

Brookfield Multiplex Constructions  
Pty Ltd  
**UNSW Biological Sciences Project**  
Traffic and Transport Report

Rev A | 28 January 2015

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 601138

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# Document Verification

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# 1 Introduction

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## 1.1 Background

Arup was appointed by Brookfield Multiplex Constructions Pty Ltd to undertake a transport assessment for the proposed Biological Sciences Project at the University of New South Wales (UNSW). The site is located in the Randwick Local Government Area (LGA) of NSW.

This report is lodged as part of the Environmental Impact Statement for State Significant Development (SSD) 6674. Specific reference will be made to the Secretary's Environmental Assessment Requirements (SEARs), with recommendations and strategies to ensure compliance with relevant standards and requirements.

UNSW is ranked within the top 50 of the 2011 Quacquarelli Symonds World University Rankings<sup>1</sup> and is one of Australia's largest universities. The university is home to more than 45,000 students and staff, and is a major source of trip demand, attracting students and staff globally, and from the wider Sydney metropolitan region.

The buildings that are the subject of this redevelopment are located in the eastern part of the site. There is no car parking associated with the building, however vehicle access is required for servicing. Improved pedestrian connectivity between the buildings and to the campus network are key outcomes of the project.

## 1.2 Scope

This transport report supports the State Significant Development application for the proposed redevelopment at UNSW, and will outline the following:

- existing transport conditions;
- forecast traffic generation;
- road network impacts;
- parking provision and analysis;
- analysis of traffic volumes;
- access arrangements;
- public transport availability;
- construction traffic management plan outline; and
- pedestrian and cycle linkages;

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<sup>1</sup> QS University World Rankings, available at <<http://www.topuniversities.com/>>

## 1.3 References

This report uses the following reference documentation:

- Randwick DCP 2012 – Randwick Education and Health Specialised Centre
- Randwick Local Environmental Plan 2012
- Guide to Traffic Generating Developments (RTA)
- EIS Guidelines – Road and Related Facilities (DoPI)
- NSW Planning Guidelines for Walking and Cycling
- Sydney’s Light Rail Future
- Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development
- NSW Long Term Transport Master Plan 2012
- Premier’s Council for Active Living (PCAL) – Development & Active Living
- AS2890.1 – Australian Standards for Off-Street Car Parking
- AS2890.2– Australian Standards for Off-Street Commercial Vehicle Facilities

## 2 Director General Requirements

This report has been prepared to accompany the Environmental Impact Statement for the proposed Biological Sciences Project. It responds to the transport related issues addressed in the SEARs for SSD 6674 as outlined in Table 1 below.

Table 1 Secretary's Environmental Assessment Requirements

| <b>SEARs - . Transport and Accessibility</b>                                                                                                                                                                                                                                    | <b>Item Discussed at:</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| existing pedestrian and cycle movements within the vicinity of the site;                                                                                                                                                                                                        | Section 3.5               |
| the number of additional staff and students generated by the proposed development;                                                                                                                                                                                              | Section 4.2               |
| estimate the total daily and peak hour trips generated by staff and students to be accommodated within the proposal, including vehicle, public transport, pedestrian and cycle trips;                                                                                           | Section 5.1               |
| the adequacy of public transport to meet the likely future demand of the proposed development, including consideration of the proposed light rail system;                                                                                                                       | Section 5.2 and 5.3       |
| measures to promote travel choices that support the achievement of State targets, such as a location-specific sustainable travel plan;                                                                                                                                          | Section 5.1 and 5.3       |
| the daily and peak vehicle movements impact on nearby intersections and the need/associated funding for upgrading or road improvement works (if required);                                                                                                                      | Section 5.1               |
| the proposed access arrangements and measures to mitigate any associated traffic impacts and impacts on public transport, pedestrian and cycle networks;                                                                                                                        | Section 4.4               |
| the proposed parking provisions (car, bicycle and motorcycle) and end of trip facilities associated with the proposed development, including consideration of the availability of public transport, and the requirements of the relevant parking codes and Australian Standards | Section 4.3               |
| identify on-site car park areas and the number of parking spaces on campus and any parking spaces being removed to make way for the proposed development;                                                                                                                       | Section 5.1               |
| the proposed service vehicle movements (including vehicle type and the likely arrival and departure times); and                                                                                                                                                                 | Section 5.6               |
| access and car parking arrangements at all stages of construction and measures to mitigate any associated pedestrian, cycleway, public transport or traffic impacts.                                                                                                            | Section 5.5               |

## 3 Existing Transport Conditions

### 3.1 Site Location

The site is situated on the eastern side of the main UNSW Kensington campus. UNSW is well established, located approximately six kilometres southeast of Sydney CBD. The main campus is bounded by High Street to the north, Anzac Parade to the west, Botany Street / Willis Streets to the east and Barker Street / Oval Lane to the south.

The area surrounding UNSW is primarily residential properties, however there is some retail and commercial activity in the vicinity of the development (see Figure 1 below).

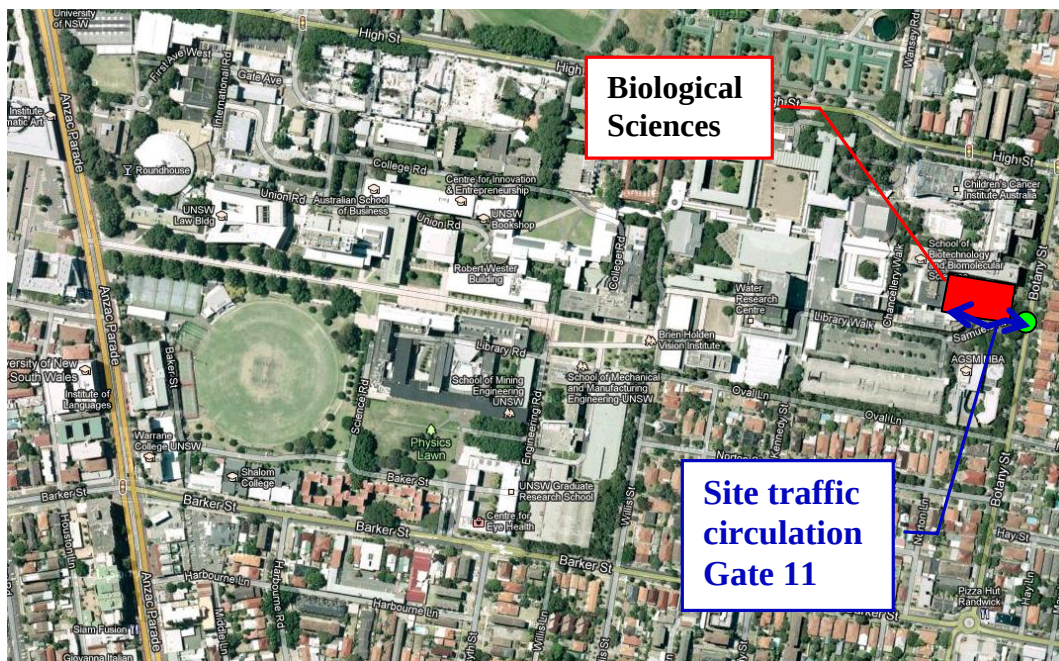


Figure 1 Site Location

(Image source: Google Maps)

### 3.2 Road Network and Access

There is a two-way vehicular site access to this section of UNSW via Gate 11 on Botany Street (see Figure 1 above). Botany Street is a local residential collector road forming the eastern boundary of the campus connecting between High Street and Barker Street.

The internal road network links the development site via Samuels Avenue which is the key eastern access via Gate 11 to the campus and serves a major car parking facility and loading access.

This arrangement is indicated in Figure 2.

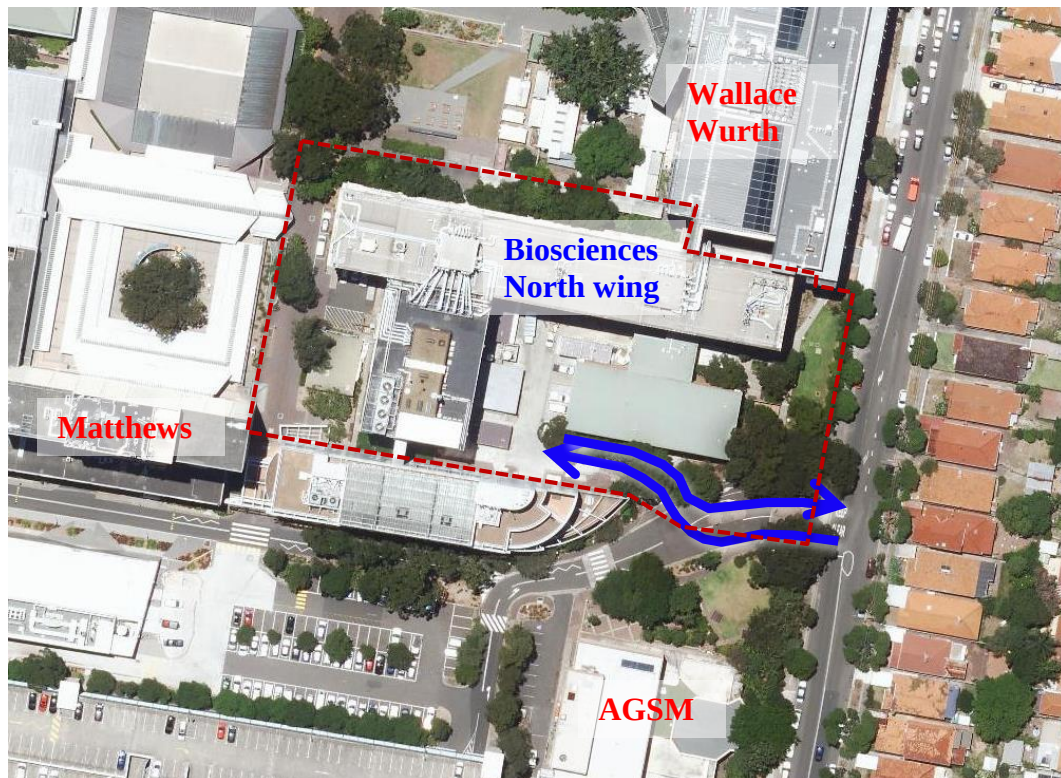


Figure 2 Existing Circulation Arrangements

### 3.3 Parking and Loading

There is no car parking directly associated with the building, however vehicle access is required for servicing off Samuels Avenue. The maximum service vehicles are 8.8m Medium Rigid Vehicles (MRV)s, and the garbage collection vehicle up to 9.9m long.

Parking is provided at pay-parking stations to the south of the site on the UNSW campus, and as on-street parking in the surrounding streets.

On-site parking is costly and available as either permit or casual day parking. Permits are usually only made available to staff for a yearly fee. Students can obtain permits (over 20 hours a week) if they are still available, or alternatively there are short-term and daily parking available. The rates for parking on-site are increased annually with the current 2014 rates as follows. This represents a significant increase on 2013 rates and aligns with the Universities policies to reduce car mode share:

- Between \$500-\$1,000 for a yearly permit (depending on staff salary and availability)
- \$4.50 per hour for 2P short-term parking (located near entrances and internal campus streets)
- All day parking = minimum \$6 for 2 hours and \$3.00/hour up to 12 hours (spaces located on the roofs of parking stations)

Parking is also available on-street usually as 2P short-term parking in the immediate surrounding streets. Otherwise, unrestricted parking is available further

away from the campus grounds. Photograph 1 below indicates an example of the constrained parking environment on the surrounding local streets.



Photograph 1 On-street Parking

## 3.4 Public Transport Network

### 3.4.1 Rail

The closest railway stations to UNSW are Green Square (approximately 3 km away), Bondi Junction (approximately 3 km away) and Central (approximately 4.5 km away). Access between these stations and the campus is by bus.

### 3.4.2 Bus

UNSW express bus routes from Central Railway Station constitute the busiest regular bus route in Australia<sup>2</sup>, carrying up to 20,000 passengers per day. The campus is well served by these bus services, with several bus stops located within 400m (less than 5 minutes walk). This public transport near the site is presented below in Figure 3.

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<sup>2</sup> UNSW Sustainability and Transport website, UNSW, available at <http://www.sustainability.unsw.edu.au/transport/>

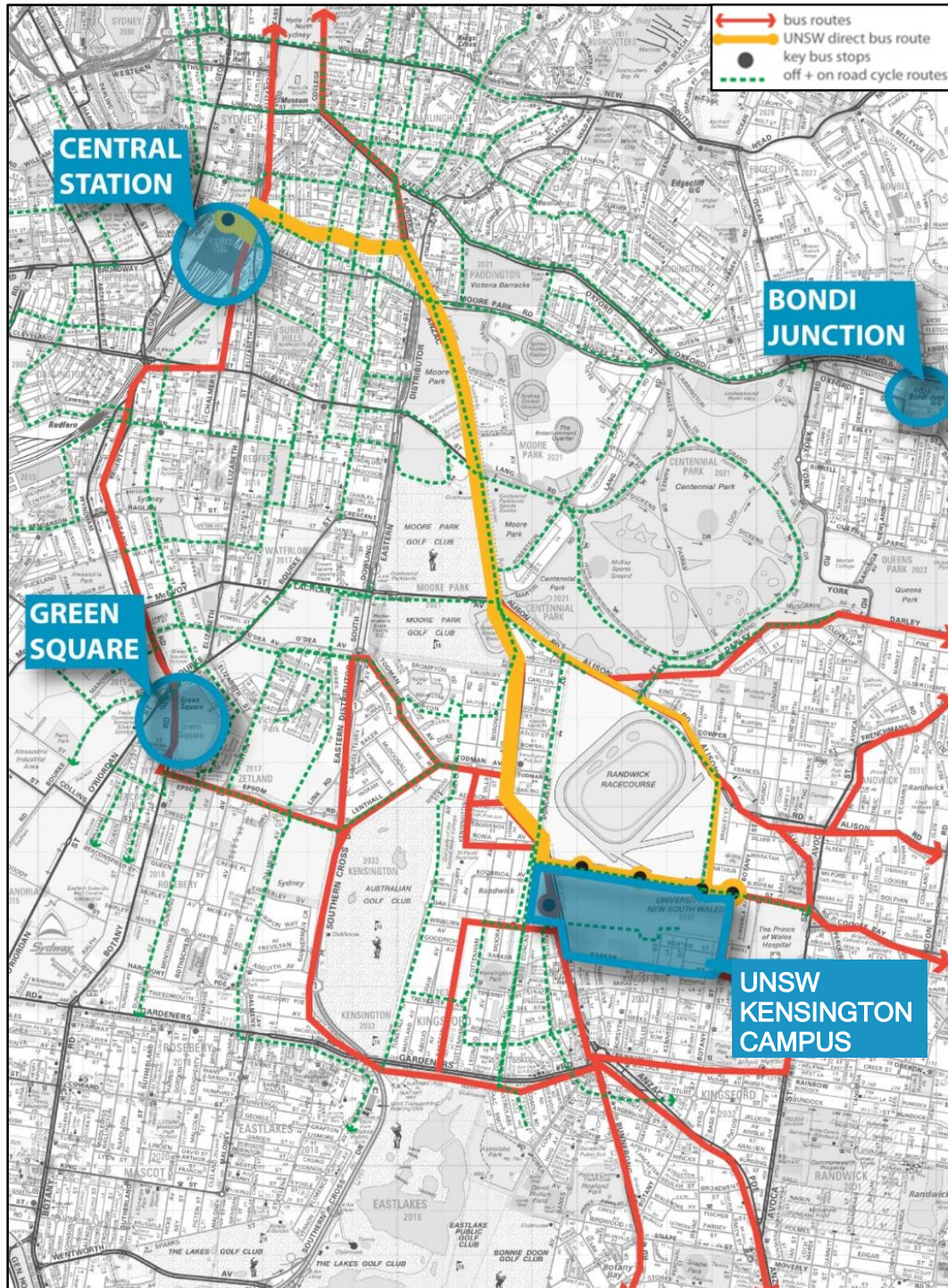


Figure 3 Bus Routes

There are a several bus services operated by Sydney Buses to UNSW. The main bus stops are located at Anzac Parade (Gate 1) and High Street (Gate 9) and provide regular express services between Central railway station and UNSW as routes: 890 / 891 / 892 (see Photograph 2). Some services also stop at the city centre and Circular Quay for ferry interchange, and are listed above as route numbers: 890 / 892. These bus stops are approximately 600m walking distance of the site via University Mall (approximately 7-8 minutes walk).



Photograph 2 UNSW Express Bus Services at Eddy Avenue Bus Stop

A complete list of peak hour services to these bus stops is shown below in Table 2 below.

Table 2 Bus route options for access to UNSW. (Source: STA Timetables)

| Route Number                              | Route description                                                                                                                                                    | Comments                                                                                 |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 890                                       | Circular Quay, Taylor Square and UNSW (High Street)                                                                                                                  | Monday to Friday AM peak hour only                                                       |
| 891                                       | UNSW (High Street) and Central Station                                                                                                                               | Monday to Friday daytime and peak EXPRESS services                                       |
| 892                                       | UNSW (High Street), Central Station, Elizabeth St and City-Circular Quay                                                                                             | Monday to Friday PM peak hour EXPRESS service only                                       |
| 895                                       | UNSW (Anzac Parade) and Central Station                                                                                                                              | Monday to Friday evening EXPRESS service only                                            |
| 348                                       | Wolli Creek to Bondi Junction                                                                                                                                        | Stops at UNSW Gates 1 & 9                                                                |
| 357                                       | Sydenham to Bondi Junction                                                                                                                                           | Stops at UNSW Gates 1 & 9                                                                |
| 370                                       | Leichhardt via Sydney University to UNSW (Anzac Parade)                                                                                                              | Existing service through Green Square                                                    |
| 391-5,<br>397,299,<br>L94,<br>X92,4,6,7,9 | Provide all stops services passing through UNSW (Anzac Parade) to Sydney CBD                                                                                         |                                                                                          |
| 400                                       | Burwood to Bondi Junction                                                                                                                                            | Approximately every 20 minutes<br>Stops at UNSW Gates 1 & 9                              |
| M10                                       | Kingsford to Leichhardt                                                                                                                                              | Running every 15 minutes.<br>Approximately 20 minute journey time (Stops at UNSW Gate 1) |
| M50                                       | The Metrobus M50 service connects Drummoyne, Rozelle, Elizabeth Street and Chalmers Street at Central Station, High Street UNSW, The Spot Randwick and Coogee Beach. | Running every 15 minutes.<br>Approximately 20 minute journey time (Stops at UNSW Gate 1) |

### 3.4.3 Sydney CBD and South East Light Rail

The CBD and South East Light Rail Project received planning approval on 4 June 2014 and early preparatory works began in August 2014. Major construction is expected to commence after Anzac Day 2015 with the system shown in Figure 4 open and operational in 2019/2020.

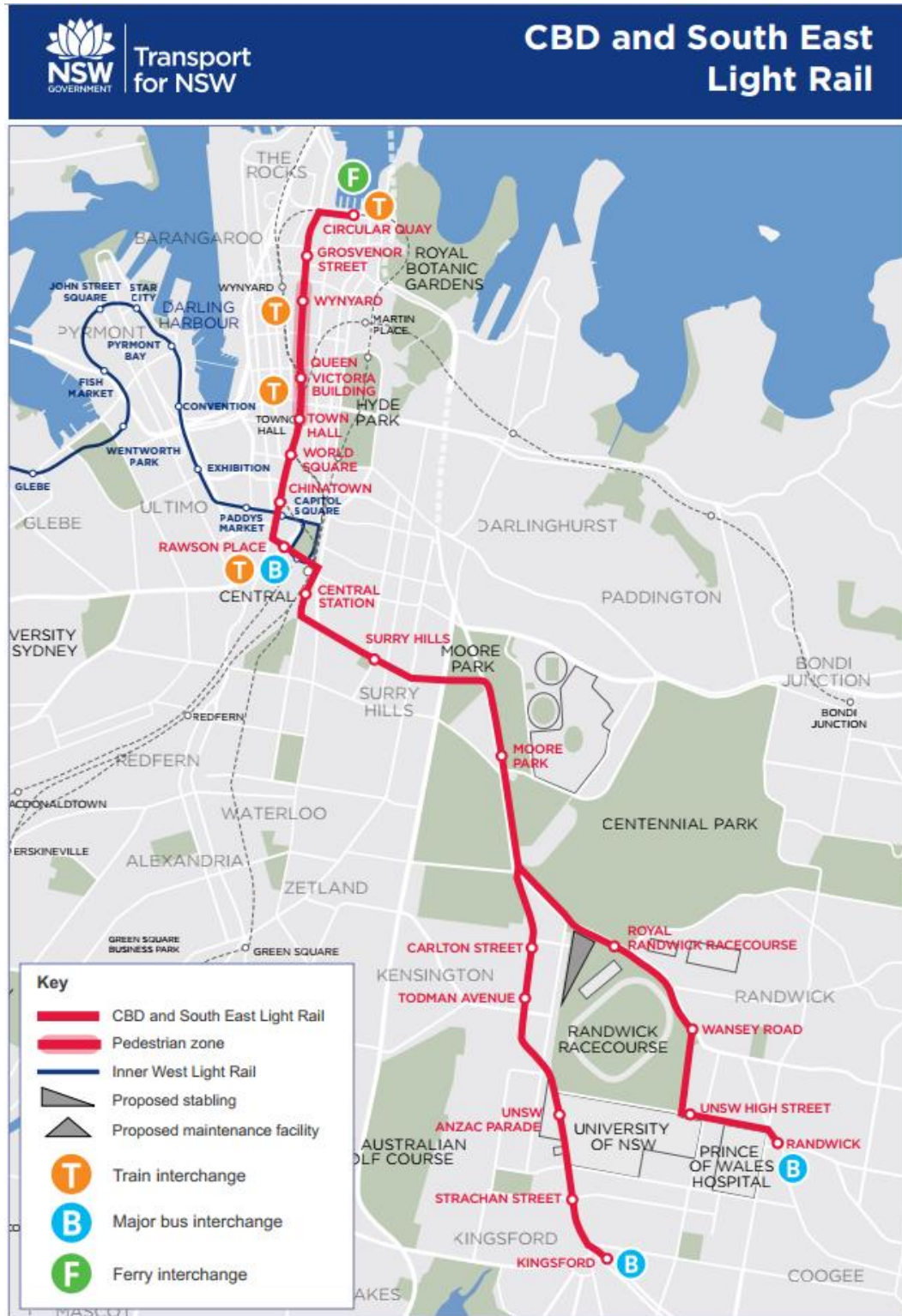


Figure 4 Sydney CBD and South East Light Rail

The Submissions Report, March 2014, provides the latest configuration for the proposed UNSW Light Rail Stops at Anzac Parade shown in Figure 5 and High Street in Figure 6.

It could be expected that with the introduction of light rail and the use of the Opal card for seamless transfer between modes, that increased patronage to public transport would occur for UNSW access.

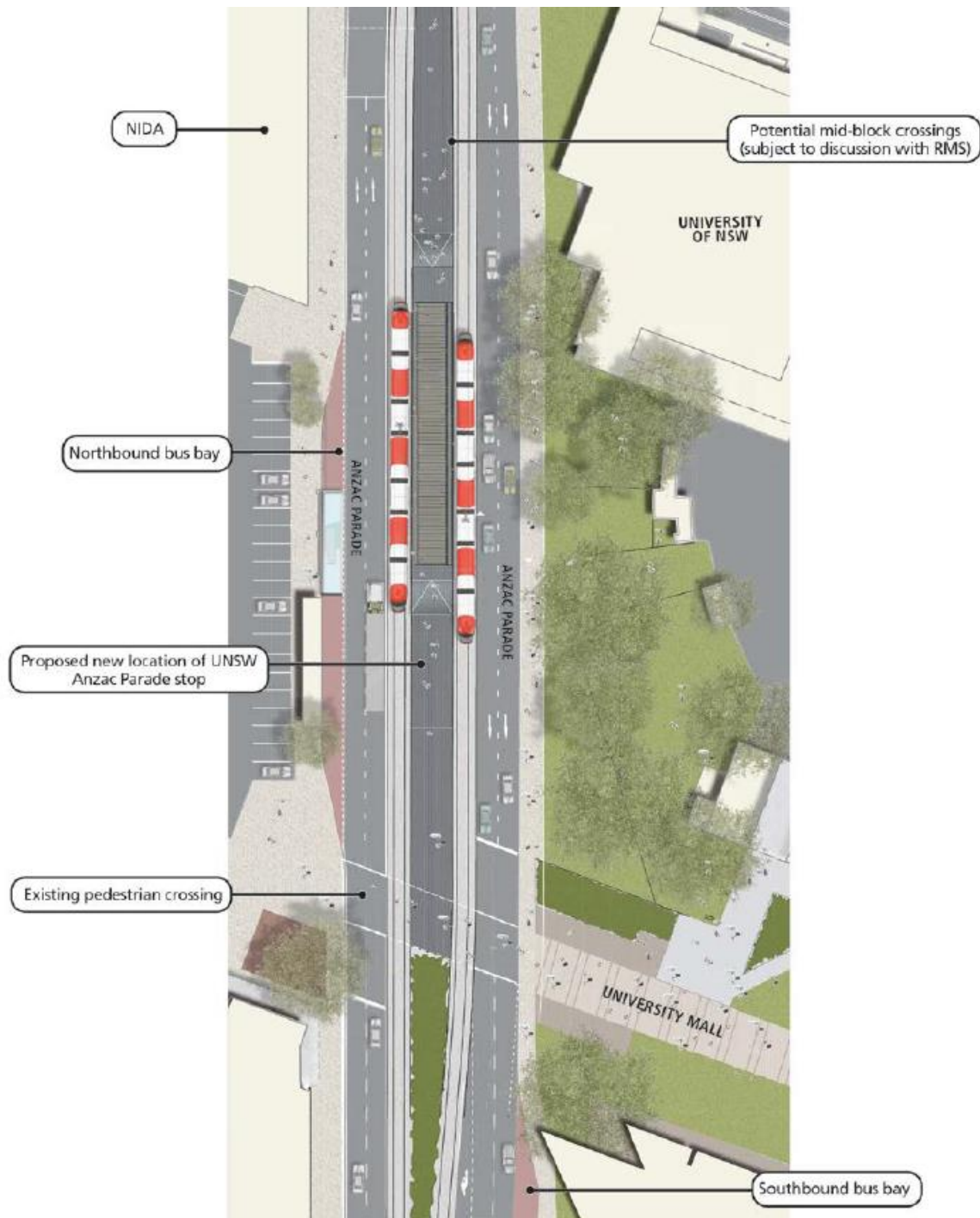


Figure 5 Proposed UNSW Anzac Parade Light Rail Stop

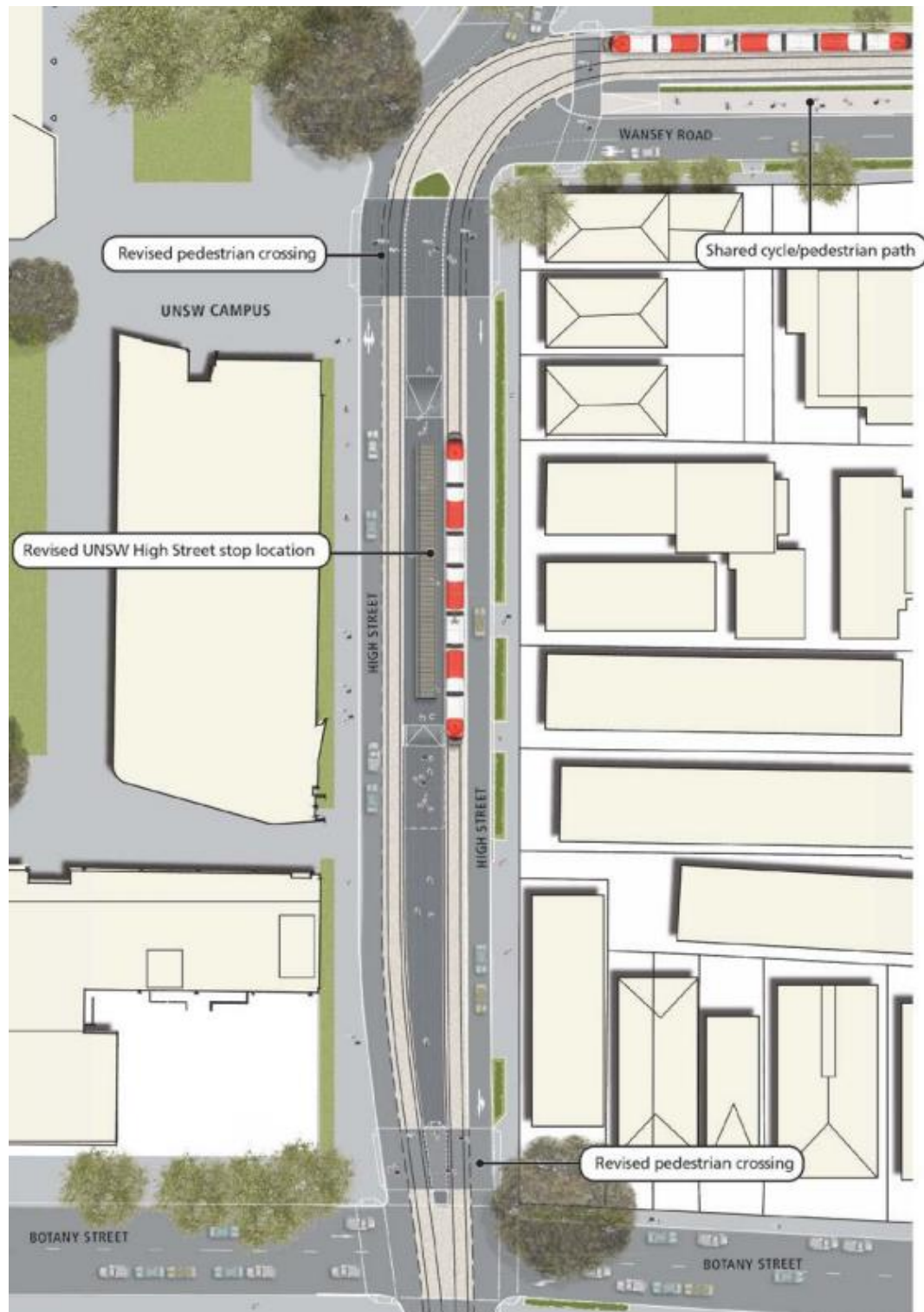


Figure 6 Proposed UNSW High Street Light Rail Stop

### 3.5 Walking and Cycling Network

There are multiple existing pedestrian and cyclist access points to the site. The site fronts the University Mall, which acts as the main pedestrian east-west spine for the entire university. There are also entrances to Willis Street and Barker Street to the east and south. Likely routes would be considered through the university grounds, where gentle slopes and steps / lifts are designed for more pedestrian friendly routes.

On-road cycleways are located adjacent to the site on Botany Road and High Street, joining with the off-road cycleways at Centennial Park in the north. Cycling connections to the Sydney CBD include a mix of separated and on road cycling facilities. UNSW also links with several other on-road cycleways to the south.

Figure 7 below shows the cycleway map of the areas surrounding UNSW, with these routes in detail.

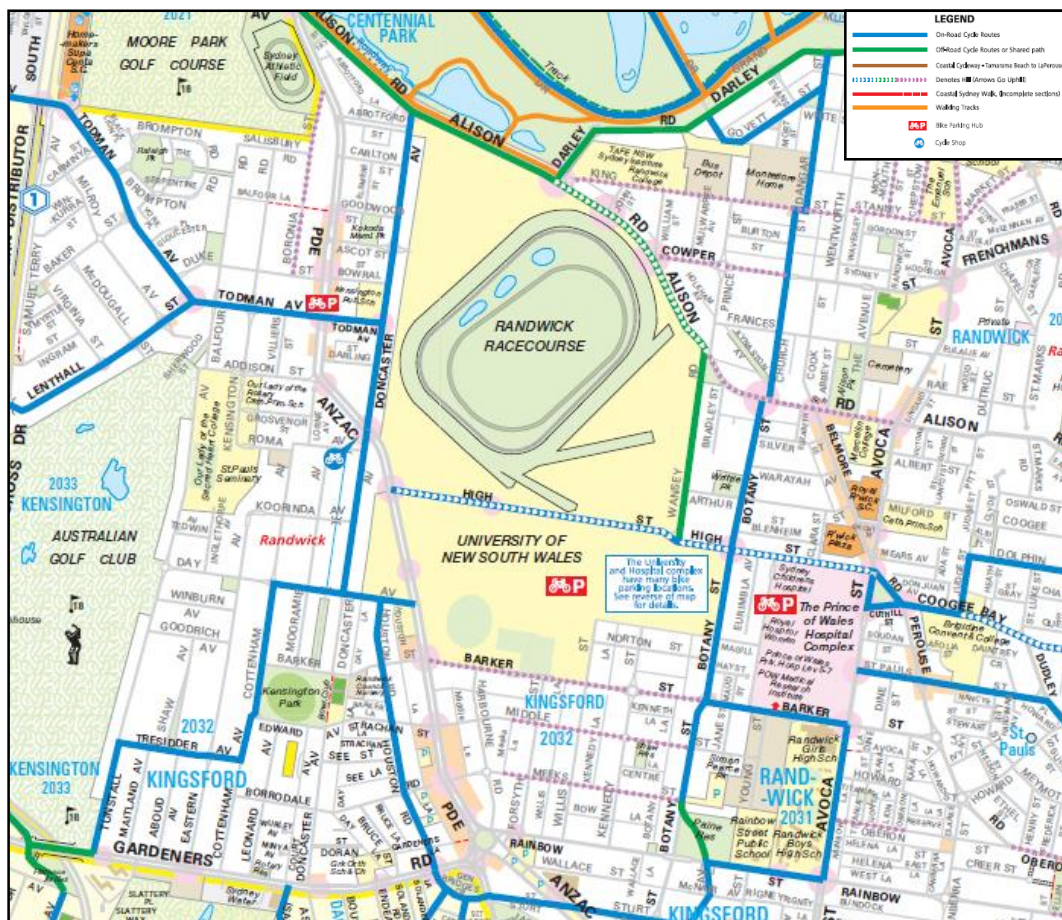


Figure 7 Cycling Network Surrounding UNSW

(source: Randwick City Council)

There is also an abundance of end of trip facilities on the campus to promote cycling to university. There are 60 bicycle racks adjacent to Building D26 and F25, with additional bicycle racks within a minute walk. There are also shower facilities located in Building D26. Figure 8 below shows the extent of the cycling facilities surrounding the site.

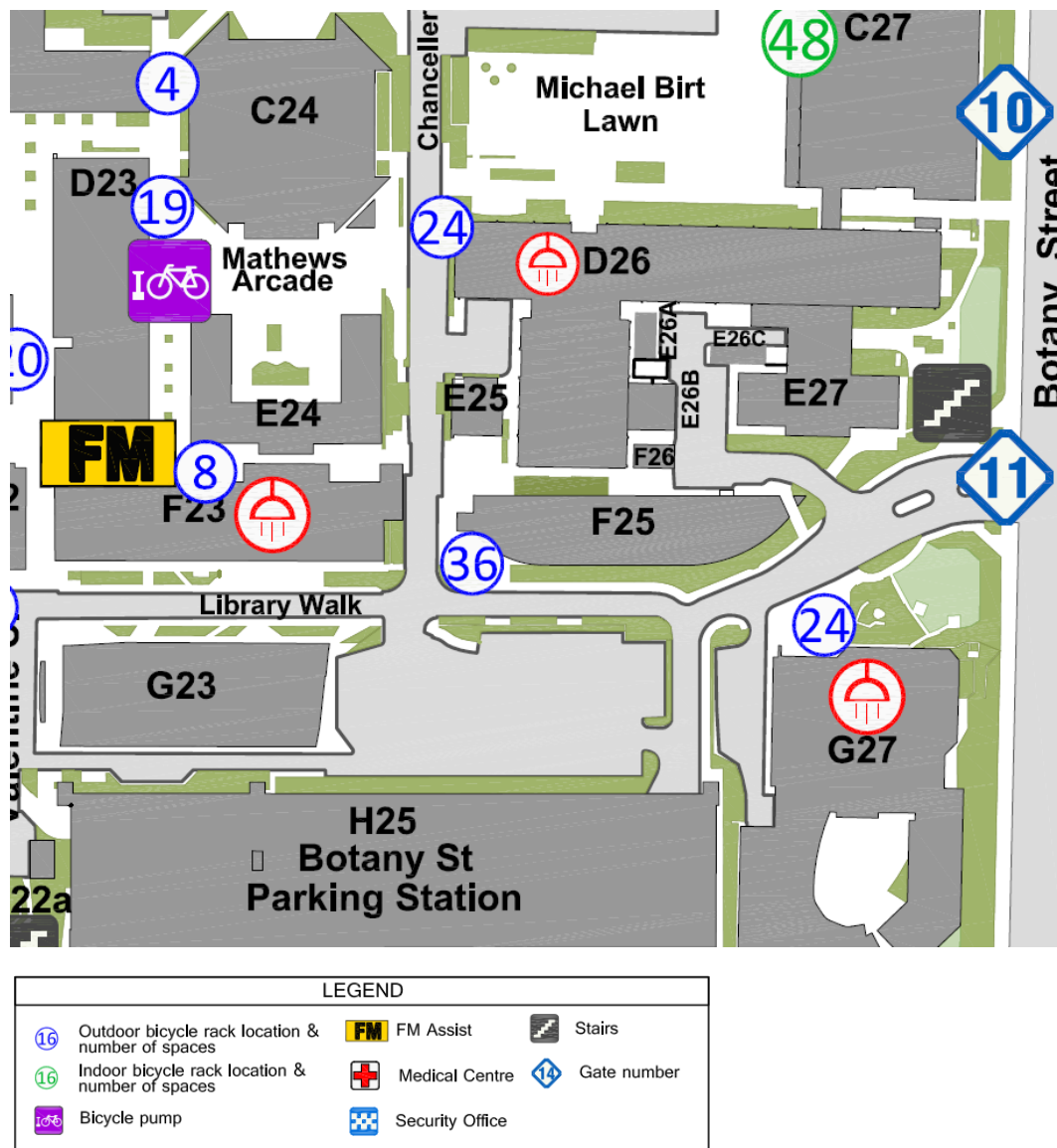


Figure 8 Nearby Campus Cycling Facilities

(Image source: UNSW)

### 3.6 Travel Survey

The 2014 travel survey undertaken by UNSW indicates a current car mode of 19%, public transport 60% and walk/bicycle 21%. The trend lines plotted through to 2020 indicate continued decline in car mode of travel to 14% with public transport use increasing to 66%.

Planning for the CBD and South East Light Rail Project which runs in the Anzac Parade corridor has proposed UNSW Light Rail Stops at Anzac Parade and High Street. The light rail provides a dedicated service with good lengths of priority running which will attract high levels of use by students and staff, supporting the trend in increased public transport use to the campus.

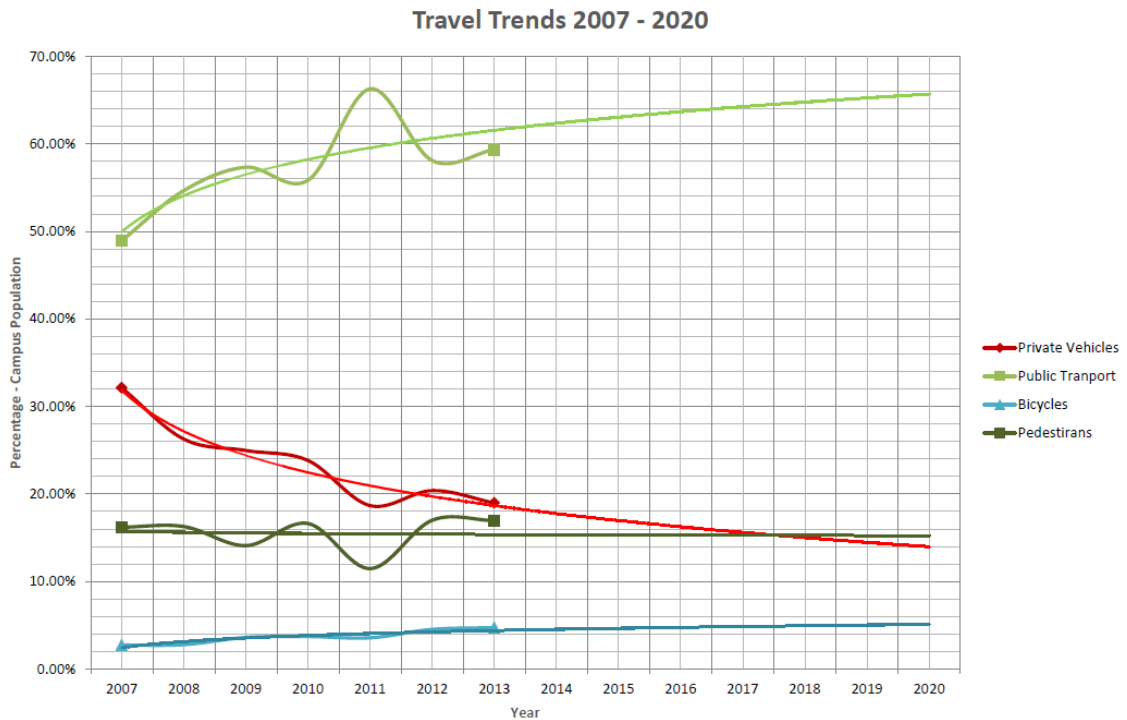


Figure 9 UNSW Student/Staff Travel Trends 2007-2020 (Source: UNSW Travel Survey)

### 3.6.1 State and Masterplan Targets

The above survey results show a general increase of public transport patronage by bus and bicycle usage. These results are in line with the State Plan targets by growing patronage on public transport by making it a more attractive choice. This is also supported by the increasing amount of bus services that provide access UNSW.

The Premiers Council for Active Living (PCAL) also supports the use of public transport by stating that walking forms a major contributor for access to public transport. This is further supported by UNSW's travel demand management measures listed further below in Section 5.3.

## 4 Proposed Development

### 4.1 Description of Proposed Works

The proposal includes modifications to a number of buildings which form part of the Biological Sciences Project as shown in Figure 10.

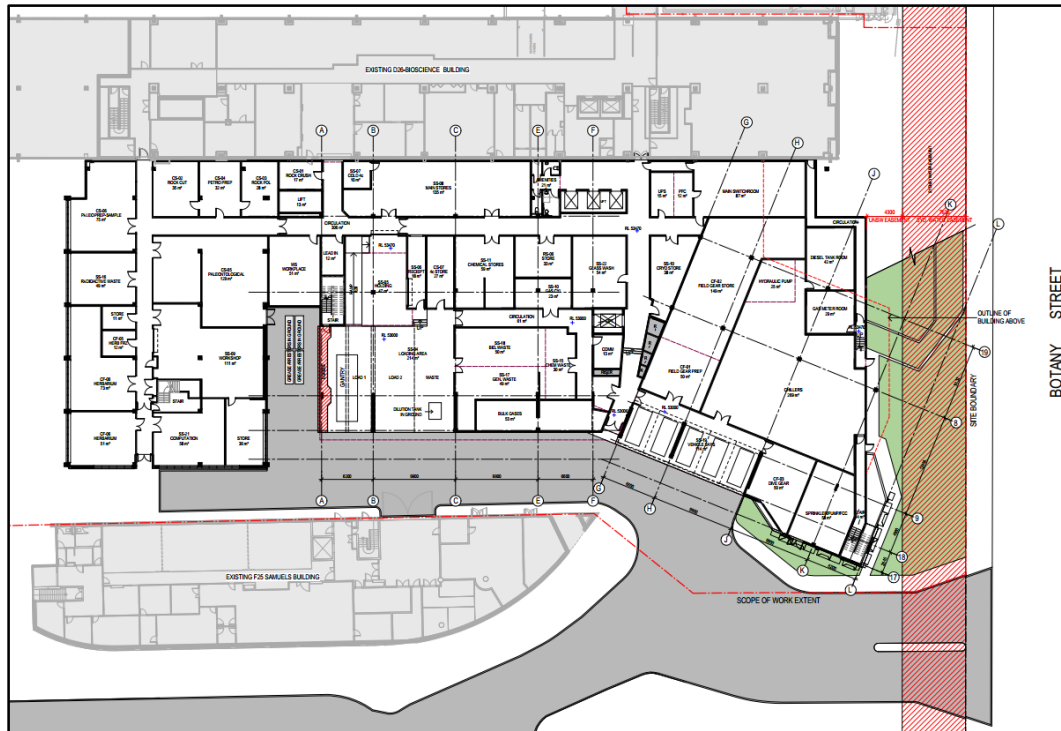


Figure 10 Proposed Site Plan

The scope of works for the main works includes:

**Stage 1** is the construction of a new nine (9) Storey building in the existing location of E27 Bio Theatres Building; fitout of the lower ground floor of the southern/western wing of Building D26, construction of the eastern atrium, construction of the structure and lift core to the western atrium and upgrade of landscape surrounding newly constructed E26.

**Stage 2** is the refurbishment of the ground floor of the existing D26 building; creating a link thru to newly constructed E26 on the north and western elevation, complete the construction of the western atrium, refurbishment of facades to the existing D26 building, construction of stair block in between Wallace Wurth and D26, upgraded landscape to the open areas surrounding the D26 buildings and a roof top plant room.

## 4.2 Building Accommodation

The Randwick DCP 2013 requires all new DAs to include an assessment of whether the proposal involves an increase in staff, student or visitations to the campus.

The proposal is designed to improve existing services only, and does not involve an increase in student numbers. There will be an increase in academic, research and professional staff in this development of 170 staff.

Making transport more sustainable is one of the key platforms of the Campus 2020 Master Plan. This is to be achieved by improving access to the campus by public transport in preference to private vehicle use. Delivery of the Sydney CBD and Eastern Suburbs Light Rail will assist with this outcome. To support this goal, no additional car parking will be provided with this development.

## 4.3 End of Trip Facilities

UNSW has recently completed a Bicycle Masterplan for the Kensington Campus which considers the provision of bicycle parking and end of trip facilities holistically across the campus. The intention is to provide improved connections between the external bicycle network and to increase bicycle parking opportunities at key locations across the campus to suit the access provisions.

Building D26 currently has showers and these will be augmented with additional facilities in the new buildings.

## 4.4 Proposed Site Access

Vehicular site access for loading and garbage collection will be largely retained via Samuels Avenue for access to the loading dock as shown in Figure 11. There are 2 loading bays and one garbage collection bay proposed.

There are also 5 smaller loading bays proposed adjacent to the loading area for use by university vehicles preparing for fieldwork trips. They will be used by researchers and undergraduates.

Articulated tankers are also expected to access the Loading Dock area in order to fill the bulk gas vessels from the fill points on the south façade of the new development. These tankers arrive weekly after normal business hours and will reverse into the Loading Dock area from Gate 11 as currently occurs.

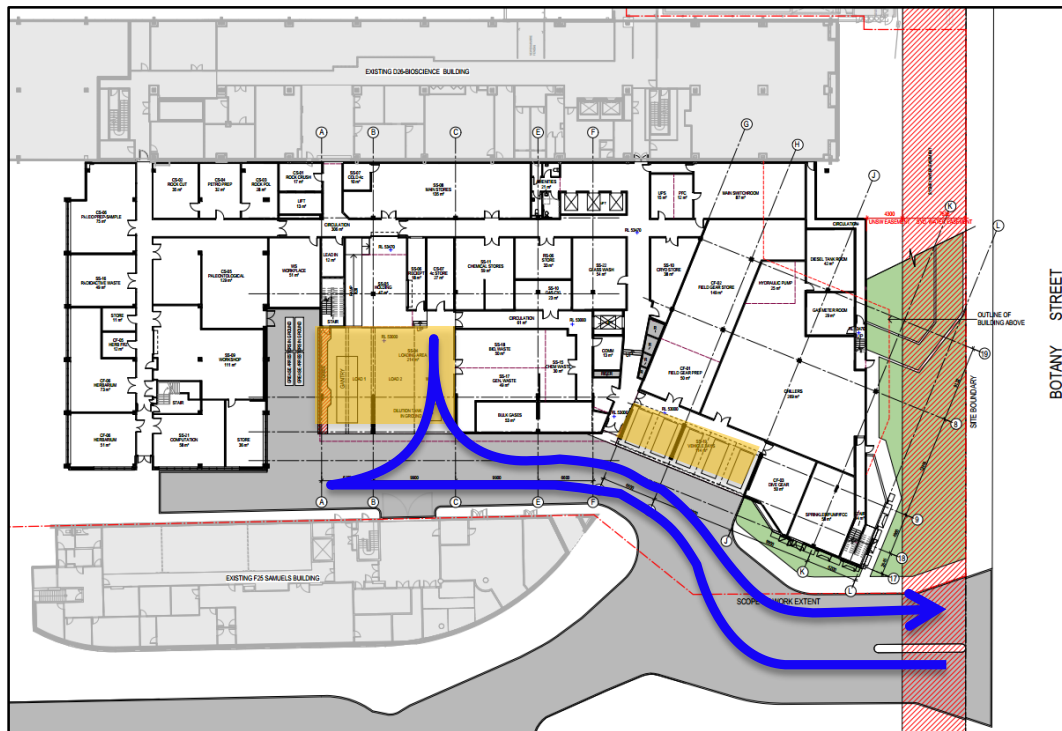


Figure 11 Proposed Circulation Arrangements

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## 5 Transport Assessment

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### 5.1 Car Parking Provision

Section 3.3 outlines the current parking for the site. UNSW objectives from the Randwick DCP 2013 state that parking demand rates are related to accommodation on campus. UNSW are also in talks with Randwick Council to minimise the amount of unrestricted parking near the campus.

The proposed development involves five additional loading bays for university operational vehicles associated with the site use. There will be no relocation or modification of existing parking areas. The building works involve an upgrade of existing facilities and in the context of the whole campus student population there will be no increase in parking requirements on or off the university campus.

The proposal does involve an increase in the UNSW staff population with an additional 170 staff anticipated. Given that there will be no additional car parking provided on the site, the additional staff will need to utilise non-car modes for access or utilise existing parking areas on campus. On-street car parking is constrained. There will be very minimal change to total site traffic generation compared with existing levels.

### 5.2 Public Transport Network

Section 3.4 demonstrates that the site is well located for public transport access, within a 10 minute walk of high frequency bus services. The arrival and departure patterns of many workers in the Randwick area (i.e. arrive 7-9am and depart 4-6pm) is different to that of university students. Students arrive and depart throughout the day based on lecture times which are often outside the commuter peak periods – further reducing the impact on the local public transport network. The UNSW travel survey in Section 3.6 states of all students and staff, approximately 30% arrive in the AM Peak period (8-9pm) and approximately 20% leave in PM Peak Period (5-6pm). This is lower than the typical arrival and departure profile of commercial workers.

### 5.3 Travel Demand Management Measures

Travel demand management measures, e.g. Travel Plans and Car Pooling, are currently well established at UNSW<sup>3</sup>. The UNSW Sustainability website outlines the current measures:

- express bus services and public transport incentives for staff;
- to ensure adequate facilities are provided at the site to enable staff, students and visitors to commute by sustainable transport modes;
- to reduce the number of car journeys associated with business travel by staff and visitors;
- to facilitate the sustainable and safe travel of new employees and students;

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<sup>3</sup> UNSW Sustainability and Transport website, UNSW, available at <http://www.sustainability.unsw.edu.au/transport/> <<http://www.sustainability.unsw.edu.au/transport>

- to raise awareness of sustainable transport amongst staff and students; and
- to encourage car pooling and off-peak travel.

The implementation of these travel plans will contribute to reducing parking demand, particularly for staff, and encourage other forms of transport to the site.

## 5.4 Walking and Cycling Access

The site is well served by a network of walking and cycling routes, with no changes proposed to the existing network during the course of the redevelopment. The current network is deemed both adequate and appropriate for the proposed works.

Secure bicycle parking is available across the campus with complementary end of trip facilities such as lockers and showers in many locations. Provision of these facilities will encourage cycling as a viable mode of transport to the site and contribute to a reduced car mode share. To promote future growth in cycling levels to the site, there will be scope to increase the number of bicycle parking spaces provided on site in the future as demand warrants. The Campus 2020 Masterplan states that bicycle parking should be provided in favour of providing car parking to further encourage cycling.

## 5.5 Construction Traffic Impacts

### 5.5.1 Impact of Proposed Works

The stages of the construction would likely contain the following works:

- Preparation of the site.
- Excavation and piling.
- Construction and refurbishment.
- Finishing works.

Excavation and piling of the development will commence with site preparation works and relocation of people from the first area of construction / refurbishment. As areas within the building are progressively completed, people will be relocated to these parts of the building.

A Site Establishment Plan is shown in Appendix A1.

Construction materials and plant will be transported by road. Construction works will generate vehicle trips using the existing Gate 11 and a Botany Road Construction Zone (subject to Council approval).

Vehicles that will access the site during construction will mainly comprise heavy vehicles including Articulated Vehicles (AV) for deliveries and Heavy Rigid Vehicles (HRV) such as concrete trucks.

Construction traffic volume peaks would likely occur in the early stages of the project during the bulk excavation stage. These volumes would be managed throughout the project stages and would be minimised so that construction volumes would be minimal during the surrounding network daily peak periods where possible. As the project is in preliminary stages, these volumes will be

determined at a later date when a Construction Traffic Management Plan (CTMP) is prepared by the building contractor. A preliminary CMP has been prepared (Brookfield Multiplex, 21 November 2014) as part of the SSD submission.

Pedestrian and cyclist access around the site will be achieved by fencing off the area surrounding the development and managing traffic movements with qualified site personnel, to guide heavy vehicles into and out of the site. This will allow manoeuvrability for all stakeholders during site construction.

The overall principles for traffic management during construction are to:

- provide a convenient and appropriate environment for pedestrians;
- minimise effects on pedestrian movements and amenity;
- provide appropriate safety fencing/hoardings around the perimeter of the construction site;
- manage and control vehicular movements to and from the site;
- maintain other existing on-street parking in the vicinity of the site;
- restrict construction vehicle activity to designated truck routes through the area (to be identified by the appointed builder); and
- manage construction vehicles to enter and exit the site in a forward direction.

## 5.5.2 Construction Traffic Management Plan

Construction vehicles will approach the site from the south via Barker Street to travel north bound traffic flow into the Botany Street Construction Zone. Two licensed traffic controllers will be positioned on Botany Street construction zone and one traffic controller located at Gate 11 to control delivery vehicle entry and exit.

Refer to Appendix A2 and A3 for the Traffic Management and Pedestrian Access plans for Phases 1 and 2.

A standalone Construction Traffic Management Plan (CTMP) will be prepared prior to the commencement of construction works. A preliminary CMP has been prepared (Brookfield Multiplex, 21 November 2014) as part of the SSD submission.

At this stage of the development, the process and staging has not been defined. The builder/contractor will therefore be responsible for the preparation of the CTMP prior to construction commencing. This will identify potential heavy vehicle movements into and out of the site on a daily basis and the associated impacts on the local road network.

The following outlines what would be provided in the CTMP report:

- construction Programme and Description of Works;
- impact of Proposed Works;
- existing Site Traffic and Forecast Construction Traffic;
  - cumulative Impact of Existing Site and Construction Traffic,
  - parking,
  - driver Code of Conduct,
- construction Traffic Routes;
- site Access for Construction Workers;

- measures to Ameliorate Impacts;
- public Transport Services Affected;
- details of Provisions Made for Emergency Vehicles, Heavy Vehicles, Cyclists and Pedestrians;
- construction activity to be carried out in accordance with the approved hours of construction; and
- maintain safety for workers.

## 5.6 Loading and Service Requirements

The site has existing loading bays associated with Building D26 and a new loading area will be located in a similar location maintaining access to Samuels Avenue. The current loading dock activity that supplies the Lowy, Wallace Wurth and D26 buildings has an average of 25 deliveries daily. In addition to these deliveries there are an equivalent number of couriers who deliver to various schools and departments. There could be expected to be a minor increase in activity which would be easily managed by the proposed dock size.

The maximum sized vehicle using the loading facilities is an 8.8m long delivery truck and the 9.9m garbage truck. These vehicles currently perform tight manoeuvres in the existing configuration with no notable issues. As the majority of vehicles are delivery vans, larger sized vehicles only access the site periodically and will be managed in the laneway. See Figure 12 below for turn path assessment of the 9.9m garbage truck showing there is ample room for this manoeuvre.

A complete vehicle turning movement investigation has been prepared for the project by Robert Bird Group which is attached in Appendix B.

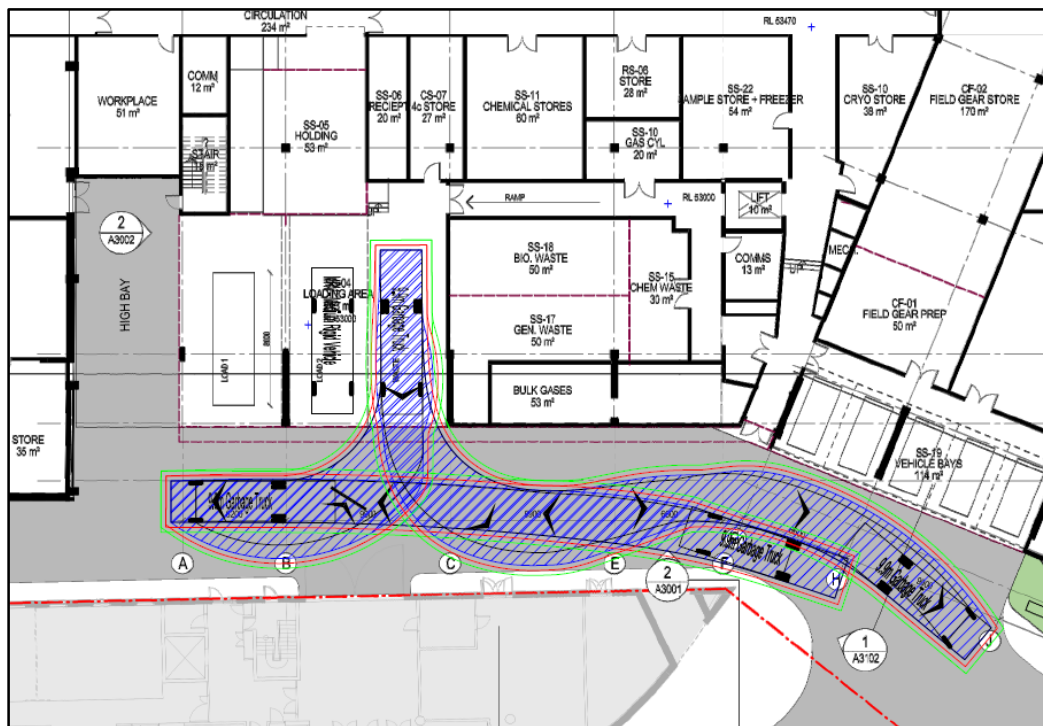


Figure 12 Turn path loading dock

## 5.7 Road Network Impacts

The proposal is considered to have a minimal impact on the operation of the local road network. Reasons for this include:

- Time restricted parking areas (including paid parking) are closely managed and enforced by Randwick Council and UNSW.
- The travel survey of UNSW students in 2014 found that just over 80% of staff and students currently use non-car modes of transport (mostly public transport) to access the campus.
- No change in parking provision is proposed.
- Given that the proposed development does not involve any increase to student numbers at the UNSW campus, and no additional staff parking will be available, there will be no increase in site traffic generation resulting from the proposal.
- No roads are proposed to be closed during construction and completion.
- Vehicular site access into UNSW is to be retained via Gate 11 on Botany Street.

## 6 Conclusions

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This report has assessed the potential transport issues associated with the proposed alterations and additions for the Biological Sciences Project at the UNSW campus. The key findings and conclusions from the study are summarised below:

- The site is well serviced by a number of public transport services.
- There are a number of designated walking and cycling routes close to the site.
- On-street and off-street parking in the vicinity of the site consists of time restricted and paid parking areas, with limited unrestricted all day parking areas for students and staff surrounding the development.
- Fewer than 80% of staff and students currently use non-car modes of transport to access the campus.
- The application proposes no net increase to the student population at the UNSW Kensington Campus although there will be an increase in staff of 170 associated with the Biological Sciences Project.
- No change in parking provision is proposed which means that the additional staff will choose non-car mode for access or utilise existing parking areas on campus.
- There will be very minimal change to total site traffic generation compared with existing levels.
- UNSW has implemented a range of travel demand measures which encourages the use of non-car modes of transport.
- All roads and vehicular site access into UNSW are to be retained via Gate 11 on Botany Street with no proposed changes.
- A construction traffic management plan will be implemented to reduce impact to the pedestrians in the area.

The assessment concludes that the traffic impacts arising from the works proposed for the Biological Sciences Project (SSD 6674) can be appropriately managed.

## Appendix A

### Construction Management Plans

# A1 Site Establishment Plan



Figure 3: Site Establishment

## A2 Traffic Management and Pedestrian Access Plan for Phase 1



## A3 Traffic Management and Pedestrian Access Plan for Phase 2



## Appendix B

### Vehicle Turning Paths



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# MEMORANDUM

**TO:** Brookfield Multiplex Constructions

**FROM:** Chris Waite, Robert Bird Group

**RE:** UNSW Biological Sciences Project – Vehicle Turning Movement Investigation Summary – Rev 5

**DATE:** 27 January 2015

## 1. Introduction

This memorandum has been prepared as a summary of the turning path investigations for the proposed loading dock area within the UNSW Biological Sciences Project (The Site).

The following sections denote the context/scope of works, vehicle specifications incorporated, summaries of the vehicle manoeuvres and an overall summary of the results.

## 2. Context

Robert Bird Group were directed to undertake a turning path assessment of the proposed loading dock and bays. The considered vehicles were those outlined in the Design Brief prepared by Capital Insight (June 2014) sections 19.1-19.3. These vehicles have been reproduced in table 2.1 below. Drawings have been prepared to demonstrate and assess these vehicles ability to enter, manoeuvre and exit the loading dock area.

**Table 2.1** – Loading Dock Vehicle Access Details (Capital Insight, June 2014)

| Item                                  | Vehicle                                                                                                                                                                                                                                                                                                                                                                                         | Frequency                                                                                    |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Consumable goods                      | Per Main Stores list at start of this section                                                                                                                                                                                                                                                                                                                                                   |                                                                                              |
| Large goods and equipment             | Per Main Stores list at start of this section                                                                                                                                                                                                                                                                                                                                                   |                                                                                              |
| General waste & comingled recyclables | The largest truck for waste is the garbage truck and its dimensions are: <ul style="list-style-type: none"><li>• Max height 3.9m</li><li>• Width 2.5m</li><li>• Length 10.4m</li><li>• Turning circle 18.6m</li><li>• Turning circle Hook truck 22m</li><li>• Tare weight garbage trucks are 14.5 tonnes and gross weight is 24.5 tonnes.</li><li>• Hook truck weight is 10.6 tonnes.</li></ul> | Daily.<br>Waste pick up needs to be independent of stores management and loading dock hours. |
| Paper recyclables                     | UNSW paper recycling truck dimensions are: <ul style="list-style-type: none"><li>• Max height 2.8m</li><li>• Width 2.2m</li><li>• Length 8m with compactor</li></ul>                                                                                                                                                                                                                            |                                                                                              |
| Biological & cytotoxic waste          | Collected by Sterihealth (biological waste). The largest in the fleet that collects at UNSW is: <ul style="list-style-type: none"><li>• Max height 3.6m</li><li>• Width 2.4m</li><li>• Length 10m</li></ul>                                                                                                                                                                                     | Waste pick up needs to be independent of stores management and loading dock hours.           |



| Chemical waste                           | 20 tonne truck.<br>Chemsal/Toxfree (chemical waste truck).<br>The largest in the fleet that collects at UNSW is:<br>• Max height 0.9m( deck to ground)<br>• Width 3m<br>• Length 8.1m | Waste pick up needs to be independent of stores management and loading dock hours.                     |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Hard waste                               | Skip truck – as general waste above (hook truck)                                                                                                                                      |                                                                                                        |
| Cadavers                                 | Small truck / van                                                                                                                                                                     | At the beginning of the year. Deliveries are mainly out of hours.                                      |
| Sterile goods & linen                    | Per Main Stores list at start of this section                                                                                                                                         |                                                                                                        |
| Animals - small                          | Small truck / van                                                                                                                                                                     |                                                                                                        |
| Animals – large (to Samuels loading bay) | Truck                                                                                                                                                                                 | Infrequently out of hours                                                                              |
| Bulk gases – liquid nitrogen             | Articulated tanker                                                                                                                                                                    | Once a week, after normal business hours.<br>Can reverse in to loading dock area from Library Walk.    |
| Bulk gases – gaseous carbon dioxide      | Articulated tanker                                                                                                                                                                    | Once a quarter, after normal business hours.<br>Can reverse in to loading dock area from Library Walk. |
| Cylinder gases                           | Per Main Stores list at start of this section                                                                                                                                         |                                                                                                        |
| Samples - frozen                         | Per Main Stores list at start of this section                                                                                                                                         |                                                                                                        |
| Samples – marine, soil and plant         | Trailers, trucks, 4WD with motor boats on tow                                                                                                                                         | Daily                                                                                                  |
| Samples - rock                           | Trailers, flatbed trucks                                                                                                                                                              | Daily                                                                                                  |
| Food and drink supplies                  | Catering deliveries only - no deliveries to Mathews Food Court are currently directed to the Biosciences Loading Dock.                                                                | Intermittent                                                                                           |
| Couriers                                 | Car, motorcycle                                                                                                                                                                       | Daily                                                                                                  |

An 11m flatbed Truck was noted in the introduction to the above design brief table as the largest vehicle to access the docks daily.

From recent project discussions, we understand that this 11m truck is longer required to enter the docks, with an 8m vehicle now governing the access requirement.

General, biological & cytotoxic waste is currently assumed to be collected from outside the Waste Dock area, with the 10.4m vehicle governing movements.

The design brief noted access for 4WD's with Boat Trailers as a requirement of the Loading Dock only. Assessment has recently been undertaken to also check if trailers can be located within the Loading Bays as a future option. This assessment has been deemed an alternate exercise, to be considered outside the scope of this memorandum issue.

### 3. Reference Information

The assessment was based on proposed architectural drawings supplied by Woods Bagot and distributed to the project team on the 21<sup>st</sup> of November 2014.

In addition, the following survey files were provided to RBG:

Site Survey Details\_Converted.dwg

11175detail 3.dwg

Vehicle properties and turning paths were analysed in accordance with Austroads Design Vehicle and Turning Path Templates Guide (2013) unless otherwise noted.



#### 4. Turning Path Assessment

The critical vehicles determined from the design brief and project discussions are listed below:

- 8m Flatbed truck
- 4WD with Boat Trailer
- 19m Articulated Tanker
- 10.4m Garbage Truck
- 7m-8.5m Skip Truck
- 10.52m Front-Lift Garbage Truck
- Small Rigid Vehicle (SRV)

Additional vehicles were denoted in the design brief, however only the largest and specific vehicles for each region were deemed to govern and were therefore assessed.

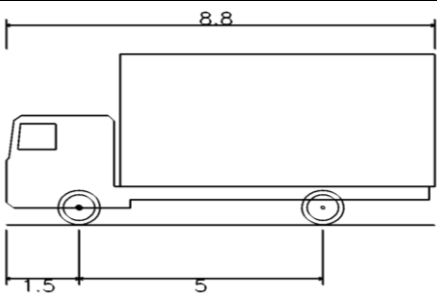
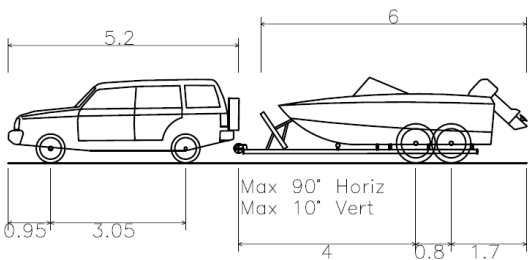
Details of each vehicle are provided in Table 4.1 for reference and review. An assessment of each vehicle and its relevant turning path(s) are outlined in the following subsections.

##### 4.1 General Comments

The following decisions have been used in completing this turning path analysis:

- Turn-on-spot has been used where necessary.
- Overhang of vehicles in some cases extends onto pedestrian footpaths.
- An additional manoeuvring clearance of 300mm has not been adopted for all proposed structural elements.
- A Design speed of 5km/h has been adopted for all scenarios. Reverse speed of 2.5km/h.
- Several of the design vehicles examined have custom properties. RBG has made assumptions based on Austroads Standards and vehicle technical specifications where required (as noted in the table below). RBG requests a review of these assumptions and confirmation where vehicles are known to the university due to current activities.
- An 8.8m Standard Medium Rigid Vehicle was incorporated instead of a noted 8m vehicle in lieu of no other information provided for the potential non-standard vehicle.

**Table 4.1 – Swept Path Vehicle Properties**

| Vehicle               | Image                                                                               | Properties                                                                                                                                                                                                                                                                                                                 | Comments                                       |
|-----------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| 8.8m Flatbed Truck    |  | Overall Length: 8.8m <sup>3</sup><br>Overall Width: 2.5m <sup>3</sup><br>Overall Body Height: 4.3m <sup>3</sup> (For Non Flatbed Vehicles)<br>Min Body Ground Clearance: 0.427m <sup>3</sup><br>Track Width: 2.5m <sup>3</sup><br>Lock-to-Lock time: 4.00s <sup>3</sup><br>Kerb-to-Kerb Turning Radius: 12.5m <sup>3</sup> | <sup>3</sup> Austroads Standard Design Vehicle |
| 4WD with Boat Trailer |  | Overall Length: 11.7m <sup>4</sup><br>Overall Width: 2.5m <sup>4</sup><br>Overall Body Height: 1.924m <sup>4</sup><br>Min Body Ground Clearance: 0.210m <sup>4</sup><br>Track Width: 2.5m <sup>4</sup><br>Lock-to-Lock time: 4.00s <sup>4</sup><br>Kerb-to-Kerb Turning Radius: 6.3m <sup>4</sup>                          | <sup>4</sup> RBG Assumption                    |



|                          |  |                                                                                                                                                                                                                                                                                                     |                                                                      |
|--------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| 19m Articulated Tanker   |  | Overall Length: 19m <sup>3</sup><br>Overall Width: 2.5m <sup>3</sup><br>Overall Body Height: 4.3m <sup>3</sup><br>Min Body Ground Clearance: 0.54m <sup>3</sup><br>Track Width: 2.5m <sup>3</sup><br>Lock-to-Lock time: 6.00s <sup>3</sup><br>Kerb-to-Kerb Turning Radius: 12.5m <sup>3</sup>       | <sup>3</sup> Austroads Standard Design Vehicle                       |
| 10.4m Garbage Truck      |  | Overall Length: 10.4m <sup>1</sup><br>Overall Width: 2.5m <sup>1</sup><br>Overall Body Height: 4.3m <sup>4</sup><br>Min Body Ground Clearance: 0.376m <sup>4</sup><br>Track Width: 2.5m <sup>4</sup><br>Lock-to-Lock time: 6.00s <sup>4</sup><br>Kerb-to-Kerb Turning Radius: 18.6m <sup>1</sup>    | <sup>1</sup> Design Brief<br><sup>4</sup> RBG Assumption             |
| Skip Truck               |  | Overall Length: 8.5m <sup>1</sup><br>Overall Width: 2.5m <sup>4</sup><br>Overall Body Height: 3.668m <sup>4</sup><br>Min Body Ground Clearance: 0.414m <sup>4</sup><br>Track Width: 2.5m <sup>4</sup><br>Lock-to-Lock time: 4.00s <sup>4</sup><br>Kerb-to-Kerb Turning Radius: 12.5m <sup>4</sup>   | <sup>1</sup> UNSW instruction.<br><sup>4</sup> RBG Assumption        |
| Front-Lift Garbage Truck |  | Overall Length: 10.52m <sup>2</sup><br>Overall Width: 2.5m <sup>4</sup><br>Overall Body Height: 4.3m <sup>4</sup><br>Min Body Ground Clearance: 0.376m <sup>4</sup><br>Track Width: 2.5m <sup>4</sup><br>Lock-to-Lock time: 6.00s <sup>4</sup><br>Kerb-to-Kerb Turning Radius: 22.1m <sup>2</sup>   | <sup>2</sup> EPA sourced vehicle data<br><sup>4</sup> RBG Assumption |
| Small Rigid Vehicle      |  | Overall Length: 5.2m <sup>3</sup><br>Overall Width: 1.94m <sup>3</sup><br>Overall Body Height: 1.804m <sup>3</sup><br>Min Body Ground Clearance: 0.295m <sup>3</sup><br>Track Width: 1.840m <sup>3</sup><br>Lock-to-Lock time: 4.00s <sup>3</sup><br>Kerb-to-Kerb Turning Radius: 6.3m <sup>3</sup> | <sup>3</sup> Austroads Standard Design Vehicle                       |

#### Notes:

- Vehicle information supplied by Capital Insight Design Brief (June 2014) or UNSW instruction.
- Vehicle information sourced from EPA 'Better Practice Guide for Waste Management in Multi-Unit Dwellings' Appendix C. Available: <http://www.epa.nsw.gov.au/resources/warr/0842AppendixC.pdf> (refer appendix B)
- Austrroads Design Vehicles (2013).
- RBG assumed data, generally directly incorporated or modified from relevant Austrroads Design Vehicles and Turning Path Template Guide (2013) vehicle data.



## 4.2 Assumptions

### 4.2.1 8.8m Flatbed Truck

Three manoeuvres (for both access and egress) have been assessed for the 8.8m flatbed truck (Refer C4-50 – 51). These include:

- Loading Dock 2 (with parked 8.8m vehicle)
- Internal High Bay
- Western High Bay Dock Region

Swept paths have been completed using placeholder vehicles in adjoining parking bays where possible. This is to replicate a worst case scenario.

An 8.8m Standard Medium Rigid Vehicle (MRV) was incorporated instead of a noted 8m vehicle in lieu of no other information provided for the potential non-standard vehicle. Turning paths are assumed to be very similar for 8m and 8.8m vehicles.

### 4.2.2 4WD with Boat Trailer

Table 2.1 from the design brief references a '4WD with motor boats on tow'. The dimensions and turning radius of this vehicle was not provided within the design brief. This vehicle was modelled using standard passenger vehicle (SRV) inputs for the towing vehicle. Data for the boat trailer has been assumed.

### 4.2.3 19m Articulated Tanker

No vehicle data was supplied for this vehicle. The vehicle was modelled using a prime mover with semi-trailer as per 2013 Austroads Standard Design Vehicles.

### 4.2.4 10.4m Garbage Truck

The length and turning circle information was supplied for this vehicle. All other vehicle dimensions have been assumed from EPA data. RBG incorporated EPA specifications from information sourced indicating that UNSW manages campus waste through EPA approved contractors.

Note; waste management locations remain to be coordinated, including if vehicles are required to enter the waste dock or the adjacent external region. If the western end of the lane is utilised as a permanent skip or waste bin location, access for some of the vehicles to the western docks may be impaired due to restricted space.

### 4.2.5 Skip Truck

A hook truck was referenced in the design brief. Upon assessment of the recent site concepts, it was noted that access for this Hook truck was not practically possible. RBG was directed to assess a smaller skip vehicle for this issue instead of the original hook truck.

Skip vehicle data was originally incorporated from a 7.4m Volvo FE 4X2 18 Tonne Skip truck. Upon review, UNSW advised that the design vehicle would range between 7m and 8.5m. An 8.5m custom vehicle has been produced to replicate the largest expected skip truck required.

### 4.2.6 Front-Lift Garbage Truck

This vehicle data was primarily sourced from the EPA 'Better Practice Guide for Waste Management in Multi-Unit Dwellings' Appendix C (refer Appendix B).

An attempted access manoeuvre to external high bay has been removed from the current assessment. Access may be technically possible to this area with a significantly large number turning movements.



#### 4.2.7 Small Rigid Vehicle

The design brief references 4WDs and other cars using the loading dock and loading bays. These vehicles have been assessed based on the small rigid vehicle (SRV) from the Austroads 2013 standard design vehicles.

### 5. Summary

As per the directions of the design brief and the assumptions outlined in section 4, an 8.8m flatbed truck can access Loading Dock 2, the internal high bay, and the external high bay. Entry into the external high bay region is very constrained and does require several movements, or a reverse manoeuvre through the dock area, to reverse this vehicle into the external high bay.

4WD's with boat trailers have also been shown to enter and exit the internal high bay dock, loading dock 2, and the western/external high bay based on the assumptions in section 4 and the proposed kerb layouts.

Based on the assumptions in section 4, the articulated tanker can enter the loading dock region with a reverse manoeuvre from Library Walk.

It has been noted that articulated vehicles can enter Gate 11 and turn around in the student carpark adjacent to Library Walk, leading to the arrangement documented on the plan. An alternate option previously shown involves reversing from the near the Gate 11 entrance, however this access requires amendments to the existing kerb alignment adjacent to the proposed Enabling Works driveway.

The 10.4m garbage truck can access and exit the loading area. Access can involve either a reverse manoeuvre from Library Walk or a forward entry. The forward entry would require a reverse exit and space to turn around within the Botany Street entrance before exiting the premises.

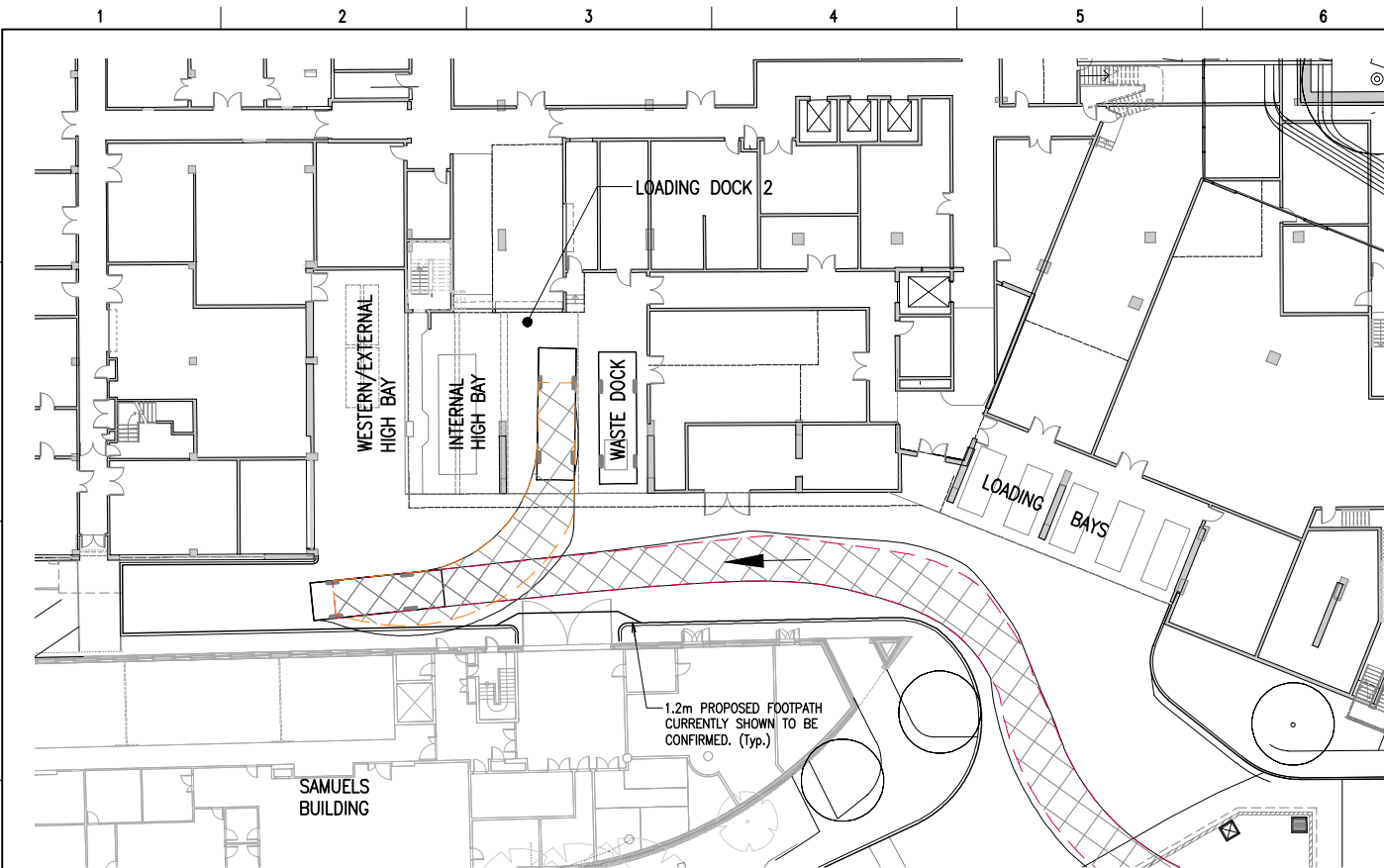
Based on the details provided in the design brief, the hook truck has been shown it cannot access or exit the western external high bay without a significant number of manoeuvres and without exceeding the proposed kerb set out.

Direction has been given from UNSW that an 8.5m skip truck is the largest expected vehicle required and that it is desired to access the western end of the dock region between the Samuels building and the Biolink. This manoeuvre has been shown to be achievable through a reverse movement through the dock.

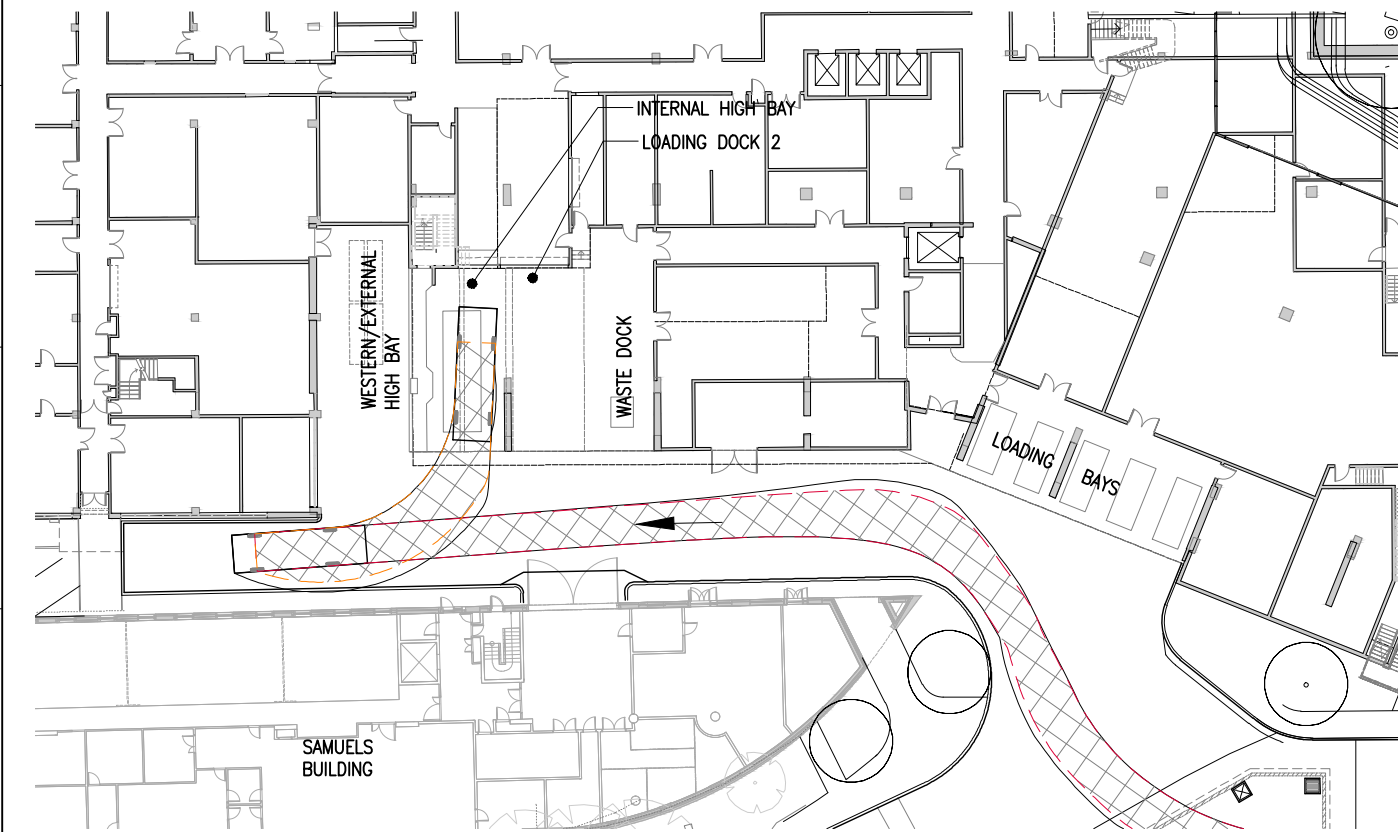
The front-lift garbage truck has been shown to reverse into the loading area by first turning around in the student carpark adjacent to Library Walk.

The small rigid vehicles can enter and exit the loading bays as per the design brief and based on the assumptions noted in section 4.

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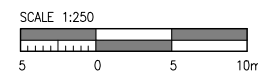


LOADING DOCK 2 – 8.8m MEDIUM RIGID VEHICLE WITH PARKED 8.8m MRV – ACCESS MANOEUVRE



INTERNAL HIGH BAY – 8.8m MEDIUM RIGID VEHICLE – ACCESS MANOEUVRE

  
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NOTE:  
1. THE TURNING PATH DRAWING SET IS TO BE READ IN CONJUNCTION WITH THE CURRENT ROBERT BIRD GROUP MEMORANDUM TITLED "VEHICLE TURNING MOVEMENT INVESTIGATION SUMMARY".

| Rev | Revision Description   | By | App. | Date     |
|-----|------------------------|----|------|----------|
| 1   | ISSUED FOR INFORMATION | RC | CW   | 25.08.14 |
| 2   | ISSUED FOR INFORMATION | RC | CW   | 18.09.14 |
| 3   | ISSUED FOR INFORMATION | RC | CW   | 08.10.14 |
| 4   | ISSUED FOR REVIEW      | RC | CW   | 21.10.14 |
| 5   | ISSUED FOR REVIEW      | RC | CW   | 27.11.14 |
| 6   | ISSUED FOR REVIEW      | RC | CW   | 05.12.14 |
| 7   | ISSUED FOR REVIEW      | RC | RL   | 20.01.15 |

| Rev | Revision Description | By | App. | Date |
|-----|----------------------|----|------|------|
|     |                      |    |      |      |
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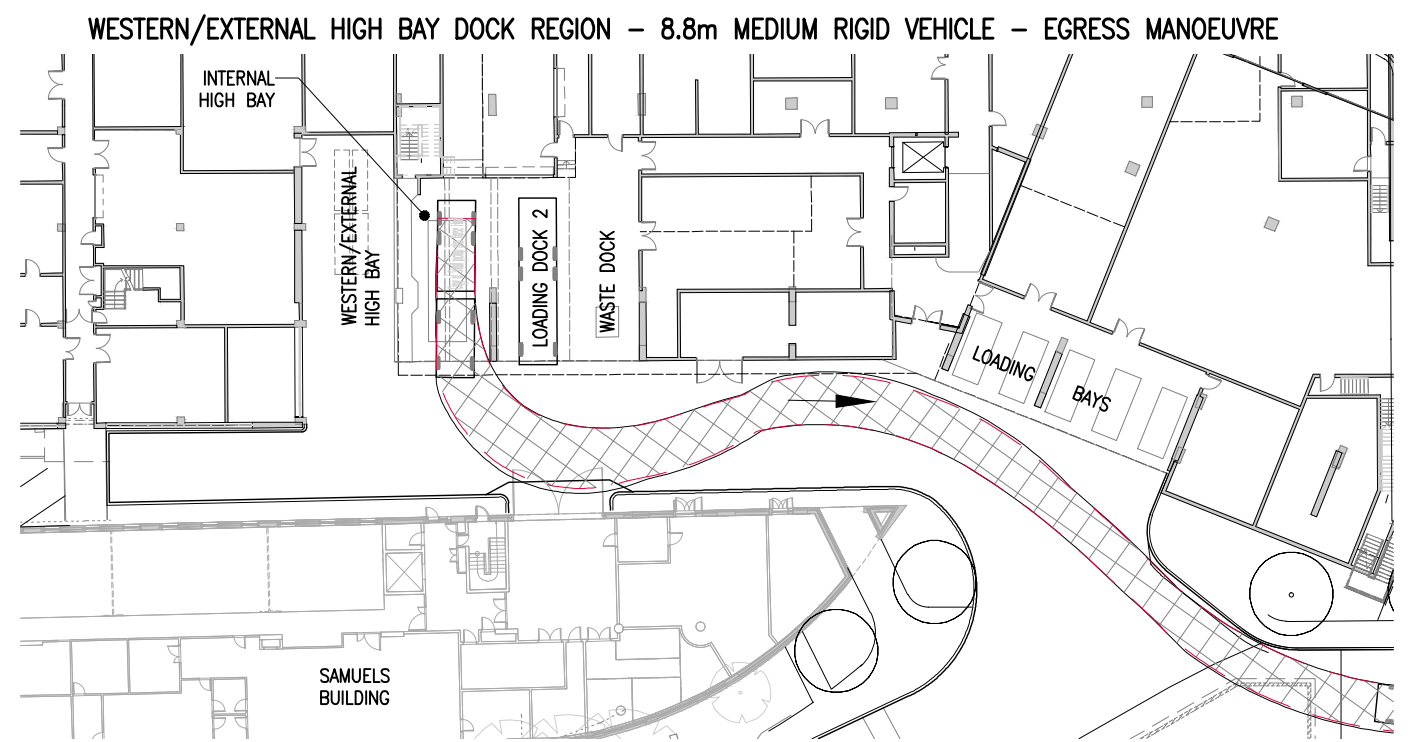
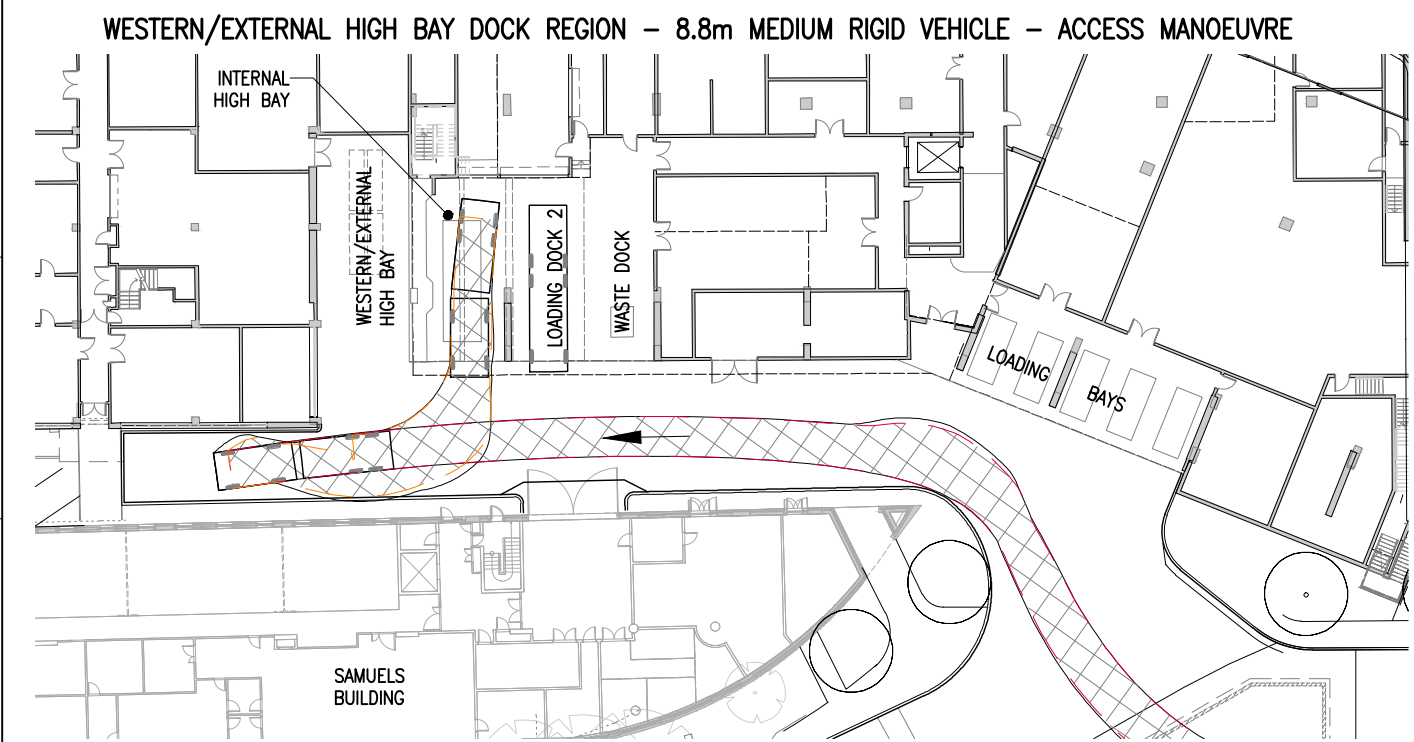
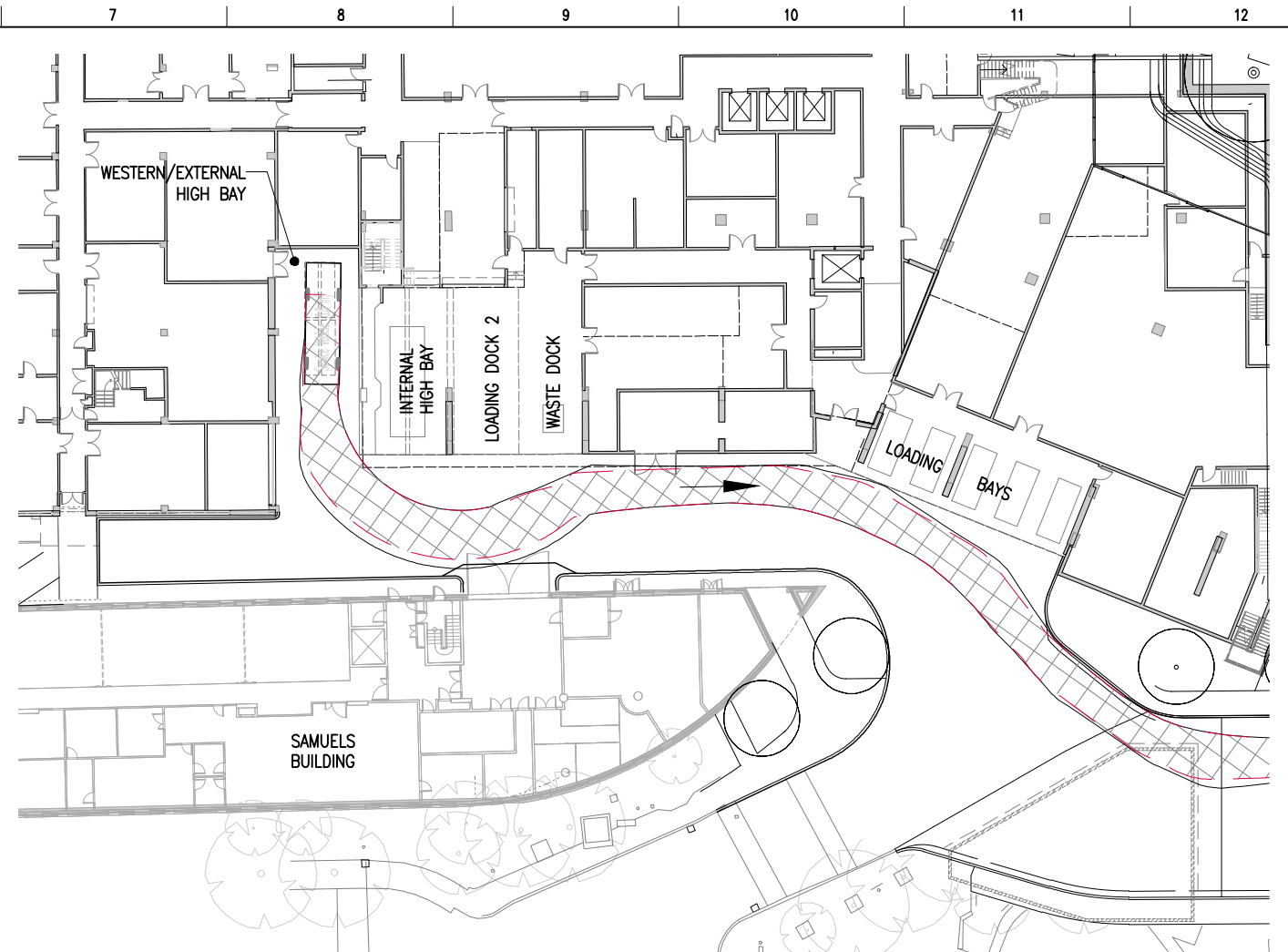
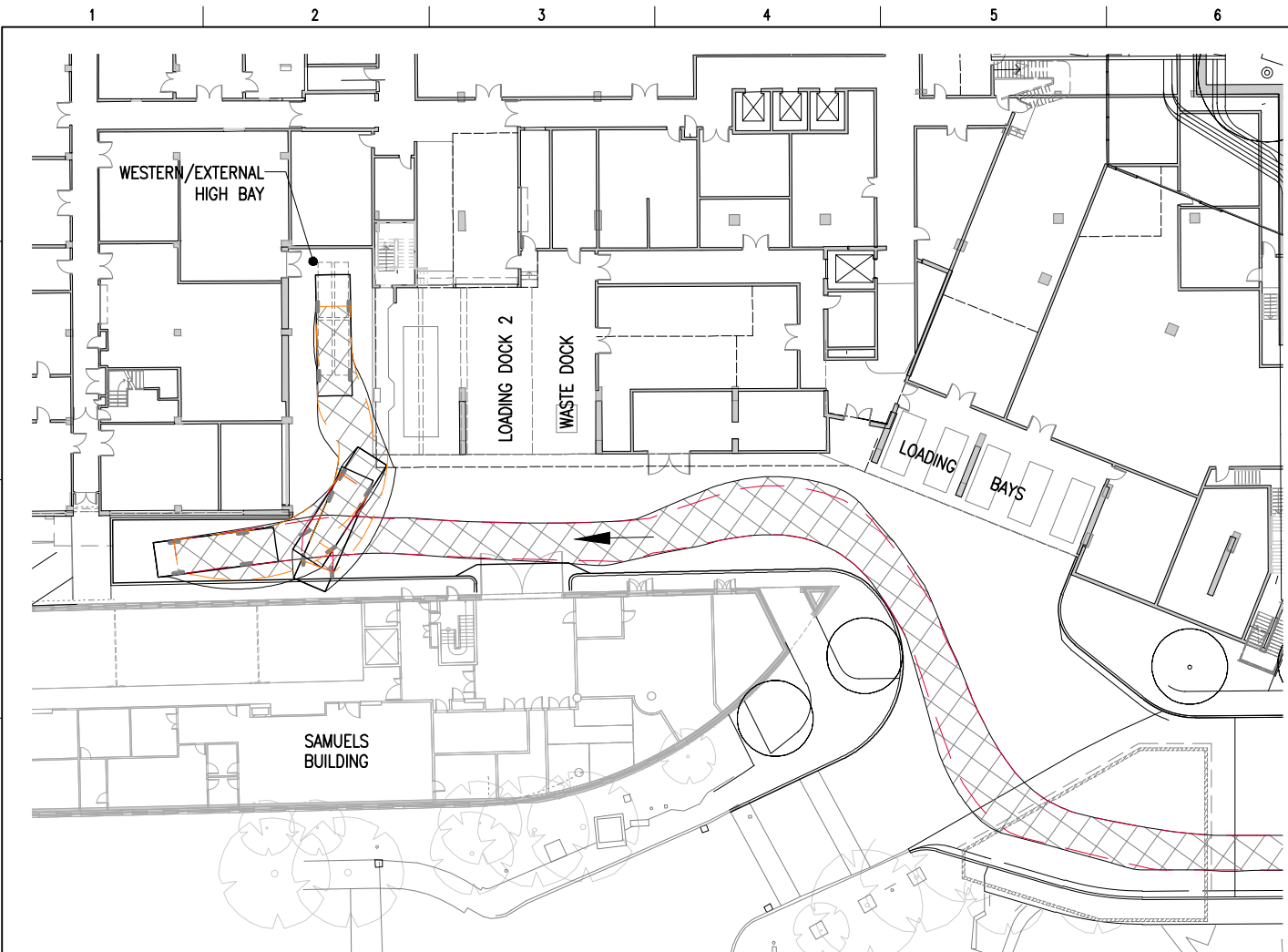


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**BROOKFIELD MULTIPLEX  
CONSTRUCTIONS PTY LTD**

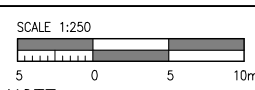
Title  
**VEHICLE TURNING  
MOVEMENTS SKETCH 1 OF  
11**  
Project  
**BIOLOGICAL SCIENCES PROJECT**

| NOT FOR CONSTRUCTION    |                         |                                     |  |
|-------------------------|-------------------------|-------------------------------------|--|
| Date<br>20.01.15        | Designer<br>C. WAITE    | Design Checker<br>L.MELVILLE        |  |
| Scale at A1<br>AS SHOWN | Drawn<br>S. MANANDHAR   | Principal/Project Leader<br>R.LUCAS |  |
| Job Number<br>14500C    | Drawing Number<br>C4-50 | Revision<br>7                       |  |

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| 6   | ISSUED FOR REVIEW      | RC | CW  | 05.12.14 |     |                      |    |     |      |
| 7   | ISSUED FOR REVIEW      | RC | RL  | 20.01.15 |     |                      |    |     |      |

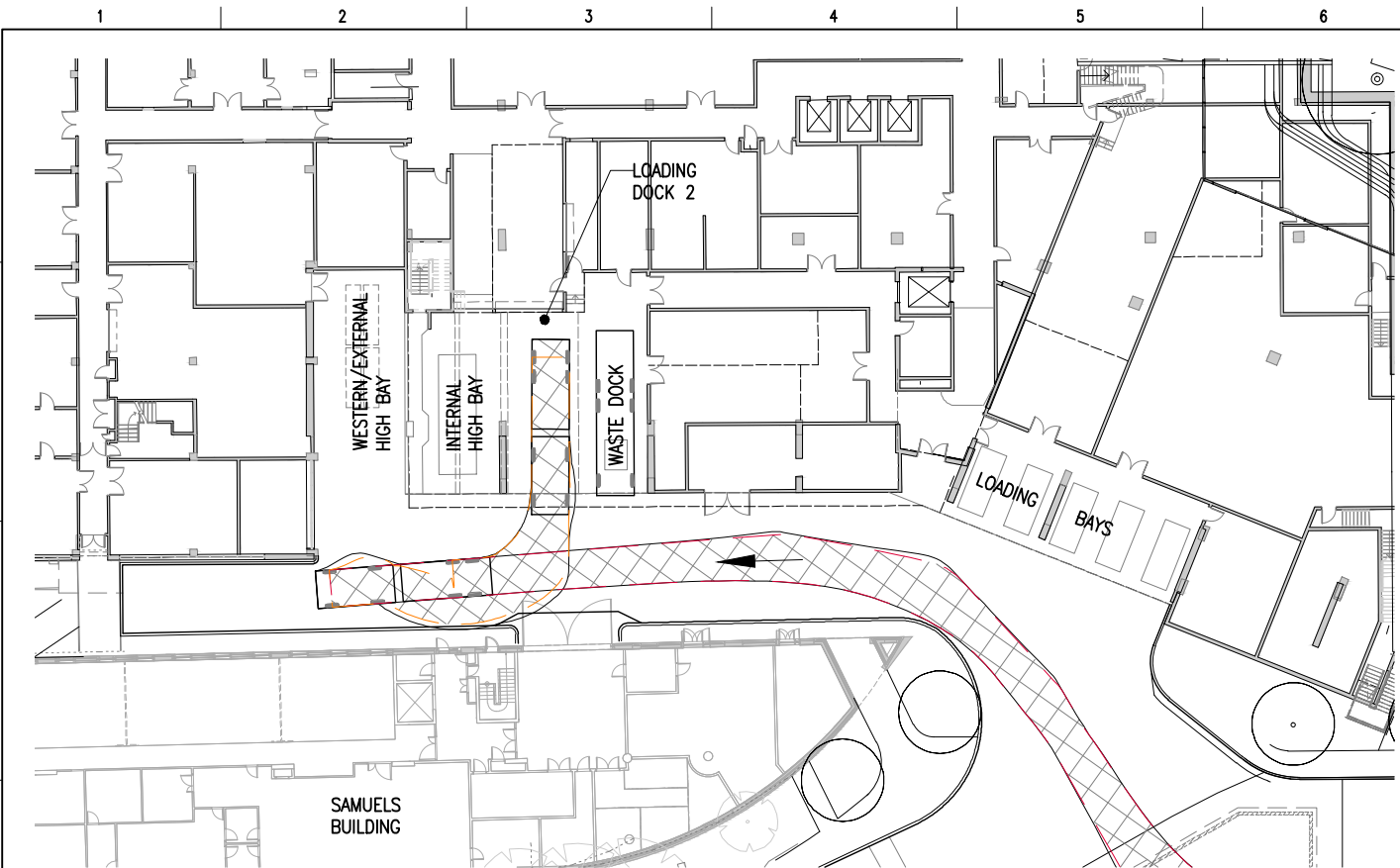
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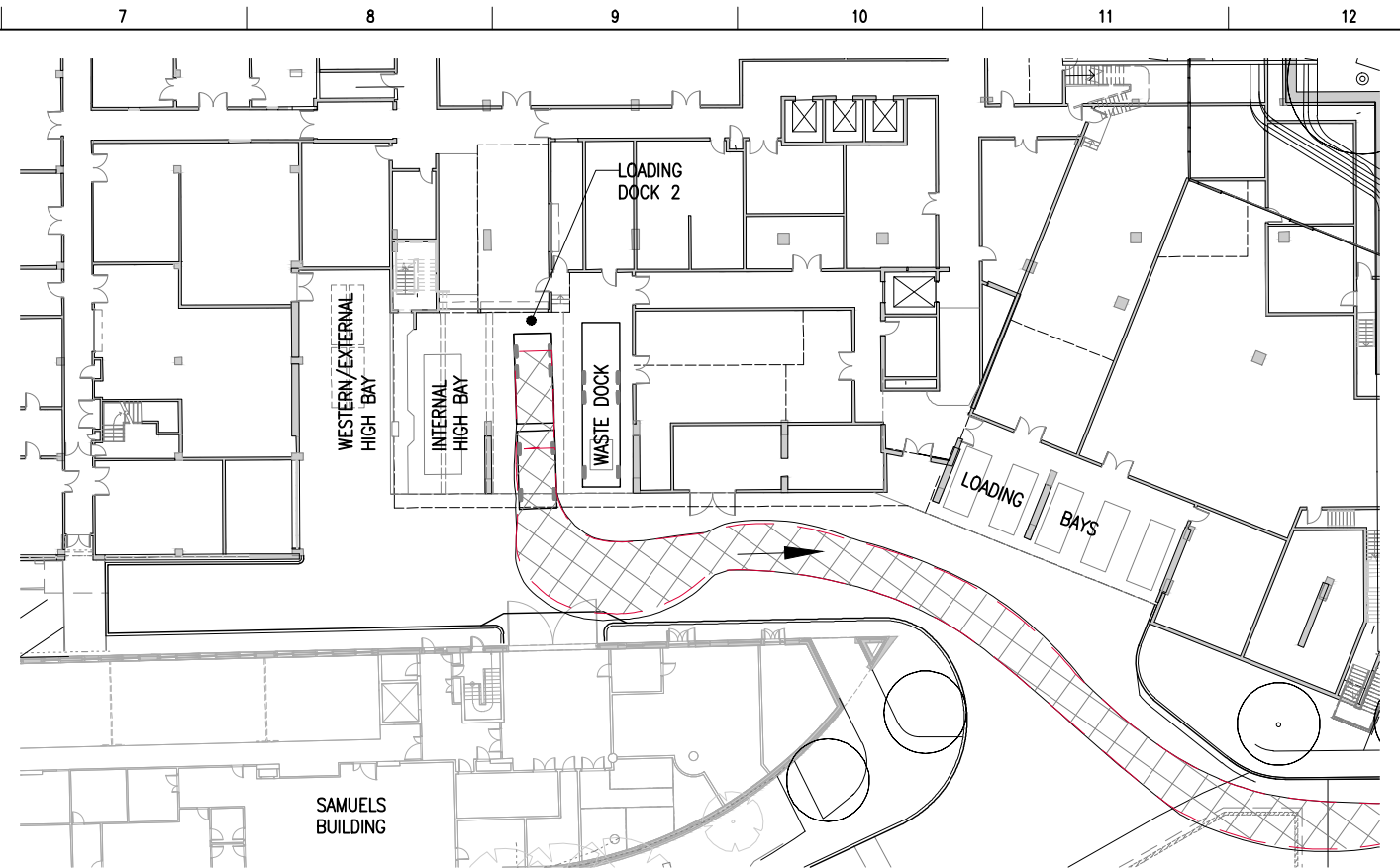
Title  
**VEHICLE TURNING  
MOVEMENTS SKETCH 2 OF  
11**  
Project  
**BIOLOGICAL SCIENCES PROJECT**

| NOT FOR CONSTRUCTION    |                         |                                     |  |
|-------------------------|-------------------------|-------------------------------------|--|
| Date<br>20.01.15        | Designer<br>C. WAITE    | Design Checker<br>L.MELVILLE        |  |
| Scale at A1<br>AS SHOWN | Drawn<br>S. MANANDHAR   | Principal/Project Leader<br>R.LUCAS |  |
| Job Number<br>14500C    | Drawing Number<br>C4-51 | Revision<br>7                       |  |

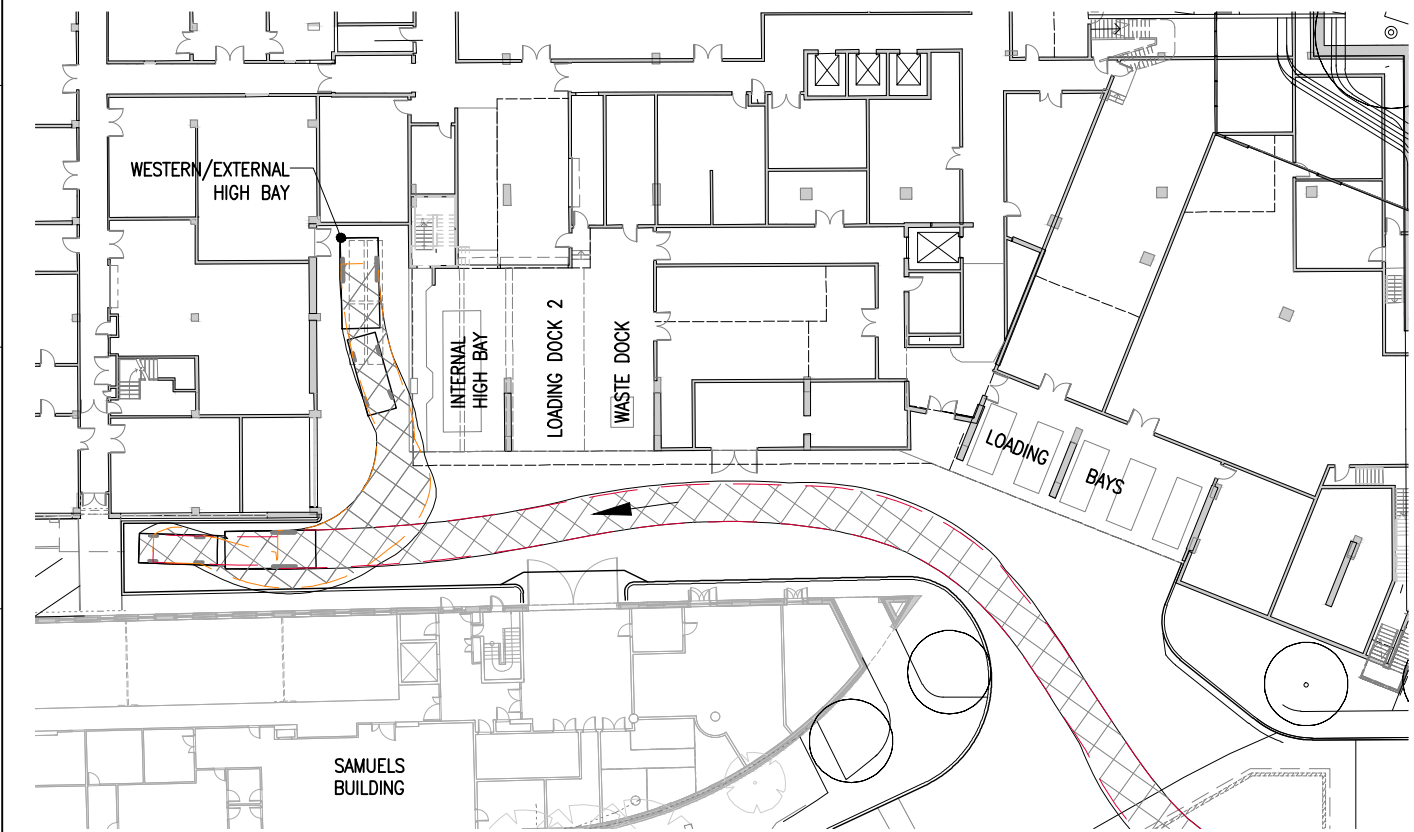
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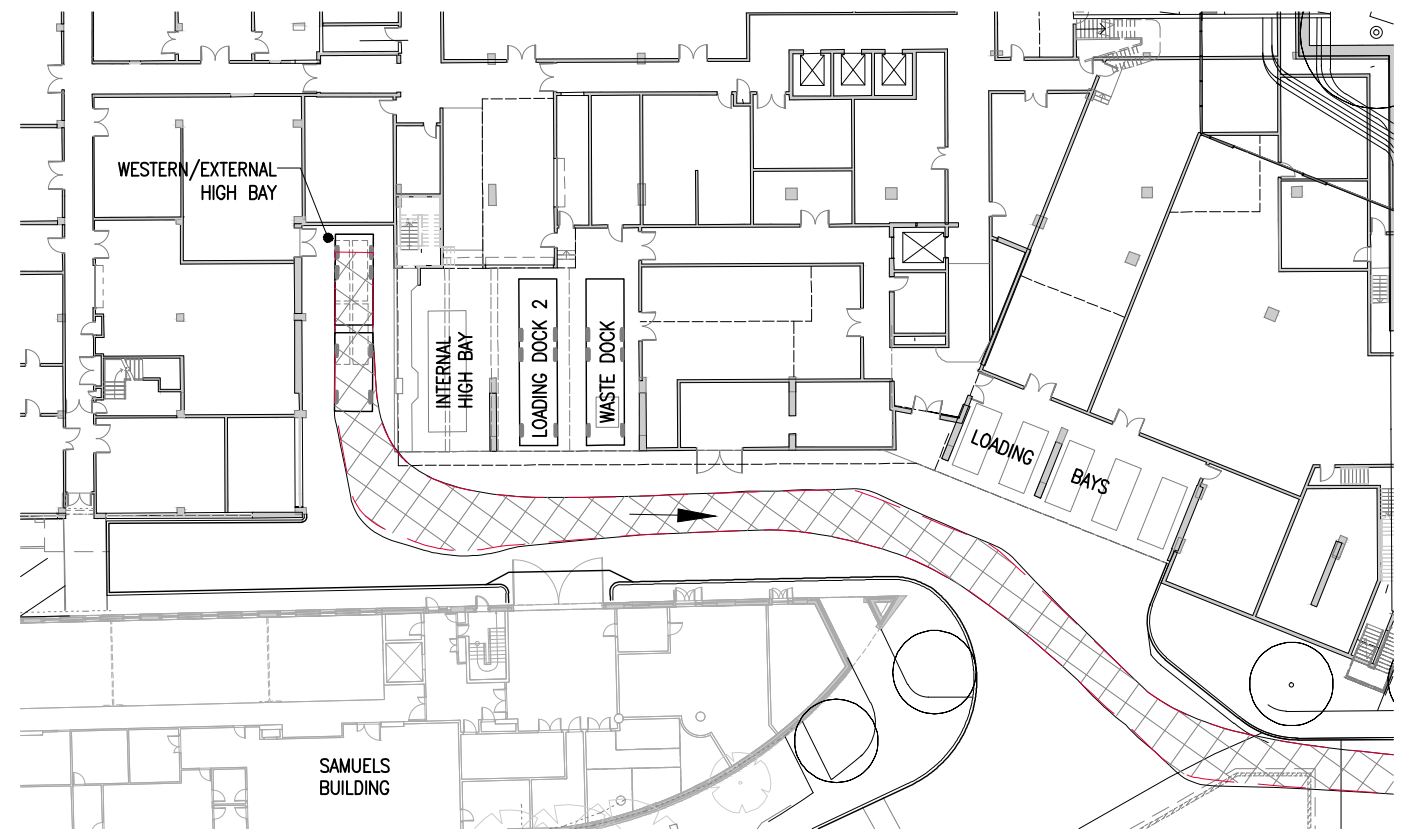
LOADING DOCK 2 - 4WD AND BOAT TRAILER - ACCESS MANOEUVRE



LOADING DOCK 2 - 4WD AND BOAT TRAILER - EGRESS MANOEUVRE

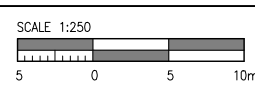


WESTERN HIGH BAY DOCK REGION - 4WD AND BOAT TRAILER - ACCESS MANOEUVRE



WESTERN HIGH BAY DOCK REGION - 4WD AND BOAT TRAILER - EGRESS MANOEUVRE

  
DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS  
REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE



NOTE:  
1. THE TURNING PATH DRAWING SET IS TO BE READ IN CONJUNCTION WITH THE CURRENT ROBERT BIRD GROUP MEMORANDUM TITLED "VEHICLE TURNING MOVEMENT INVESTIGATION SUMMARY".

| Rev | Revision Description   | By | App | Date     | Rev | Revision Description | By | App | Date |
|-----|------------------------|----|-----|----------|-----|----------------------|----|-----|------|
| 1   | ISSUED FOR INFORMATION | RC | CW  | 25.08.14 |     |                      |    |     |      |
| 2   | ISSUED FOR INFORMATION | RC | CW  | 18.09.14 |     |                      |    |     |      |
| 3   | ISSUED FOR INFORMATION | RC | CW  | 08.10.14 |     |                      |    |     |      |
| 4   | ISSUED FOR REVIEW      | RC | CW  | 21.10.14 |     |                      |    |     |      |
| 5   | ISSUED FOR REVIEW      | RC | CW  | 27.11.14 |     |                      |    |     |      |
| 6   | ISSUED FOR REVIEW      | RC | CW  | 05.12.14 |     |                      |    |     |      |
| 7   | ISSUED FOR REVIEW      | RC | RL  | 20.01.15 |     |                      |    |     |      |

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Client  
**BROOKFIELD MULTIPLEX  
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Title  
**VEHICLE TURNING  
MOVEMENTS SKETCH 3 OF  
11**  
Project  
**BIOLOGICAL SCIENCES PROJECT**

| NOT FOR CONSTRUCTION    |                         |                                     |  |
|-------------------------|-------------------------|-------------------------------------|--|
| Date<br>20.01.15        | Designer<br>C. WAITE    | Design Checker<br>L.MELVILLE        |  |
| Scale at A1<br>AS SHOWN | Drawn<br>S. MANANDHAR   | Principal/Project Leader<br>R.LUCAS |  |
| Job Number<br>14500C    | Drawing Number<br>C4-52 | Revision<br>7                       |  |