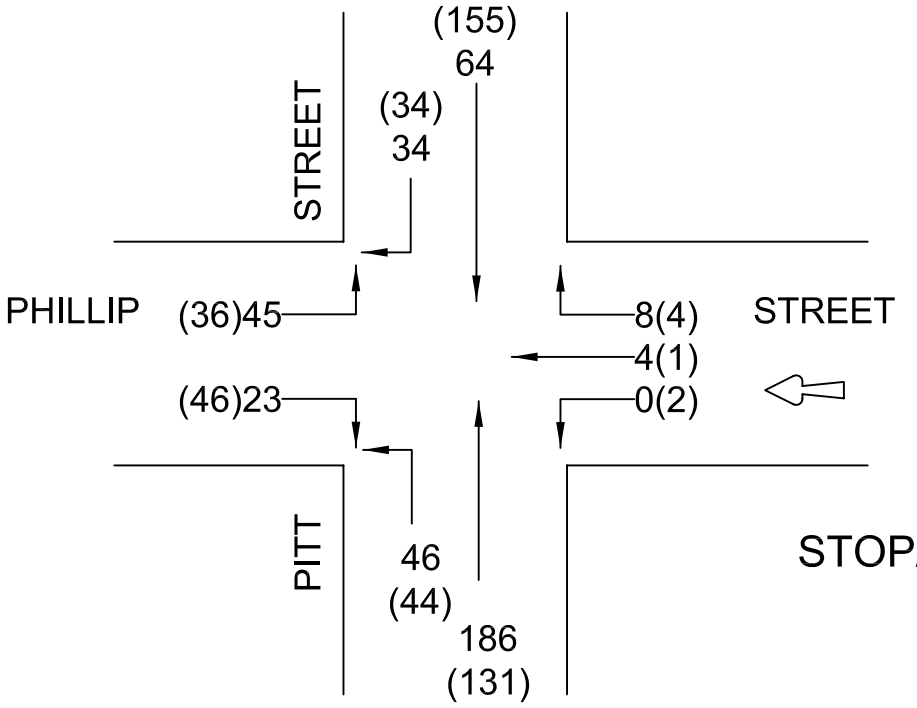
Traffic movement surveys conducted by this firm on Pitt Street at both Redfern and Phillip Street in the first week of May 2007 during the AM and PM peak periods of a typical weekday are summarised in Figure 5.

An assessment of the operational performance of the Pitt Street and Redfern Street intersection was modelled using the computer software model SIDRA. The result of this assessment is summarised in the table overleaf whilst the criteria for interpreting the results is shown overleaf.



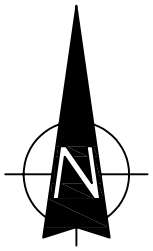
TRAFFIC SIGNAL CONTROL

XXX - AM PEAK
(XX) - PM PEAK



STOP/GIVE WAY CONTROL

LEGEND



EXISTING TRAFFIC FLOWS

FIG 5

PITT STREET AT REDFERN STREET, REDFERN
SIDRA ANALYSIS

Location	AM			PM		
	LOS	DS	AVD	LOS	DS	AVD
At Redfern Street	B	0.55	11.5	B	0.77	13.0

The analysis indicates that this intersection is operating with a good level of service and with negligible congestion or delay apparent on any vehicle approach.

3.4 PUBLIC TRANSPORT

The development site is highly accessible to both road and rail based public transport services being less than 400 metres from high frequency bus services on nearby Redfern Street and Regent Street and approximately 500-600 metres from Redfern Railway Station.

Details of the bus routes which operate in the vicinity of the site are outlined in the table below whilst route maps for each are provided in Appendix A.

Route №	Service Frequency	Route Description
305	Mon-Fri (Peak Hour Services)	Railway Square to Mascot via Redfern, Alexandria and Beaconsfield
308	Daily Daytime Services	Marrickville to City via St Peters, Alexandria and Redfern
309	Daily Full Time Service	Port Botany to City via Broadmeadow, Botany, Mascot and Redfern
310	Daily Full Time Service	Eastgardens to City via East Botany, Mascot and Redfern
355	Daily Daytime Service	Marrickville to Bondi Junction via Enmore, Newtown, Waterloo, Redfern, Surry Hills and Moore Park.

Criteria for Interpreting Results of SIDRA Analysis

1. *Level of Service (LOS)*

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

2. *Average Vehicle Delay (AVD)*

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

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

3. *Degree of Saturation (DS)*

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

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

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[1] *the values of DS for intersections under traffic signal control are only valid for cycle length of 120 secs*

Nearby Redfern Station provides access to 10 of the 11 lines on the City Rail network as well as convenient connection to Central Station and the extensive network of inter urban and country link services which operate to/from this station.

Given the site's high level of accessibility to public transport, both residents and visitors of the development are expected to make good use of the services provided particularly for journey to work purposes.

4. TRAFFIC

An indication of the potential traffic generation of the concept development scheme can be established from rates which are provided for a wide range of landuses in the RTA document 'Guide to Traffic Generating Developments'.

For residential developments of the scale proposed the RTA document specifies the following peak hour trip generation rate.

Residential Developments (comprising more than 20 dwellings)

Peak hour – 0.29 trips per apartment

Application of this rate to a development comprising of 150 apartments indicates a peak period traffic generation of some 44 movements per hour. These movements would comprise:

AM		PM	
IN	**OUT**	**IN**	**OUT**
10	34	33	11

This level of activity is not only unlikely to result in any adverse capacity or environmental impacts on the surrounding road network but will also be considerably less than that which would have been generated when the site was occupied by a fully operational hospital. Whilst data is not available of the traffic movements generated by the site at the time when the Rachel Forster Hospital was operational, surveys undertaken by this firm of the Concord and St George Hospitals provides a sound basis for estimating the morning, evening and peak vehicle trips generated by the site's former use.

Concord Hospital and St George Hospital have floorareas of some 53,500m^2 and 58,000m^2 respectively. Concord Hospital has some 730 beds and 1,560 full-time

equivalent staff whilst St George Hospital has in the order of 560 beds and 1,060 full-time equivalent staff.

These figures equate to:

* 1 bed per 73m^2 (Concord) and 1 bed per 100m^2 (St George)
* 1 bed for 2.13 staff (Concord) and 1 bed per 1.9 staff (St George).

It is understood that between 1980 and its closure in 2000, the Rachel Forster Hospital operated as an 89 bed specialist hospital for arthritic and orthopaedic patients. By applying an average of 2 staff per bed to the former Rachel Forster Hospital, the following morning, evening and peak vehicle trip generation rates can be established from the formula provided for private hospitals in the aforementioned RTA document:

Peak (PVT)	=	-14.69 + (0.69 x 89 beds) + (0.31 x 188 staff)	=	105 vtph
Morning (MVT)	=	-10.21 + (0.47 x 89 beds) + (0.06 x 188 staff)	=	43 vtph
Evening (EVT)	=	-2.84 + (0.25 x 89 beds) + (0.4 x 188 staff)	=	95 vtph

Based upon this assessment it is apparent that the proposed residential development will generate vehicle movements to/from the site which are less than half that estimated of the former hospital use during the evening commuter peak and peak arrival/departure period, and similar to the hospital's morning peak trip generation.

5. PARKING

Parking is proposed on the site for in the order of 160 vehicles which will be provided over 2 basement levels accessed from an existing combined entry/exit driveway and access road off Pitt Street adjacent to the site's southern boundary.

The parking provision is based upon the following parking rates:

0.8 spaces per one-bedroom apartments	=	79 spaces
1.2 spaces per two-bedroom apartments	=	56 spaces
2 spaces per three-bedroom apartments	=	8 spaces
Visitors – 1 space per 8 apartments	=	19 spaces
Total	**=**	**162 spaces**

There is currently no carparking development control plan or policy applying to this site. The former South Sydney Council DCP № 11 continues to apply to the surrounding area while the Central Sydney LEP 2005 contains parking provisions for the Central Sydney CBD area.

Whilst the adopted parking rates slightly exceed the provisions adopted in the Central Sydney LEP (2005) and the requirements specified in the former South Sydney Council DCP № 11 they are considered appropriate on the basis that:

* a significant proportion of the surrounding landuses comprise of older style terrace houses of which many do not have access to off-street parking. In recognition of this, Council has introduced a time restricted resident exempt parking scheme to signficiant lengths of the surrounding streets to discourage all day worker/commuter parking and assist residents of adjacent dwellings with access to kerbside parking.

Residents of the proposed development will not be eligible to participate in the resident parking scheme, and as such it is imperative that adequate parking is provided on-site

* surveys carried out by this firm in 2005 on behalf of the City of Sydney indicate that there is a relatively high level of use of the kerbside parking provisions in the immediate vicinity of the site. To ensure that demand for these spaces is not exacerbated it is desirable that adequate provisions are made within the site to accommodate the parking requirements of visitors

* the supply of parking in residential developments does not influence traffic generation, but rather it is the number of dwellings which determines such activity.

This position is supported by the Roads and Traffic Authority document 'Guide to Traffic Generating Developments' which specifies traffic generation rates for residential developments on the basis of type (ie single dwelling/multi-unit dwelling/aged persons) and number of dwellings proposed.

This correlation was supported in a recent survey carried out of the traffic generated by 2 Central Sydney residential apartment complexes (Century Tower and Observatory Tower). The Century Tower (in Pitt Street) comprises 296 apartments with 129 parking spaces whilst the Observatory Tower (in Kent Street) has 199 apartments and 245 parking spaces.

The survey results of the carpark vehicle generation rate of both developments in the AM and PM peaks are summarised below:

Location	№ Apts	№ Parking Spaces	Pkg Spaces per Apt	AM Vehicle Trips	PM Vehicle Trips	Generation Rate[1] (Apartment)		Generation Rate[2] (Carpark)	
Century Tower	296	129	0.44	34	39	0.12	0.13	0.26	0.3
Observatory Tower	199	245	1.23	21	29	0.11	0.15	0.09	0.12

1 *Rates are the №'s of movements per apartment*

2 *Rates are the №'s of movements per parking space*

These results clearly support the position that the number of dwellings and not the number of parking spaces, determine the level of traffic generation.

On the basis of these considerations, the proposed parking provision is considered to be appropriate and will be sufficient to ensure that the normal day to day parking demands generated by the development do not impact on the accessibility to on-street parking for neighbouring residents and business owners.

6. ACCESS, SERVICING, CARPARK DESIGN AND CONSTRUCTION ACTIVITY

Vehicular Access

Vehicular access to the site is proposed via an existing 5.7 metre wide combined entry/exit driveway located on Pitt Street and adjacent to the southern property boundary. The remaining 3 driveways (2 on Pitt Street and the other on Albert Street) will be closed. The consolidated driveway will facilitate access to the site's basement carparking and at grade delivery vehicle area. The internal access road is generally some 6.0 metres wide enabling non-conflicting two-way movements and sufficient width for delivery vehicles up to 10.5 metres in length to enter and depart the site in a forward direction.

Pedestrian Access

The development site has good pedestrian access to not only public transport nodes and essential services but also nearby public open spaces such as Redfern Park and Prince Alfred Park. Pedestrian access to all these facilities are provided by means of constructed footways and signalised pedestrian crossings at major intersections as well as marked footcrossings at a number of the more lightly trafficked intersections (eg Phillip Street/Pitt Street and Phillip Street/George Street).

Servicing

As indicated above, it is proposed to provide an area adjacent to the internal access road to facilitate delivery vehicles (including Council's refuse vehicles) servicing the site. All waste and recycling material generated by the complex will be stored at this centralised location. The service vehicle area is quite generous in size, being capable of accommodating more than 1 truck at a time whilst sufficient manoeuvring space is provided to ensure that service vehicles are able to enter and depart the

site in a forward direction (refer to Figures SP1 – SP3 of Appendix B). In addition to the delivery dock area, visiting maintenance personnel (eg electricians/plumbers) and doctors will also have access to the visitor parking spaces located in the basement level carpark.

Carpark Design

The parking spaces are provided within a two-level basement carpark. The layout of the carpark generally complies with requirements specified in AS 2890.1 in terms of parking bay sizes, access and circulation aisle widths, height clearances and ramp grades/widths.

Construction Activity

The construction of the concept development scheme will involve 3 principle phases namely demolition, excavation and construction. The demolition and excavation phases will generate the highest concentration/volume of heavy vehicle movements, although the duration of both these phases will be considerably shorter than the construction phase.

To ensure that the impact of construction activity is minimised on the surrounding areas all heavy vehicle movements will be directed to access the site via Raglan Street and Pitt Street and egress via Pitt Street and Redfern Street. Workers will also be encouraged to travel by public transport with on-site parking being generally restricted to sub-contractors and the like who are required to carry tools and materials. Once approval is granted to the proposed development a more comprehensive Construction Traffic Management Plan will be prepared for approval of relevant authorities at Project Application or Construction Certificate stage.

7. CONCLUSION

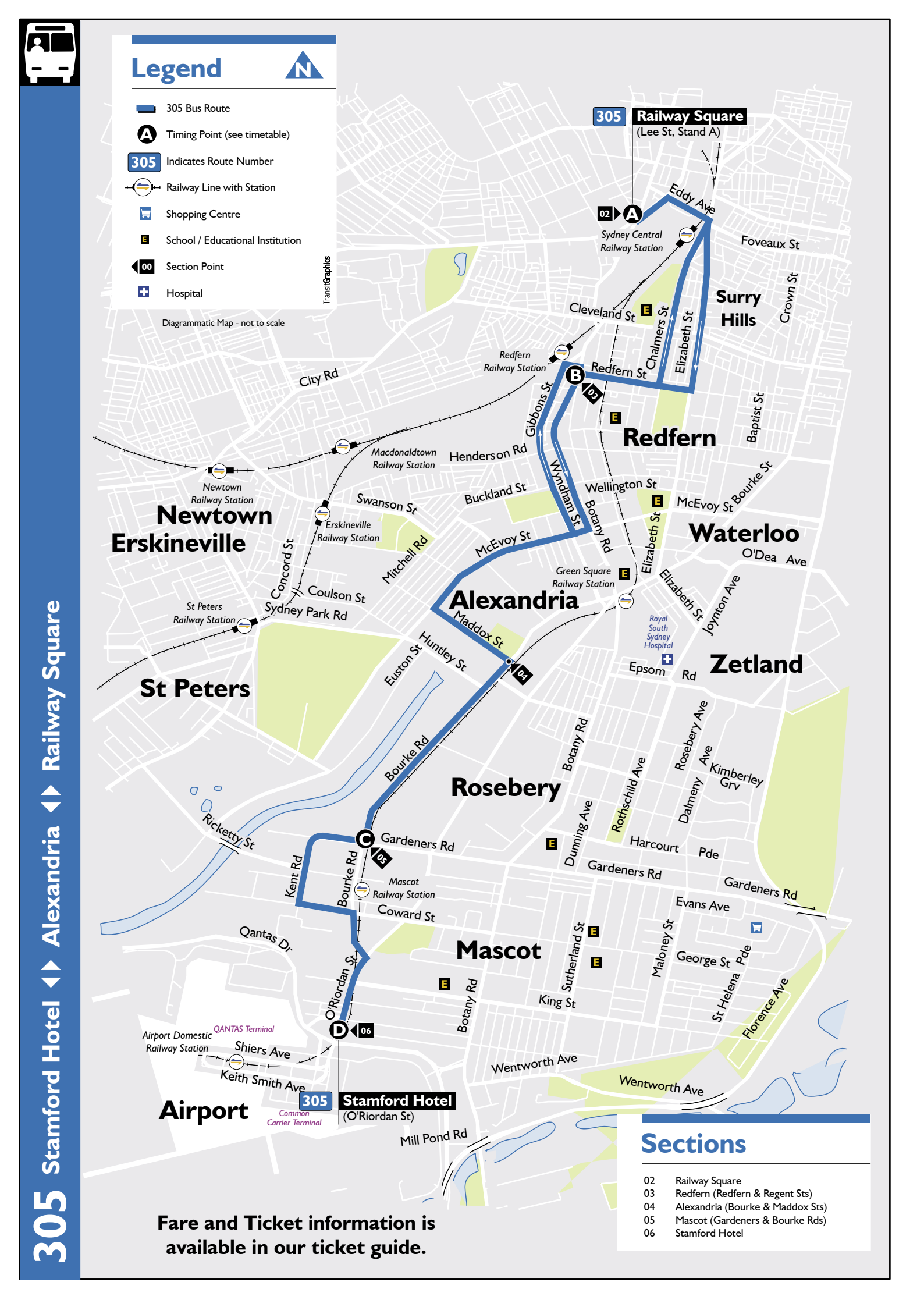
This report has examined the traffic and parking, and local access implications of a concept scheme prepared by the Redfern Waterloo Authority to develop a high density residential development on the grounds formerly occupied by the Rachel Forster Hospital.

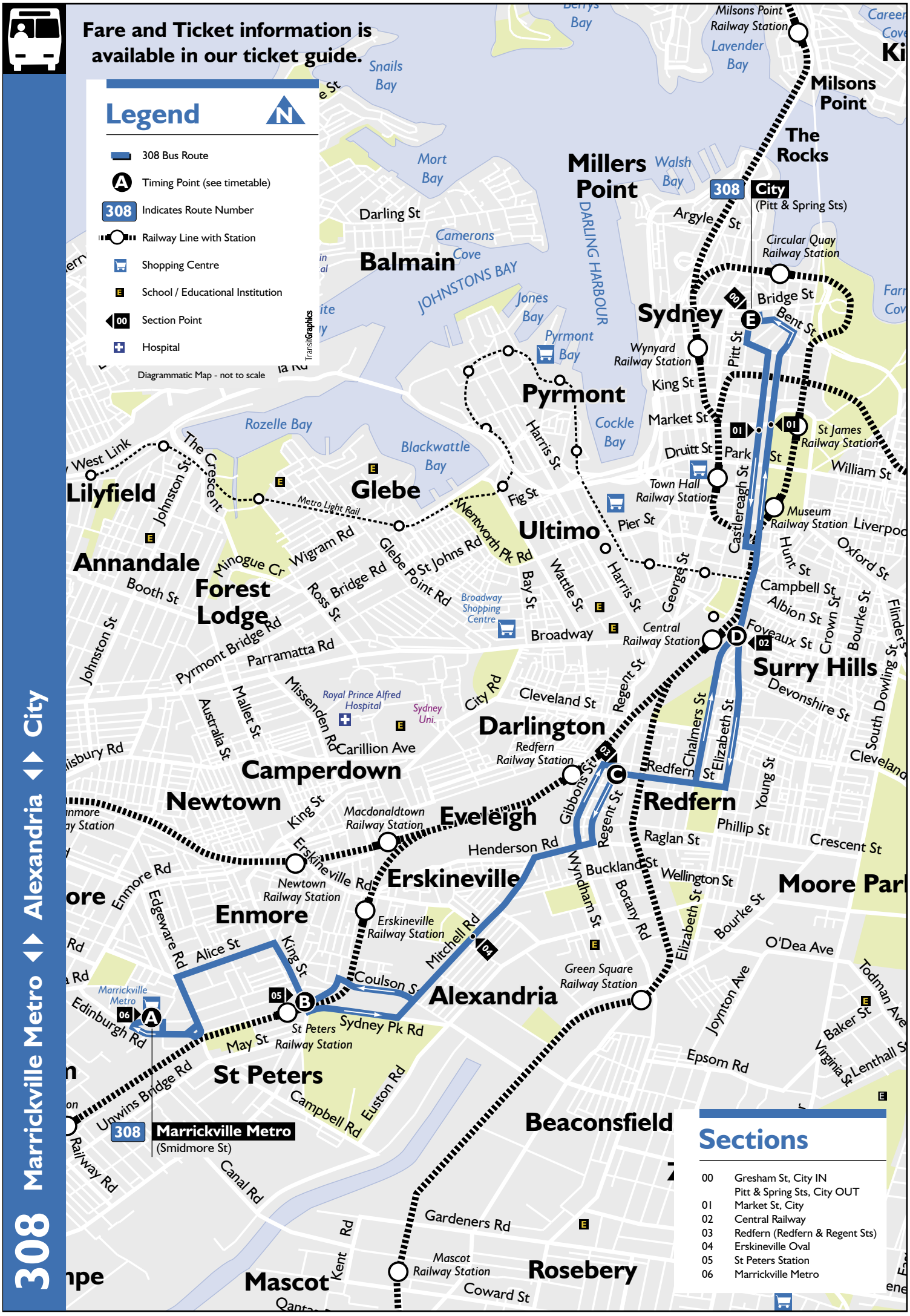
The assessment has established that the concept development scheme:

* will generate only a light to moderate level of vehicle activity and that this can be readily accommodated on the surrounding road network

* the proposed parking provision will be adequate to accommodate demands of both residents and visitors and sufficient to ensure that demand on the limited on-street parking supply is not exacerbated

* the proposed servicing provisions will be sufficient for the needs of the proposed development.


305 Stamford Hotel ◀▶ Alexandria ◀▶ Railway Square
Legend
305 Bus Route
Timing Point (see timetable)
305 Indicates Route Number
Railway Line with Station
Shopping Centre
School / Educational Institution
00 Section Point
Hospital
TransitGraphics
Diagrammatic Map - not to scale
305 Railway Square
(Lee St, Stand A)
02 A
Sydney Central Railway Station
Eddy Ave
Foveaux St
Surry Hills
Crown St
Cleveland St
Chalmers St
Elizabeth St
Redfern Railway Station
Redfern St
B 03
Redfern
Baptist St
Gibbons St
City Rd
Macdonaldtown Railway Station
Henderson Rd
Wyndham St
Wellington St
McEvoy St
Bourke St
Waterloo
Newtown Railway Station
Newtown
Erskineville
Swanson St
Erskineville Railway Station
Buckland St
Botany Rd
Elizabeth St
O'Dea Ave
Concord St
Mitchell Rd
McEvoy St
Green Square Railway Station
Alexandria
Coulson St
Sydney Park Rd
St Peters Railway Station
Maddox St
Elizabeth St
Joynton Ave
Royal South Sydney Hospital
Huntley St
Euston St
Epsom Rd
Zetland
St Peters
C 04
Bourke Rd
Botany Rd
Rosebery Ave
Kimberley Grv
Rosebery
Ricketty St
Rothschild Ave
Dalmeny Ave
Dunning Ave
Gardeners Rd
C 05
Harcourt Pde
Kent Rd
Bourke Rd
Mascot Railway Station
Gardeners Rd
Evans Ave
Coward St
Qantas Dr
Mascot
Sutherland St
Maloney St
George St
Pde
O'Riordan St
Botany Rd
King St
St Helena Pde
Florence Ave
D 06
QANTAS Terminal
Airport Domestic Railway Station
Shiers Ave
Keith Smith Ave
Wentworth Ave
Wentworth Ave
Airport
Common Carrier Terminal
305 Stamford Hotel
(O'Riordan St)
Mill Pond Rd
Sections
02 Railway Square
03 Redfern (Redfern & Regent Sts)
04 Alexandria (Bourke & Maddox Sts)
05 Mascot (Gardeners & Bourke Rds)
06 Stamford Hotel
Fare and Ticket information is available in our ticket guide.


Fare and Ticket information is available in our ticket guide.
Legend
308 Bus Route
Timing Point (see timetable)
308 Indicates Route Number
Railway Line with Station
Shopping Centre
School / Educational Institution
00 Section Point
Hospital
TransitGraphics
Diagrammatic Map - not to scale
308 Marrickville Metro ◀▶ Alexandria ◀▶ City
Sections
00 Gresham St, City IN
Pitt & Spring Sts, City OUT
01 Market St, City
02 Central Railway
03 Redfern (Redfern & Regent Sts)
04 Erskineville Oval
05 St Peters Station
06 Marrickville Metro
Milsons Point Railway Station
Lavender Bay
Milsons Point
The Rocks
Millers Point
Walsh Bay
Snails Bay
Mort Bay
Darling St
Balmain
Camerons Cove
JOHNSTONS BAY
Jones Bay
DARLING HARBOUR
Pyrmont Bay
Pyrmont
Cockle Bay
Rozelle Bay
Blackwattle Bay
Lilyfield
Glebe
Ultimo
Annandale
Forest Lodge
Darlington
Camperdown
Newtown
Eveleigh
Redfern
Erskineville
Enmore
Alexandria
St Peters
Beaconsfield
Rosebery
Mascot
Surry Hills
Moore Park
Sydney
Circular Quay Railway Station
Wynyard Railway Station
Town Hall Railway Station
St James Railway Station
Museum Railway Station
Central Railway Station
Redfern Railway Station
Macdonaldtown Railway Station
Newtown Railway Station
Erskineville Railway Station
St Peters Railway Station
Green Square Railway Station
Mascot Railway Station
Marrickville Metro
Royal Prince Alfred Hospital
Sydney Uni.
Broadway Shopping Centre
Carillion Ave
Metro Light Rail
308 City (Pitt & Spring Sts)
308 Marrickville Metro (Smidmore St)

309/X09/310/X10 Port Botany/Eastgardens ◀▶ City

Legend

- Bus Route
- A Timing Point (see timetable)
- A Timing Point (for Route L09 only)
- 309 Indicates Route Number
- Railway Line with Station
- Route Diversion (see timetable)
- Shopping Centre
- E School / Educational Institution
- 00 Section Point
- Hospital

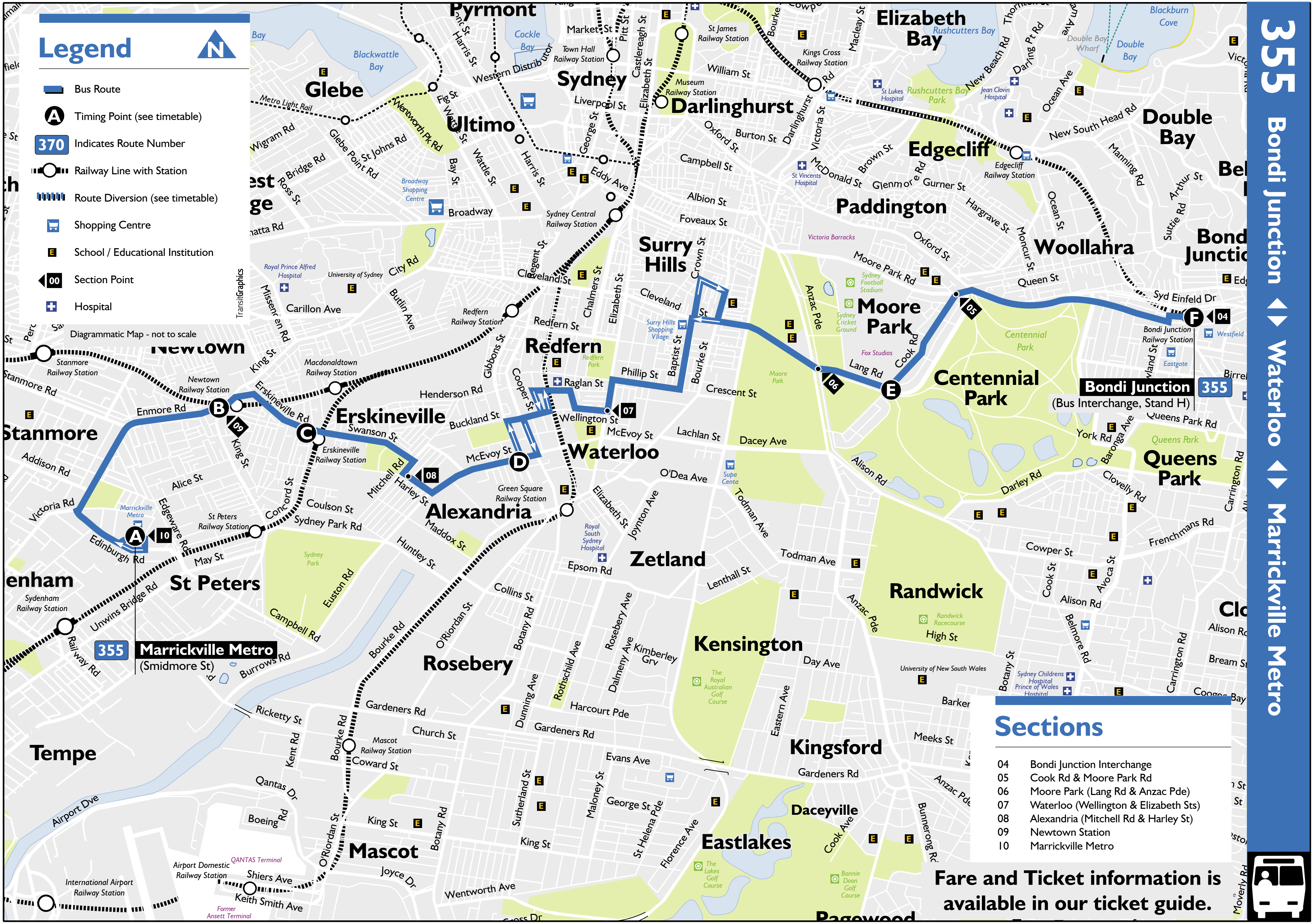
TransitGraphics

Diagrammatic Map - not to scale

Rocks
309 310 Circular Quay (Alfred St, Stand D)
X09 X10 City (Spring St)
Harbour Bridge
Argyle St
Circular Quay Railway Station
Farm Cove
Woolloomooloo Bay
The Domain
Bridge St
Macquarie St
Woolloomooloo
Wynyard Railway Station
Martin Place Railway Station
Sydney Hospital & Sydney Eye Hospital
Cowper Wharf Roadway
Elizabeth Bay
King St
Pyrmont St
Market St
St James Railway Station
Bourke St
Macleay St
Elizabeth Bay
Rushcutters Bay
Western Distributor
Town Hall Railway Station
Castlereagh St
Sydney
William St
Kings Cross Railway Station
New Beach Rd
Museum Railway Station
Darlinghurst
St Lukes Hospital
Rushcutters Bay Park
Jean Clovin Hospital
Liverpool St
Wattle St
George St
Oxford St
Burton St
Darlinghurst
Victoria St
Edgecliff
Campbell St
Eddy Ave
McDonald St
Brown St
Glenmore Rd
Gurner St
Railway Station
Albion St
Broadway
Redfern (Railway Station)
L09
Central Station
Foveaux St
Paddington
Hargrave St
Victoria Barracks
Oxford St
Surry Hills
Crown St
Royal Prince Alfred Hospital
University of Sydney
City Rd
Cleveland St
Moore Park Rd
Sydney Football Stadium
Missenden Rd
Carillon Ave
Butlin Ave
Chalmers St
Elizabeth St
Redfern Railway Station
Redfern St
Surry Hills Shopping Village
Anzac Pde
Sydney Cricket Ground
Moore Park
Newtown
Gibbons St
Redfern
Fox Studios
Cook Rd
Macdonaldtown Railway Station
Newtown Railway Station
Phillip St
Baptist St
Bourke St
Lang Rd
Centennial Park
Erskineville Rd
Henderson Rd
Waterloo
Crescent St
Erskineville
Buckland St
Wellington St
McEvoy St
Lachlan St
Dacey Ave
Swanson St
Erskineville Railway Station
King St
Alice St
Mitchell Rd
Harley St
Concord St
Green Square Railway Station
O'Dea Ave
Alison Rd
Darley Rd
Coulson St
Elizabeth St
Joynton Ave
Todman Ave
St Peters Railway Station
Sydney Park Rd
Maddox St
Alexandria
Huntley St
Royal South Sydney Hospital
Zetland
Todman Ave
Edgeware Rd
May St
Sydney Park
Euston Rd
Epsom Rd
Lenthall St
Randwick
St Peters
Collins St
Botany Rd
Rosebery Ave
Anzac Pde
Randwick Racecourse
High St
Campbell Rd
O'Riordan St
Bourke Rd
Rosebery
Kensington
Canal Rd
Burrows Rd
Dunning Ave
Rothschild Ave
Dalmeny Ave
Kimberley Grv
Day Ave
University of New South Wales
Botany St
The Royal Australian Golf Course
Eastern Ave
Barker St
Harcourt Pde
Gardeners Rd
Kingsford
Meeks St
Kennedy St
Rainbow St
Ricketty St
Kent Rd
Bourke Rd
Mascot Railway Station
Coward St
Evans Ave
Anzac Pde
Qantas Dr
Sutherland St
Maloney St
George St
St Helena Pde
Florence Ave
Daceyville
Cook Ave
Bunnerong Rd
Boeing Rd
King St
Botany Rd
O'Riordan St
Mascot
Eastlakes
The Lakes Golf Course
Bonnie Doon Golf Course
Airport Domestic Railway Station
QANTAS Terminal
Shiers Ave
Joyce Dr
Wentworth Ave
Keith Smith Ave
Former Ansett Terminal
Common Carrier Terminal
Airport
Mill Pond Rd
Southern Cross Dr
Pagewood
310 X10 Eastgardens (Bus Interchange)
aroubra Junction
Botany
Page St
Heffron Rd
Maroubra Rd
Banksia St
Wentworth Ave
Banks Ave
Westfield Drive
Wild St
Walsh Ave
General Holmes Dr
William St
Stephen Rd
Westfield Eastgardens
O'Sullivan Ave
Donovan Ave
309 X09 L09
Swinbourne St
Eastgardens
Bunnerong Rd
Heffron Park
X09 Banksmeadow (Discovery Cove)
Southpoint Shopping Centre
Botany Rd
Foreshore Rd
Stephen Rd
Hillsdale
L09 Port Botany (Military & Bunnerong Rds)
Banksmeadow
Sir Josephs Banks Park
309
Beauchamp Rd
Matraville
Botany Rd
Franklin St
Bunnerong Rd
L09
Patrick Container Terminal
Military Rd
Bumborah Point Rd
CTAL Container Terminal
Botany Cemetery
Macquarie St
Port Botany Depot (Bumborah Point Rd) 309
Bulk Liquids Storage Area
Phillip

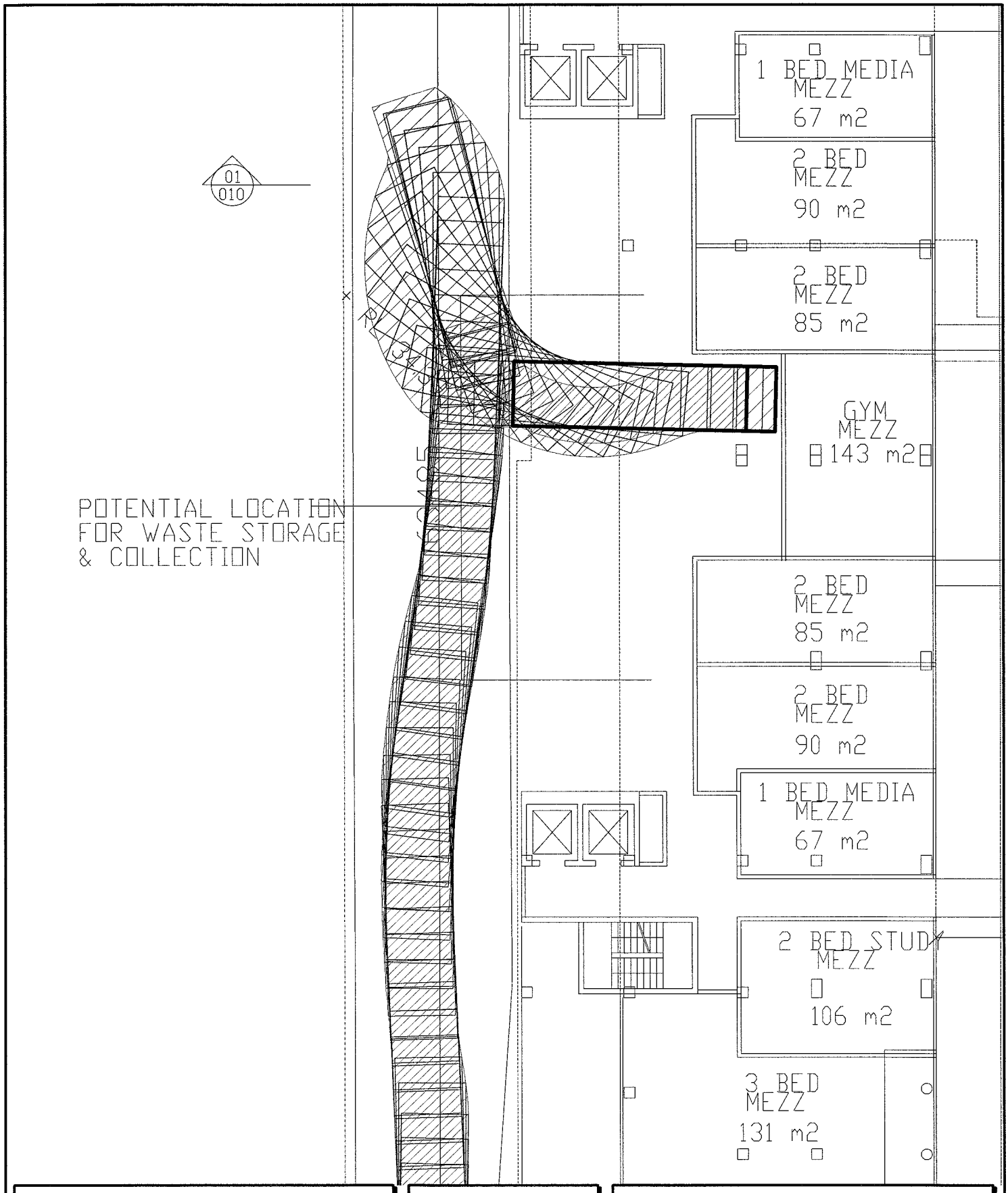
Fare and Ticket information is available in our ticket guide.

L09 Port Botany ◀▶ Redfern


355 Bondi Junction ↔ Waterloo ↔ Marrickville Metro
Legend
Bus Route
Timing Point (see timetable)
370 Indicates Route Number
Railway Line with Station
Route Diversion (see timetable)
Shopping Centre
School / Educational Institution
00 Section Point
Hospital
TransitGraphics
Diagrammatic Map - not to scale
Bondi Junction 355
(Bus Interchange, Stand H)
355 Marrickville Metro
(Smidmore St)
Sections
04 Bondi Junction Interchange
05 Cook Rd & Moore Park Rd
06 Moore Park (Lang Rd & Anzac Pde)
07 Waterloo (Wellington & Elizabeth Sts)
08 Alexandria (Mitchell Rd & Harley St)
09 Newtown Station
10 Marrickville Metro
Fare and Ticket information is available in our ticket guide.
Pyrmont
Glebe
Ultimo
Sydney
Darlinghurst
Elizabeth Bay
Double Bay
Edgecliff
Paddington
Woollahra
Surry Hills
Moore Park
Centennial Park
Queens Park
Redfern
Newtown
Stanmore
Erskineville
Waterloo
Alexandria
Zetland
Randwick
St Peters
Kensington
Rosebery
Kingsford
Tempe
Daceyville
Eastlakes
Mascot

APPENDIX B

SWEPT PATH ANALYSIS



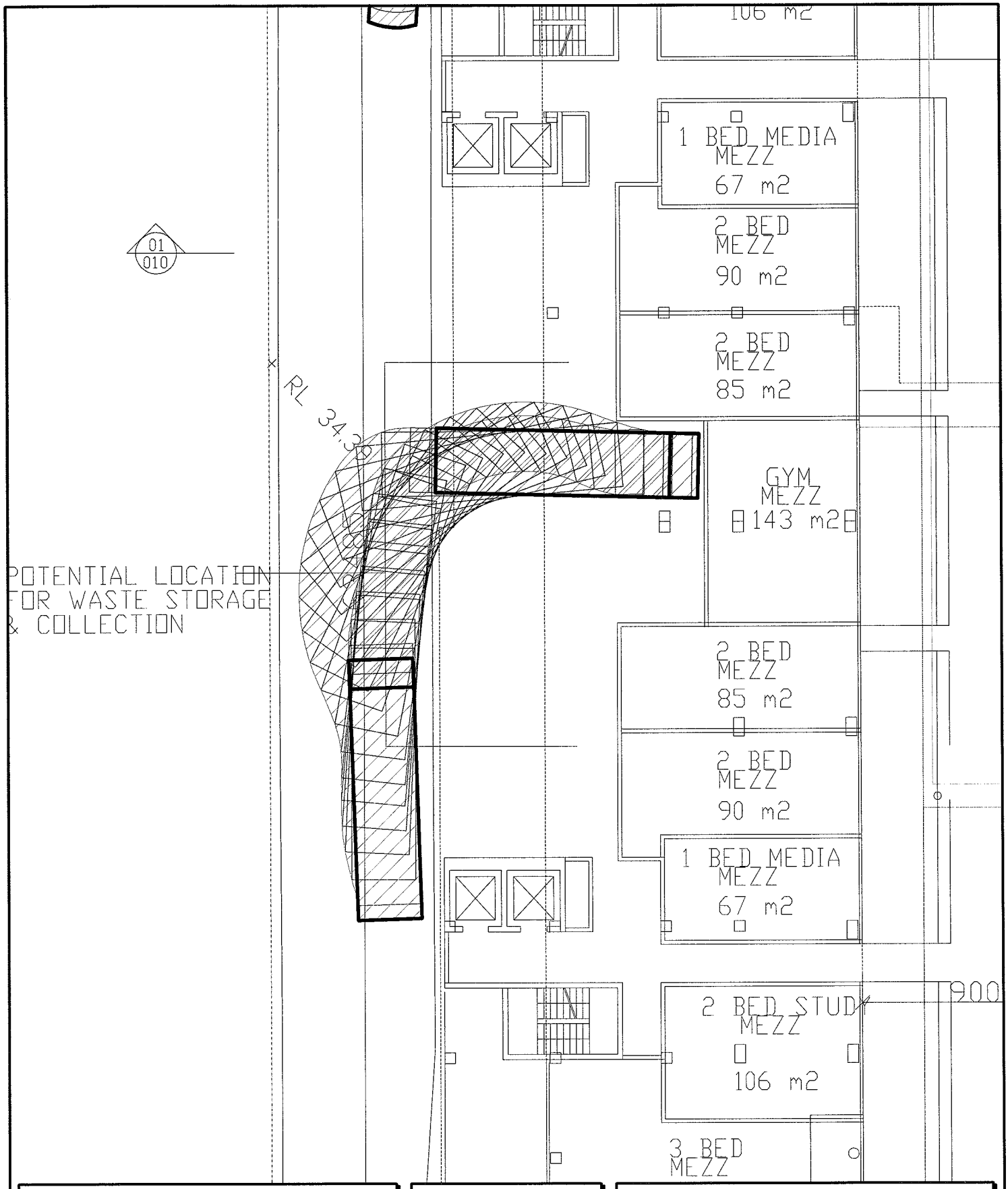
LEGEND

This drawing has been prepared using vehicle modelling computer software AutoTrack V5.00a in conjunction with AutoCAD 2000. The vehicle used is based upon vehicle data provided by Austroads and incorporates a reasonable degree of tolerance. However, it is not possible to account for all vehicle types/characteristics and/or driver ability.

N

SWEPT PATH ANALYSIS OF A 10.2m REFUSE VEHICLE VEHICLE ENTERING THE REFUSE BAY

SP 1



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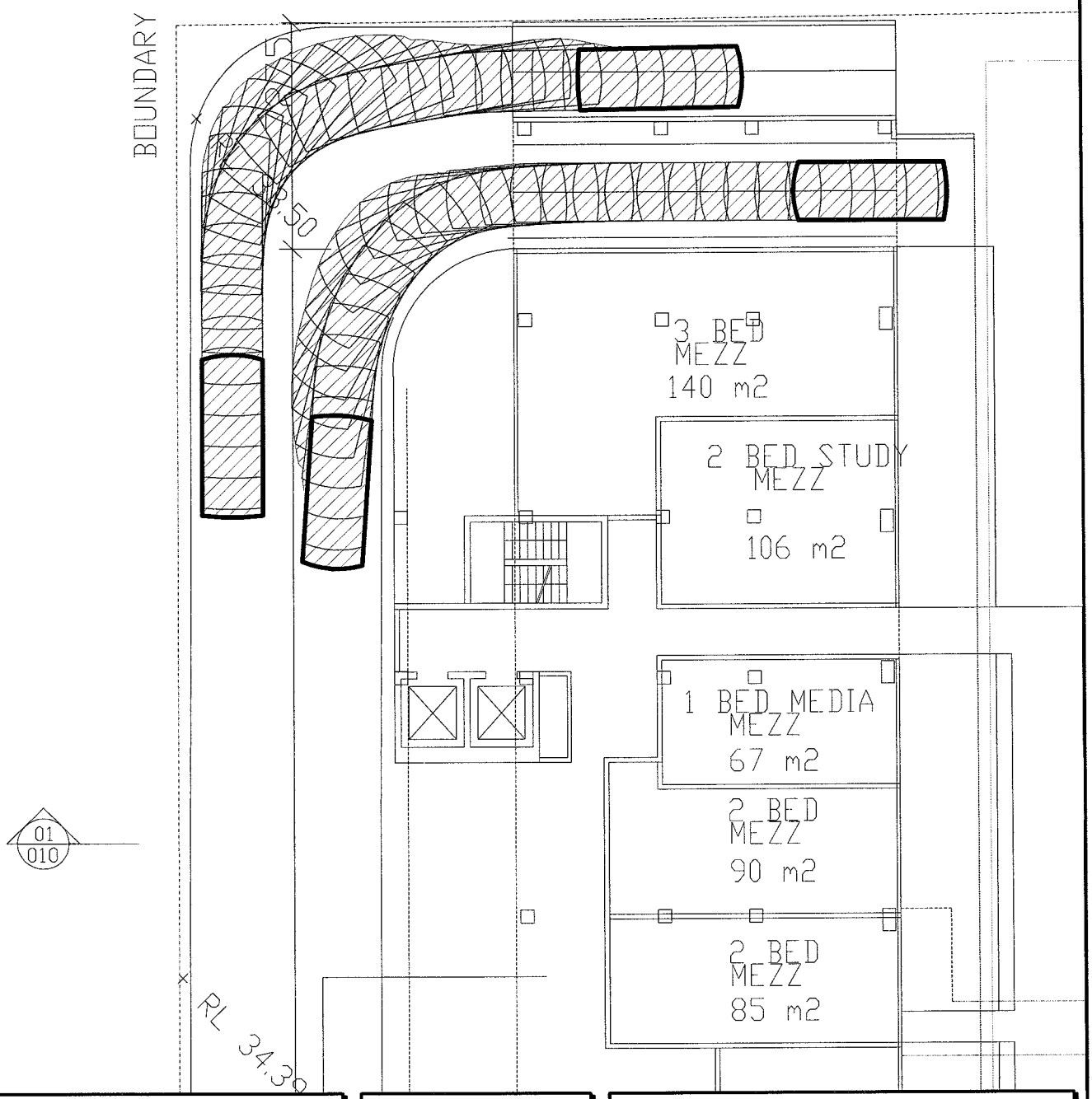
N

SWEPT PATH ANALYSIS OF A 10.2 REFUSE VEHICLE EXITING THE REFUSE BAY

SP 2



LEGEND

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N

SWEPT PATH ANALYSIS OF A 85th AND 99th PERCENTILE VEHICLE ENTERING AND EXITING THE SITE

SP 3